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EXHIBIT 15

Tab 6 – April 18, 2025 Expert Report of Dimitri Christakis

EXPERT REPORT OF

Dimitri Christakis, M.D., M.P.H.

April 18, 2025

Dimitri Christakis, M.D., M.P.H.

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I. Introduction

I was asked to provide an expert assessment of what, if any, role social media (SM) usage plays in youth mental health and function. For the purposes of this report, I will classify children ages 8-12 as "pre-teens," children 13-17 as "teens," and the 18-26 age group as "emerging adults." As discussed below, teens and preteens are especially vulnerable to the effects of SM. My report and opinions will primarily focus on SM's impact on teens and preteens.

A copy of my CV is attached (Exhibit A), Materials List (Exhibit B), Compensation Statement (Exhibit C), and Prior Testimony (Exhibit D).

II. Summary of Key Opinions

1. Problematic social media use and addiction are disorders defined in part by the compulsive use of social media. They are well recognized in the scientific community and peer-reviewed literature.
2. Pre-teens and teens are particularly vulnerable to the problematic use of social media and its resulting negative health outcomes. Pre-teens are the most vulnerable to effects from social media, including problematic use, addiction, mental health harms, and inappropriate contact from adults.
3. A review of the available meta-analyses and other relevant literature establishes that social media causes or contributes to addiction, problematic usage, anxiety, depression, body dysmorphia, eating disorders, sleep deprivation, suicide, and self-injury.

4. Specific design features of Facebook, Instagram, Snap, YouTube, and TikTok work in concert to promote both the addictive nature of social media and its associated harms. Platform features and platform algorithms create and amplify mental health problems for pre-teens and teens.
5. Defendants' (Meta, Snap, TikTok, and YouTube) internal studies and documents show the harmful effects of their social media platforms, including addiction and negative mental health outcomes. The documents also reveal that the resources Defendants put towards mitigating these harmful effects were weighed against user engagement and the risk of subsequent loss of revenue. Perhaps as a consequence, Defendants only instituted minimal change prior to the initiation of this litigation.
6. Regardless of any safety changes, the ongoing research and literature shows that children and teenagers continue to be harmed by social media use.
7. In other instances, Defendants had internal data regarding potential harms and the ability to further investigate those harms, but did not do so.
8. Despite Defendants' internal data showing that their social media sites are addictive, promote problematic use, and result in an increased risk of anxiety, depression, suicidality, sleep deprivation, body dysmorphia, and eating disorders, as well as other mental health issues, Defendants did not provide meaningful information about these harms to parents or children.
9. For parents and children to make an informed decision regarding the risks/benefits of social media, social media companies need to fully disclose the nature and risk of harms to them.
10. Social media has also changed the school environment. The same addictive design features of social media that drive user engagement result in its use during the school day. The

school environment has been negatively impacted by the mental health problems social media causes in kids, and by increases in distraction and behavioral issues linked to social media use.

11. Because of the increased risk of harm to children and adolescents, in my opinion, social media platforms, as designed, are not reasonably safe for children. At a minimum, informed parental consent should be required for use of social media under the age of 16.
12. Due to the risks to children, effective age verification and parental controls are necessary.
13. Due to the risks to children, including the risk of addiction, better user controls are necessary.

III. Qualifications

I am the George Adkins Professor of Pediatrics and an adjunct Professor in Psychiatry and in Health Services at the University of Washington. I have been studying children and media for 27 years (including social media since it was launched) and have secured millions of dollars in federal and foundation grants as a principal investigator or co-investigator. I have served as a mentor to over 15 junior faculty and post-doctoral students who also study children and media. In addition to clinical and teaching duties, I am a prolific researcher. I have published over 275 peer reviewed scholarly articles including over 80 related to children and media. My current h Index (measure of scholarly impact) is 102 (>60 = "Exceptional"). I am the editor in chief of *JAMA Pediatrics*, the world's leading pediatric scientific journal with an impact factor of 24.7.

I received the Academic Pediatric Association Research award for lifetime contribution to pediatric research. I received the Holroyd-Sherry Award from the American Academy of Pediatrics (AAP) for my outstanding contributions to research related to children and media. I was asked to give the University of Washington Distinguished Scientist Lecture (Highest Faculty

Honor 2021). I served on the AAP Executive Committee on Children and Media for six years and have been the lead author of several AAP guidelines on children and media. I was a member of the National Academy of Sciences Board of Children Youth and Families for six years. I served on a National Academy of Medicine expert panel on children and media. I was a member of the 2023 National Sleep Foundation expert consensus panel on screens and sleep. I am the co-editor of a recently published 87-chapter comprehensive *Handbook on Children and Screens* (Springer 2025). I served on the Advisory Board for Children and Screens, a not-for-profit foundation with a mission to help children live healthy lives in a digital world, from 2009-2022, and have served as its Chief Science Officer since 2022. In that capacity, I review all of the current research and oversee our grants related to the foundation's mission.

Currently, I serve on the DSM-VR expert panel that is seeking to add gaming addiction to the manual. Finally, as a board-certified pediatrician and Professor of Pediatrics, I have provided direct patient care to children 0-26 (including those with eating disorders, depression, anxiety, suicidality, and addiction) in both inpatient and outpatient settings. As part of my clinical work, I have directly seen the impact social media has had on adolescents and their mental health.

IV. Methodology

I approached my evaluation by drawing upon my multidisciplinary expertise as a Professor of Pediatrics, Psychiatry, and Health Services, which combines both medical training and public health education. My analysis employs a systematic review of meta-analyses of existing literature, individual studies where relevant, and internal industry documents and studies done by some of the Defendants. My systematic approach evaluated the "strength of the evidence," which aligns with clinical frameworks used in pediatric practice, while incorporating epidemiological principles

from the public health field. Throughout my academic career and clinical practice, I have routinely evaluated research based on this methodology.

In forming my opinions regarding the potential causal relationship between social media platform use and adolescent mental health outcomes, I have relied upon my medical training, training in public health and epidemiology, my clinical experience, and my own research into media as well as an extensive review of academic literature. I have also reviewed and considered internal documents from the Defendants and depositions of current and former employees of the Defendants that were provided to me.

I hold all the opinions stated in this report to a reasonable degree of scientific and medical certainty.

A. Strength of the Evidence

Scientific discovery is an iterative process with a generally accepted hierarchy of the strength of evidence.

Figure 1: Hierarchy of Types of Scientific Studies

1) **Editorials, expert opinions**. These lie at the bottom of the "pyramid" as they do not "add" any new evidence but rather render opinion(s) on existing data.
2) **Case series, case reports**. These are descriptive studies ranging from one to several cases. They do not test specific hypotheses and lack a comparison ("control") group. Accordingly, their broader implications are difficult to contextualize.
3) **Case-control studies**. These studies are designed especially for "rare" outcomes. They retrospectively compare exposures among "cases" that have a particular outcome or condition to "controls" that do not to try and identify antecedent risk factors for developing a condition of interest.

4) **Cohort studies**. These are studies of "exposed" and "unexposed" populations. They can be prospective, retrospective, or cross sectional. Cross sectional studies compare the groups at a single point in time. In general, prospective longitudinal (cohort) designs are stronger than cross-sectional ones. They begin with a population with (or without) a particular exposure and follow them through time. Retrospective cohort studies compare groups as well but look backwards rather than forwards. Cohort studies can generate (or corroborate) hypotheses and reliably estimate the prevalence of conditions in populations.

5) **Randomized Controlled Trials (RCTs)**. Long considered the "gold standard" of evidence, these entail experimental manipulations of a prespecified exposure or treatment (e.g. a drug) as well as a prespecified outcome of interest. RCTs have the most robust control (comparison) group, since the randomization of the exposure ensures that any differences between the "exposed" and "unexposed" (or the "treatment" and the "control") group are due to random chance. However, there are many situations in which RCTs are neither practical nor ethical (e.g., exposing a comparison group to a known carcinogen), and indeed a great many accepted causal relationships are based on observational studies alone. The vast majority of social media studies that are available in the general scientific literature are observational, as randomizing people to sites, platforms, or exposure time is impractical in real world settings.

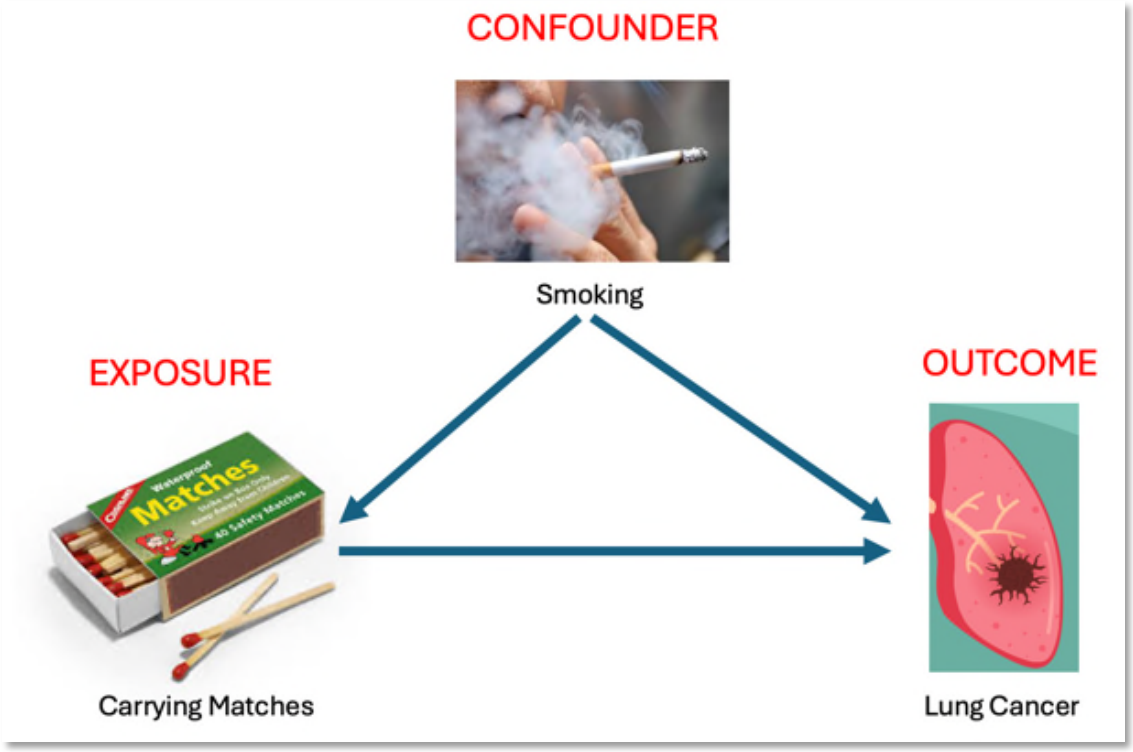
6) **Systematic reviews**. Even strong study designs, including RCTs, however large or well done, are always subject to limitations of generalizability as they almost certainly focus on a particular subset of the population at a particular point in time. Accordingly, the "pinnacle" of the pyramid is occupied by "systematic reviews." A systematic review is a scientifically reproducible search that aims to acquire and summarize all of the studies

published on a particular topic within a specified date range. Once the relevant studies are collected and summarized, researchers can, when possible, conduct a "meta-analysis" wherein the results of multiple studies are combined to establish a summary estimate of an effect.

Residual confounding is always a potential limitation of even the best-done observational studies. In statistical parlance, a "confounding" variable is something that is associated with both the exposure and the outcome of interest. Consider the ("true") finding that people who carry matches are 10 times more likely to die of lung cancer than people who do not carry them. (Figure 2). While the association is real, it is "confounded." Smokers are also 10 times more likely than non-smokers to carry matches and smoking increases the chances of developing lung cancer. (Figure 3). Indeed, once "smoking" is added as a variable to the statistical model, the relative risk of "carrying matches" leading to "lung cancer" is dramatically reduced and is no longer statistically significant.

Figure 2: Carrying Matches and Lung Cancer

Figure 3: Carrying Matches, Smoking, and Lung Cancer



Conceptually, confounding is different from mediation. While confounding creates spurious associations, mediation explains the mechanism by which an exposure leads to an outcome. Mediating variables are *in the causal pathway* between an exposure and an outcome.

The distinction between a confounder and a mediator is critical to understanding how to interpret results of statistical models. Adding a "confounder" to a statistical model eliminates a spurious association; adding a "mediator" to a statistical model is a way of testing whether it is potentially in the causal pathway. It explores the *mechanism* by which an exposure leads to an outcome. Table 1 below summarizes the differences between confounding and mediation.

Table 1: Confounders and Mediators

Aspect	Confounding	Mediation
Role	External distortion of relationship	Explains causal mechanism
Association	Related to both variables but not on pathway	Lies on causal pathway between variables
Effect on Analysis	Biases the estimate of causal effect	Decomposes effect into direct/indirect paths
Goal	Remove or control for it	Understand the causal mechanism

When it comes to interpreting effect sizes, larger effect sizes from observational studies are generally thought to provide stronger evidence for a given association being causal because they make it less likely that a residual confounding variable might explain the observed association. Nevertheless, there are several reasons why small effect sizes still have serious implications.

First, while the probability of an exposure leading to an outcome might be low, it is crucial to remember that for the individuals affected should the outcome occur, the consequences can profoundly affect their life. That basic fact has been acknowledged by at least one of the platforms at issue in this litigation. In an interview with the *Wall Street Journal* responding to Meta documents leaked by whistleblower Frances Haugen, Adam Mosseri, CEO of Instagram is quoted as saying, "In no way do I mean to diminish these issues," including teen body image issues among others. "Some of the issues mentioned in the story aren't necessarily widespread, but their impact on people may be huge."[1]

Second, even very small probabilities can create large problems when applied at a population level. For example, in 2023, *JAMA* found that exposure to air pollution for more than

[1] Alison Lee Deposition Exhibit 7 at 4

one year increased the chances of developing cardiovascular disease over one's lifetime by 8%.[2] Although the relative risk is numerically "small," it results in a sizeable number of additional cases of heart disease (800,000 of them).

Figure 4: JAMA - Relative Risk - Air Pollution Exposure

Relative Risk (RR): Long-term exposure to fine particulate matter (PM2.5) increases the risk of heart disease by 8% (RR = 1.08).

Baseline Risk: Suppose the baseline risk of heart disease in a population is 10% (i.e., 10% of adults develop heart disease over their lifetime without exposure to PM2.5).

Population Size: Imagine a population of 100 million adults.

Risk Without PM2.5 Exposure: 10% × 100 million = 10 million cases.

Risk With PM2.5 Exposure:

- Relative risk increases to **10% × 1.08 = 10.8%**.
- Cases = 10.8% × 100 million = **10.8 million cases**.

Additional Cases: 10.8 million − 10 million = 800,000 additional cases.

Similarly, at his deposition, Mark Zuckerberg (the CEO and founder of Meta) acknowledged he was sent an email from another Meta executive indicating that the company had a "deep understanding" that the prevalence of severe problematic use among Facebook users was 3.1%.[3] Mr. Zuckerberg acknowledged the obvious, which is that "3 percent of billions of people is a lot of people….It's not – not the majority, but it's – obviously, it's millions of people."[4]

Third, effect sizes—however small—can be contextualized by comparing them to other known effect sizes that are deemed "worthwhile."

[2] Alexeeff SE, Deosaransingh K, Van Den Eeden S, Schwartz J, Liao NS, Sidney S. Association of Long-term Exposure to Particulate Air Pollution With Cardiovascular Events in California. *JAMA Network Open*. 2023;6(2):e230561-e230561. doi:10.1001/jamanetworkopen.2023.0561

[3] Mark Zuckerberg Dep. Exhibit 39 at -0761; Mark Zuckerberg Deposition Transcript at 262:5-266:13.

[4] Mark Zuckerberg Deposition Transcript at 275:2-6

B. Review of Publicly Available Medical Literature

Given the multitude of studies that have been performed relevant to the questions of interest, I prioritized systematic reviews and/or metanalyses of each of the possible pathways. My searches primarily focused on publications from the past 5 years, as these studies are inclusive of the most recent scientific data and include metanalyses and citations to foundational studies and scientific research from earlier years. Where appropriate, I have searched and reviewed earlier relevant studies. Table 2 below summarizes my search terms.

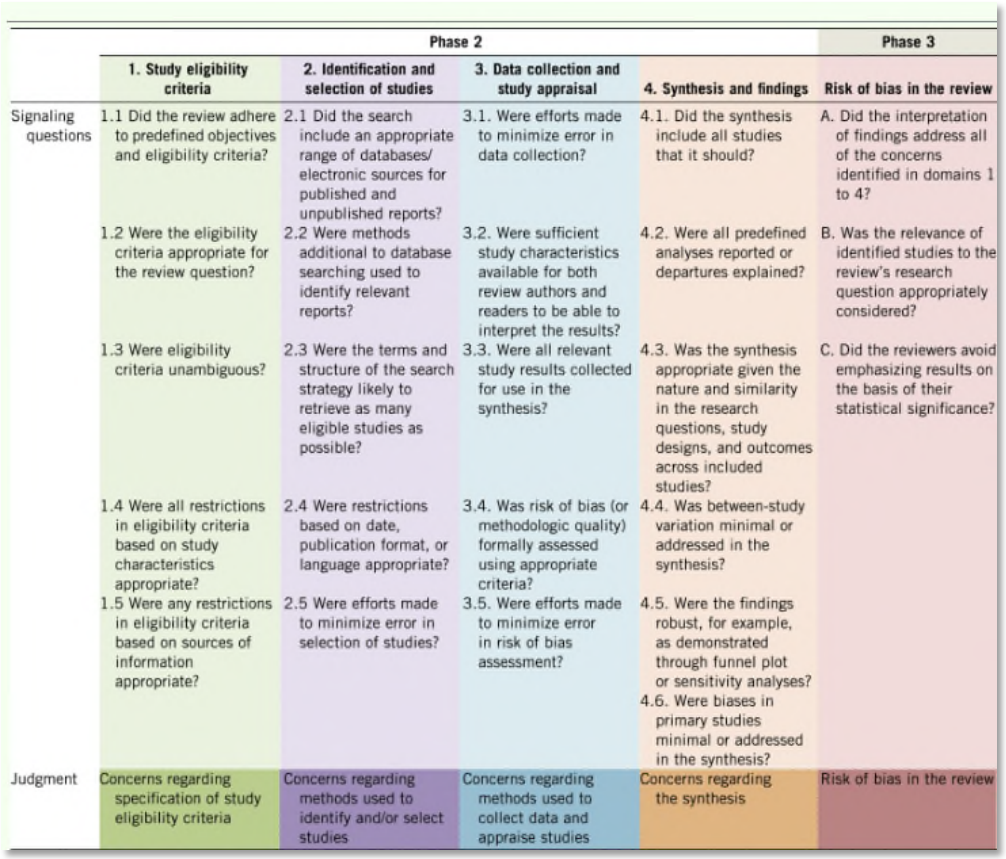
Table 2: Search Terms and Approach Deployed

Outcome	Search Terms
Addiction	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking")* and ("addiction" or "problematic use" or "habitual use") and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Body Image/Eating Disorder	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking") and* ("body image" or "body dysmorphic disorder" or "eating disorder" or "body dissatisfaction" or "anorexia" or "bulimia" or "disordered eating") and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Sleep	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking")* and ("sleep" or "insomnia") and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Depression	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking*") and ("depression" or "depressive symptoms") and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Anxiety	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking)"* and "anxiety" and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Suicide	*"Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking" and ("suicide" or "suicidal ideation" or "self-harm")* and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
School Performance	*"Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking" and ("school" or "school performance")* and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Risky Behaviors	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking*") and ("risk taking" OR "risk*behave*" OR sex* OR smoke* OR substance use OR aggress* OR

	alcohol OR viol*) and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.
Cyberbullying	*("Social Media" OR "Facebook" OR "Instagram" OR "snapchat" OR "TikTok" OR "YouTube" OR "social networking*") and ("cyberbullying" or "students") and "systematic review" Since 2020; include citations; (exclude patents). Sort by date.

I then used the ROBIS approach (summarized below) to assess the completeness and quality of all reviews and for selecting which ones to include.[5]

Figure 5: ROBIS Criteria for Evaluating Systematic Reviews



	Phase 2				Phase 3
	1. Study eligibility criteria	**2. Identification and selection of studies**	**3. Data collection and study appraisal**	**4. Synthesis and findings**	**Risk of bias in the review**
Signaling questions	1.1 Did the review adhere to predefined objectives and eligibility criteria?	2.1 Did the search include an appropriate range of databases/ electronic sources for published and unpublished reports?	3.1. Were efforts made to minimize error in data collection?	4.1. Did the synthesis include all studies that it should?	A. Did the interpretation of findings address all of the concerns identified in domains 1 to 4?
	1.2 Were the eligibility criteria appropriate for the review question?	2.2 Were methods additional to database searching used to identify relevant reports?	3.2. Were sufficient study characteristics available for both review authors and readers to be able to interpret the results?	4.2. Were all predefined analyses reported or departures explained?	B. Was the relevance of identified studies to the review's research question appropriately considered?
	1.3 Were eligibility criteria unambiguous?	2.3 Were the terms and structure of the search strategy likely to retrieve as many eligible studies as possible?	3.3. Were all relevant study results collected for use in the synthesis?	4.3. Was the synthesis appropriate given the nature and similarity in the research questions, study designs, and outcomes across included studies?	C. Did the reviewers avoid emphasizing results on the basis of their statistical significance?
	1.4 Were all restrictions in eligibility criteria based on study characteristics appropriate?	2.4 Were restrictions based on date, publication format, or language appropriate?	3.4. Was risk of bias (or methodologic quality) formally assessed using appropriate criteria?	4.4. Was between-study variation minimal or addressed in the synthesis?	
	1.5 Were any restrictions in eligibility criteria based on sources of information appropriate?	2.5 Were efforts made to minimize error in selection of studies?	3.5. Were efforts made to minimize error in risk of bias assessment?	4.5. Were the findings robust, for example, as demonstrated through funnel plot or sensitivity analyses?	
				4.6. Were biases in primary studies minimal or addressed in the synthesis?	
Judgment	Concerns regarding specification of study eligibility criteria	Concerns regarding methods used to identify and/or select studies	Concerns regarding methods used to collect data and appraise studies	Concerns regarding the synthesis	Risk of bias in the review

[5] Whiting P, Savović J, Higgins JP, et al. ROBIS: A new tool to assess risk of bias in systematic reviews was developed. *J Clin Epidemiol*. Jan 2016;69:225-34. doi:10.1016/j.jclinepi.2015.06.005

All included studies conformed to Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines. In cases where there were multiple reviews within the same time period, I reviewed them for consistency and completeness. If they were comparable, I chose the more recent one (if it included more studies). If they were inconsistent, I assessed the quality of each and determined which one better represented robust scientific findings. A relevant example of this is the Ferguson meta-analysis of SM and mental health outcomes which contained multiple fundamental methodological flaws discussed in detail in section XI.B below.[6]

In addition to the five-year lookback discussed above, my review and knowledge base also includes published papers and studies from the inception of social media, as I have spent 25 years researching and publishing in this area. In addition, I reviewed the reference lists of selected studies, searched for RCTs published that were not included in the meta-analyses, and used the Web of Science to find studies that cited the studies I used. As discussed below, I also considered some other individual, high-profile studies.

C. Review of Defendant Documents & Research

I also reviewed internal Defendant documents to assess what the companies' internal research demonstrated about the role their products play in the development and/or exacerbation of mental health harms. Additional materials I considered are listed on my materials list that is attached to this report. These materials were made available to me based upon searches and topics that I requested.

[6] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541

The table below summarizes a sampling frame of a few company studies that I came across while reviewing documents. In most of these studies, survey data were linked to actual usage statistics and user experiences on the platform.

Table 3: Select Internal Studies from Defendants

Sample Size	Country	Reference
22,410 Instagram users	International	META3047MDL-003-0009501
~30,000 adult Facebook users ~30,000 youth Facebook users ~30,000 adult Instagram users ~30,000 youth Instagram users	International	Zuckerberg Dep. Ex. 31
20,000 US Facebook users	US	METATNAG-010-00000060
6,000 US Facebook users	US	META3047MDL-019-00033466
7,471 Instagram; 37,729 FB	International	META3047MDL-020-00588061
~15,000 FB users	International	META3047MDL-020-00588282
100,000 FB cross-sectional; 15,000 longitudinal	International	METAMAAG-011-00000381
50,590 FB users	International	META3047MDL-014-00401897
19,275 Teen Facebook and Instagram users	International	META3047MDL-004-00003256
2,503 Instagram users	International	Bhutada Depo Exhibit 7; slide 3
6,793 Instagram users	International	Bhutada Depo Exhibit 11; slide 8
3,155 Meta users	Unclear	META3047MDL-044-00171351
689,003 Facebook users	International	Kramer et al[8]
1,000,000 TikTok users	Unclear	TIKTOK3047MDL-047-LARK-00510819
238,000 Instagram Users	Unclear	Arturo Bejar Deposition (p. 241)

Speaking as a scientist in this research field, the size, scope, and granularity of these data are extraordinary. They are among the largest samples of social media users ever assembled for research purposes. Compared to any independent scientist or the medical community at large, the Defendants had ready access to precise and granular data as well as the ability to deploy robust studies to better understand and mitigate the risks of their platforms. For example, the investigators

had the ability to link survey data to actual site usage (something an independent researcher cannot readily do).

Publicly, Meta assured parents and physicians that they hoped to share their research through peer-reviewed publications.[7] However, only a small number of these studies (or versions of them) were made available to the medical community, and very few were published in the peer-reviewed literature. Perhaps even more concerning, I saw no evidence that Meta's internal findings that its products are harmful to children and emerging adults was communicated to parents or children who used their product, whether on the platform itself, the company website, or elsewhere.

Further, my review indicates that—to the extent Meta's research was made public—there were sometimes meaningful differences between what the company found and what it published. As noted above, Mr. Zuckerberg was informed that Meta had a "deep understanding" that 3.1% of Facebook users experienced *severe* problematic use. In the same communication, he was informed that 55% of Facebook users experienced *mild* problematic use.[8] This indicates that, according to Meta's own research, collectively 58.1% of its Facebook users experience some form of problematic use. Weeks after this email was sent, Meta researchers published a paper concerning problematic use as part of a conference held in May 2019 (the CHI Conference on Human Factors in Computing Systems Proceedings).[9] That paper, titled "Understanding Perceptions of Problematic Facebook Use," states that, "we estimate (as an upper bound) that 3.1% of Facebook users in the US experience problematic use."[10] Given that a 3.1% "upper bound" is significantly

[7] META3047MDL-020-00253760, -3762
[8] Mark Zuckerberg Deposition Exhibit 39 at -0761
[9] Mark Zuckerberg Deposition Exhibit 89
[10] Mark Zuckerberg Deposition Exhibit 89 at p. 2.

lower than 58.1%, the published research significantly understates the prevalence of problematic use as known to Meta.[11] As Bejar states in his deposition "you weren't supposed to use the term addiction. That instead they labeled it "problematic use." And they had defined problematic use to be very narrow."[12] Meanwhile, Mr. Zuckerberg acknowledged at his deposition, published research is "not very helpful if it's not accurate."[13]

My comparison of internal company research and publicly available studies indicates that there are also sometimes meaningful differences between purely internal studies and those that developed in consultation and collaboration with outside scientists. Perhaps the most notable example of research by a social media company conducted in collaboration with academia is a recently completed study that attempted to assess the introduction of Facebook on well-being using a global sample.[14] The authors (Vuorre and Przybylski) acquired daily (DAU) and monthly active users (MAU) from Facebook and regressed those on to Gallup World Poll (GWP) data from 72 countries. GWP data are collected annually on 1000 noninstitutionalized civilians ages 15 and older per country. For this study, positive emotions included affirmative responses to "did you feel well- rested yesterday?", "were you treated with respect all day yesterday?," "did you learn or do something interesting yesterday?", and "did you smile or laugh a lot yesterday?".[15] The negative emotions included affirmative responses to "did you experience the following during a lot of the day yesterday: physical pain, worry, sadness, stress and anger?"[16] In brief, they report finding no

[11] Mark Zuckerberg Deposition Transcript at 682:3-684:8
[12] Arturo Bejar Deposition Transcript at 136:16-21
[13] Mark Zuckerberg Deposition Transcript at 681:8-9
[14] Vuorre M, Przybylski AK. Estimating the association between Facebook adoption and well-being in 72 countries. *R Soc Open Sci*. 2023;10:221451.
[15] Vuorre M, Przybylski AK. Estimating the association between Facebook adoption and well-being in 72 countries. *R Soc Open Sci*. 2023;10:221451.
[16] Vuorre M, Przybylski AK. Estimating the association between Facebook adoption and well-being in 72 countries. *R Soc Open Sci*. 2023;10:221451.

significant association between the rise of Facebook usage and wellbeing changes in the countries studied.

But there are multiple limitations to this study. First, the data are ecological, meaning that Facebook usage was not tied to the actual responders to the survey. It is not even clear if the responders used Facebook at all. Second, the ages ranged from 15 years and older. Although the paper does not provide exact numbers, they aggregated data into two strata—15-34 years and 35 plus. Hence, the actual number of teens in their sample is small and not reported separately, making it impossible to discern if they were directly affected. Third, the outcomes measured, while they may have face validity for positive and negative emotions, are not consistent with the constructs believed to be associated with excessive social media usage. For example, no one has ventured a hypothesis that social media use leads to physical pain for a lot of the day.

Furthermore, while this might seem like a *prima facia* example of Meta collaborating with an independent scientist, that collaboration is not entirely independent. Przybylski discloses that he has served as an "unpaid" advisor to Facebook in the past, and he is an outspoken critic when it comes to social media's effects on teenagers. Finally, the article states "that the data are not publicly available, the study was not pre-registered, and researchers can contact Facebook if they wish to reproduce the analyses." These facts are not consistent with transparent open science.

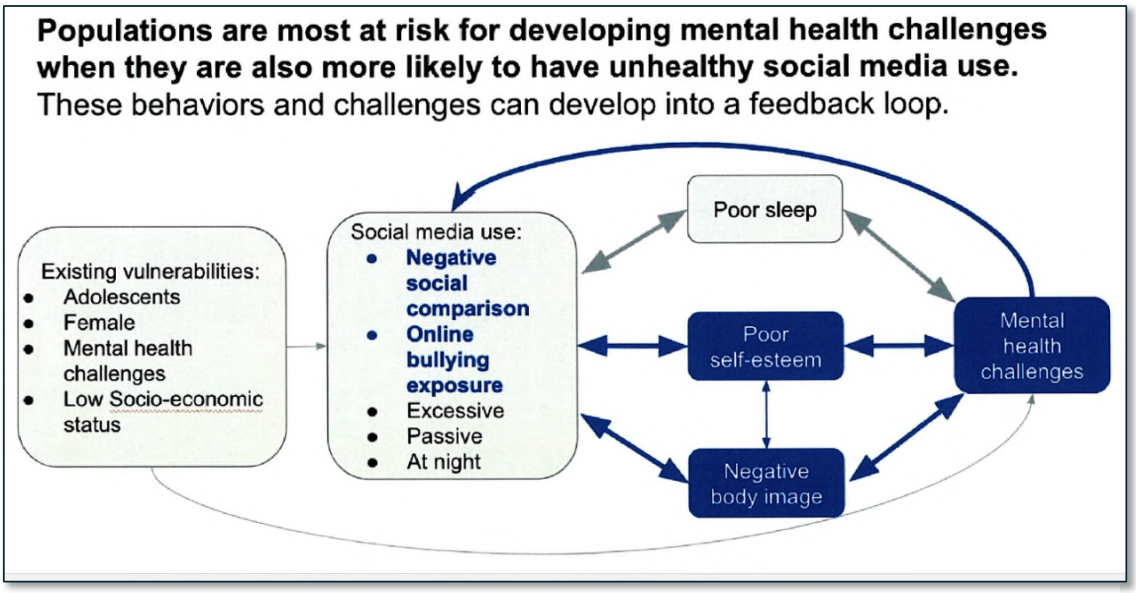
My report reviews and synthesizes the existing scientific evidence as well as the industry's own findings made available through discovery, for each of the eight main outcomes that result from social media exposure in children and emerging adults—Problematic Social Media Use, Body Image, Eating Disorders, Sleep Disorder, Depression, Anxiety, Suicide, and School Performance.

V. Social Media Use and Mental Health Harms

Pre-teens and teens are particularly vulnerable to problematic use of social media and the resulting negative health outcomes. Social media causes or contributes to causing mental health harms such as addiction, problematic usage, anxiety, depression, body dysmorphia, eating disorders, poor sleep, suicide, and self-injury. The paths by which media use in general, and social media use in particular, are related to these mental health outcomes are complex and inter-related.

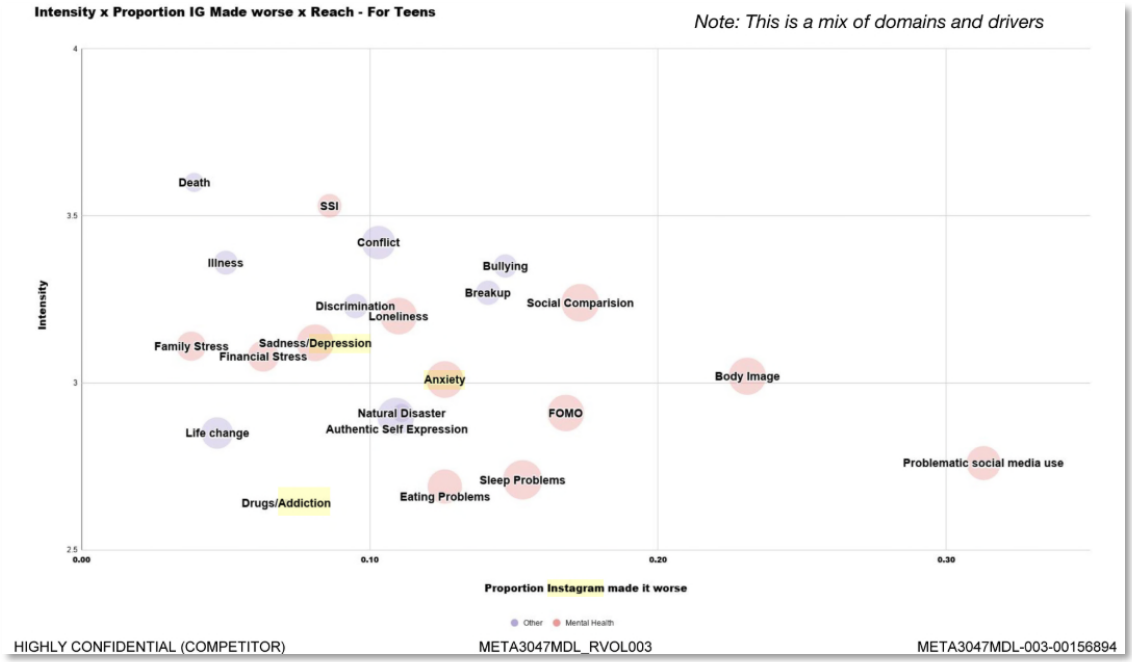
A. Conceptual Models from Defendant Platforms

Interestingly, Meta has a model illustrating the negative harms caused by social media and acknowledges adolescents as a vulnerable group.



Document 1: Deposition of Diego Castaneda, Exhibit 26 at 3

The existence of this Meta logic model suggests that at least some of its scientists, (Dr. Castaneda was a leader in the Instagram well-being team) are both cognizant of and conceptually grounded in the current scientific literature. In fact, an internal Meta presentation contained the following slide depicting certain harms that Instagram "made [] worse" for teens:

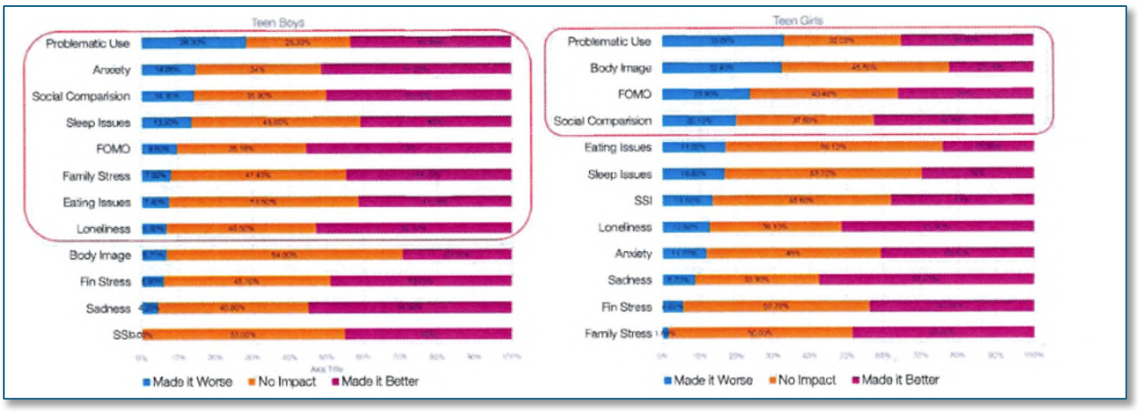


Document 2: META3047MDL-003-00156888, -6894

The pink bubbles highlight some of the mental health harms I address in this report. Based on my review of similar documents, it is apparent that the size of the circles corresponds to the "reach" of these issues.[17] The figure indicates Instagram worsens the mental health areas noted.

The self-perceived role that social media plays in many mental health outcomes was assessed by Meta itself in a survey of over 22,410 Instagram users across the United States, Japan, Brazil, Indonesia, Turkey and India. Amongst teens, the results were as follows:

[17] META3047MDL-003-00094811, -4828.

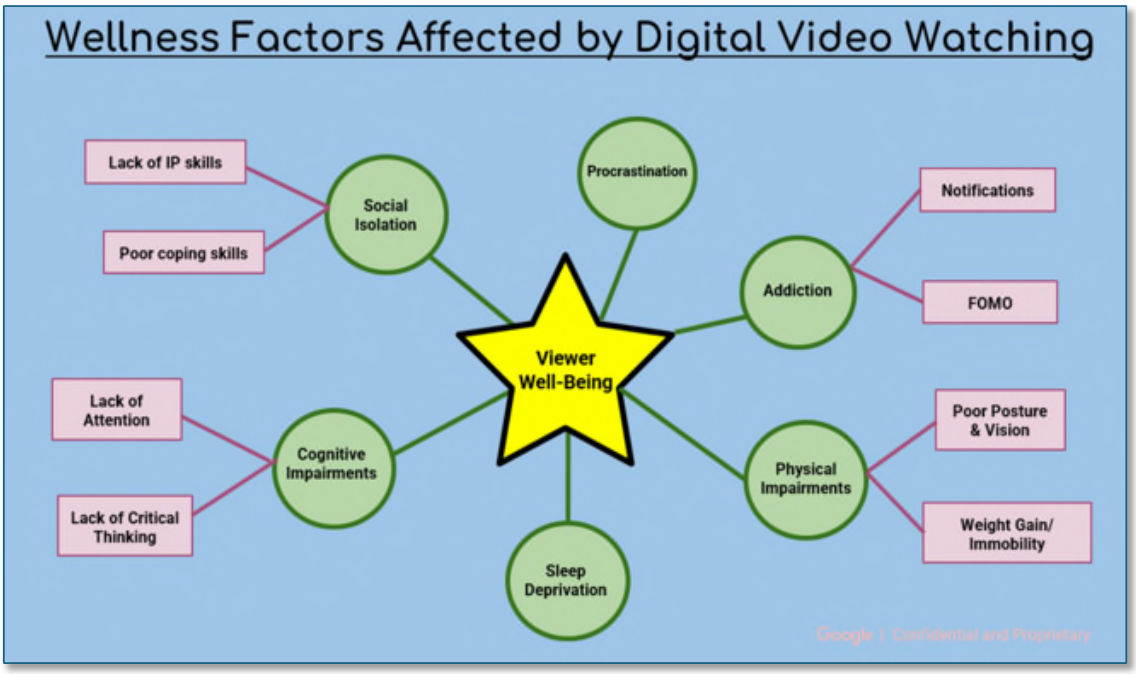


Document 3: Deposition of Alison Lee, PhD, Exhibit 10 at p. 14

Although a sizeable percentage of respondents felt that Instagram ameliorated certain outcomes, a sizeable percentage also felt it made them worse—and in the case of body image for teen girls, that represented over 1/3 of respondents.[18] Consistent with differential susceptibilities, the effect of social media is not uniform across all children, and a subset of them are especially vulnerable to it. These data are subjective self-reports and although the questions have face validity, other studies have used validated measures of affect and mood and are addressed in my report.

YouTube also has a conceptual framework with some antecedent pathways:

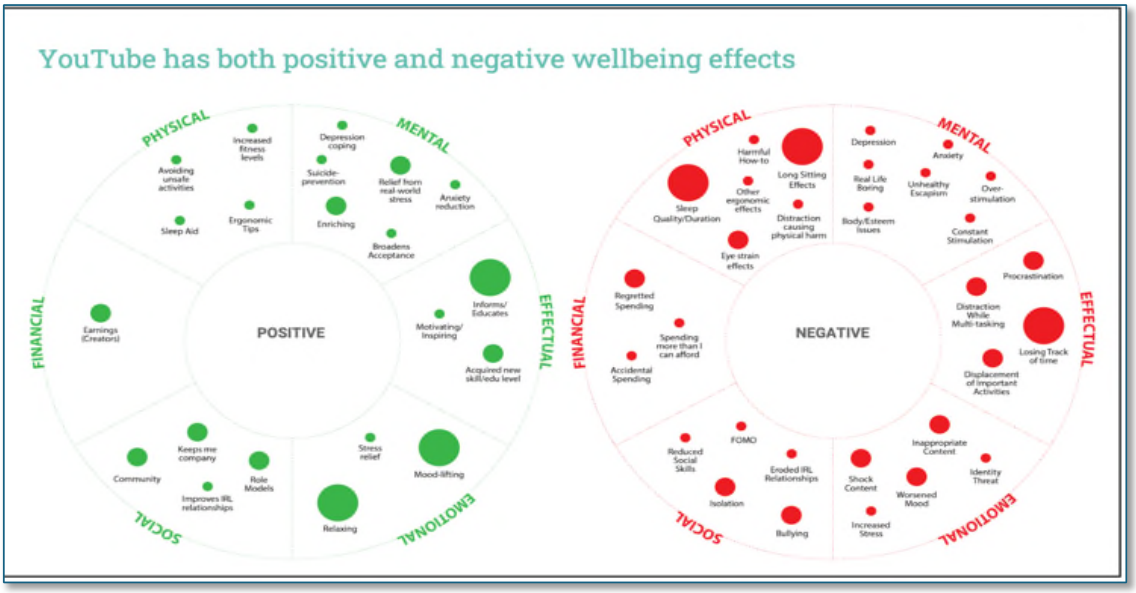
[18] *See also* META3047MDL-003-00094811 at -4828: "1 in 3 teen girls blame Instagram for making their body image issues and problematic social media use worse."



Document 4: GOOG-3047MDL-04918852 at Slide 5

Their framework includes pathways to social isolation, addiction, sleep deprivation, and cognitive impairments, among other "wellness factors".

I also reviewed a YouTube framework, below, for what it sees as its "positive" and "negative" effects of a variety of domains. My interpretation is that the size of the circles corresponds with the effect size. Again, many of the "negative well-being effects" they ascribe to YouTube are discussed in this report.



Document 5: GOOG-3047MDL-00898168 at Slide 7

Lastly, while I have not located a similar visual diagram for TikTok or Snapchat, I would note that internal TikTok documents reflect the knowledge that "[c]hildren that are most vulnerable off-line are typically those who are most vulnerable online."[19] Similarly, internal TikTok presentations note that, "Whatever our background, we all inherently understand that children are more vulnerable than adults and that we as adults have a responsibility to keep them safe."[20]

In Snap's case, the lack of conceptual models seems to be the result of willful blindness. Communications intended for Snap's Board of Directors acknowledged that "Ages 13 to 17 years are a large Snap demographic and, given their age, are also a vulnerable population. We believe they require a heightened standard of care." Evan Speigel, Snap's CEO, testified that he personally agreed with these statements and that Snap has a moral responsibility to children who use Snapchat.[21] However, Morgan Hammerstrom, Snap's Director of Product Research, testified that

[19] TIKTOK3047MDL-018-00361108, -1108
[20] TIKTOK3047MDL-044-00859648 at Slide 5
[21] Evan Spiegel Rough Dep. Tr. at 17:21-20:1

she had never been asked to research a user's experience in app as it relates to their mental health.[22] She also testified specifically that she had never researched whether or not users find Snapchat to be addictive, and that such information "wouldn't have anything to do with my job or the role that I have at Snapchat."[23] Similarly, Lauryl Schraedly, Snap's former Global Head of Consumer Insights, testified that the Consumer Insights team was never asked to assess the impact of Snapchat on users' mental health or Snapchat creating addictive behavior in users.[24]

B. Other Foundational Concepts

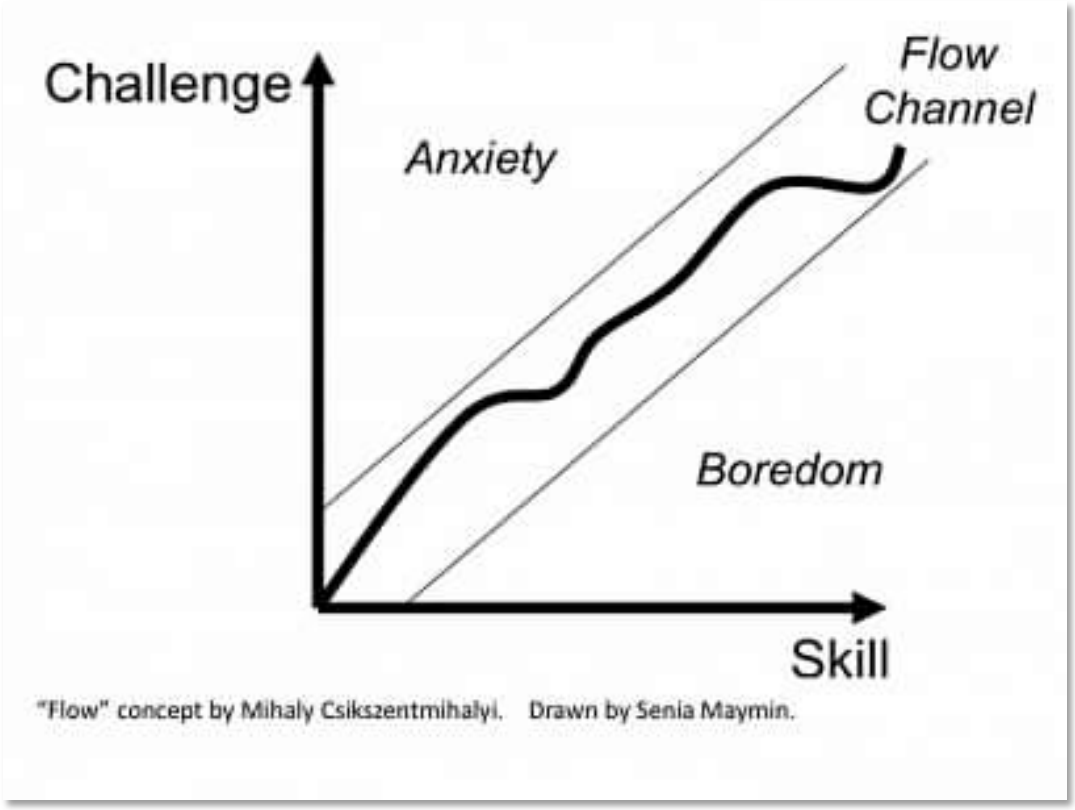
Before delving into each of the relevant outcomes, a few more methodological and psychological constructs relevant to social media effects are worthy of review.

i) The Psychology of "Flow"

Humans bring innate and acquired skills to the challenges they face. When skills are high and challenges are low, the task at hand is sufficiently easy that it can induce boredom. Conversely, when challenges are high and skills are low, the task is sufficiently hard that it can induce anxiety. The psychologist Mihaly Csikszentmihalyi introduced the concept of "flow" as that mental state where the challenges and skills are sufficiently balanced that the experience is engrossing, engagement is easy, enjoyment is high, and time passes effortlessly.[25] Flow states result in dopamine release (discussed in Section VII below) and are inherently pleasurable. The flow channel is demonstrated in the figure below.

[22] Morgan Hammerstrom Dep. Tr. at 96:22-97:13, 606:3-608:7
[23] Morgan Hammerstrom Dep. Tr. 148:9-19, 151:3-9.
[24] Lauryl Schraedly Dep. Tr. at 280:18-281:12.
[25] Csikszentmihalyi M. Flow : the psychology of optimal experience. Simon & Schuster; 1994.

Figure 6: Psychology of Optimal Experience[26]



In the "real world" flow can be achieved by such things as well-timed promotions at work so that one feels deployed at the limit—but not beyond—their skill set, or in gaming contexts such as chess clubs by finding players that are worthy opponents. Both of those examples take time and effort and maybe even luck to achieve. Job promotions are rarely "perfectly timed" if they happen at all, and finding the "right" chess player can be challenging. With effort, some people can find flow in art, sports, music, and even work, for example. Although Csikszentmihalyi maintained that "flow" was the key to a happy and fulfilling life, he cautioned that is not inherently or universally a "good" thing. He argued it could be misused in business and war and that "mountaineers" and "gamblers" could become obsessed with it to the point of neglecting other aspects of their lives.

[26]Maymin, S., *Flow*, THIS EMOTIONAL LIFE (May 24, 2023), available at https://thisemotionallife.org/blogs/flow/

Structured by algorithms as opposed to real world constraints, the online experience can create flow instantaneously and effortlessly and maintain it indefinitely. Consider the simple game of "Candy Crush," which launched in 2012 and continues to command the attention of hundreds of millions of players.[27] It takes no skill to play for the first time and so anxiety is low. In fact, reading the rules is unnecessary. The game is intuitive and there is no barrier—no friction—to beginning. Once a player begins playing, the game quickly and seamlessly ratchets up its difficulty in accordance with a player's skill and engagement: never so hard that it becomes frustrating, never so easy that it becomes boring. Two players starting at the same time play different games, but each is likely to find theirs enjoyable. Keeping people in a flow state is an engagement strategy that many social media sites also actively deploy.

People in a state of flow are, by definition, deeply engaged in the experience and less mindful of outside distractions or perturbations: it is an "escape." This explains in part why people with underlying mental health conditions, or particularly disturbing realities (e.g. challenging socioeconomic circumstances), are more susceptible to the allure of a flow state and at greater risk for becoming addicted to what provides it to them—whether this is alcohol, drugs, gambling, or social media. To that end, Qin and colleagues specifically investigated if flow (which they parameterized as enjoyment, concentration and time distortion) was associated with problematic TikTok use and found a strong correlation.[28]

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[27] Keza MacDonald, *Crushing it: Why millions of people still can't stop playing Candy Crush*, The Guardian (Aug. 1, 2024), https://www.theguardian.com/games/article/2024/aug/01/crushing-it-why-millions-of-people-still-cant-stop-playing-candy-crush.

[28] Qin Y, Musetti A, Omar B. Flow Experience Is a Key Factor in the Likelihood of Adolescents' Problematic TikTok Use: The Moderating Role of Active Parental Mediation. *Int J Environ Res Public Health*. Jan 23 2023;20(3)doi:10.3390/ijerph20032089; Qin Y, Omar B, Musetti A. The addiction behavior of short-form video app TikTok: The information quality and system quality perspective. *Front Psychol*. 2022;13:932805. doi:10.3389/fpsyg.2022.932805.

ii) Active vs Passive Social Media Use

The experience of being on social media can be provisionally and conceptually divided into "active" and "passive" use. Active use entails posting or interacting with content while passive use entails viewing or scrolling. These distinctions are artificial and arbitrary: active users also view content and many people engage in both types of uses in single sessions, making operationalizing usage patterns problematic. Furthermore, they are potentially confounded (see section IV.A) since people who are depressed (or just down or tired at a given moment) might be more passive just as people who are manic (or just joyous or energetic at a given moment) might be more active. Nevertheless, these "distinct" patterns of usage found their way into the scientific literature in part as a means to potentially explain heterogenous findings relating usage to outcomes. Might it be that small overall effect sizes or "positive" vs. "negative" studies could be further elucidated by studying the *ways* in which people were using social media?

The theoretical basis for this hypothesis was that active users might be garnering social support through their interactions whereas passive users might be more likely to be engaging in social comparisons.[29] This theory implicitly discounts the possibility that active interactions might also be problematic—cyberbullying or asking about one's appearance is interactive. Similarly, passive scrolling might involve watching neutral, salubrious, or social comparative content.

Some individual studies examined usage type and found significant mediation effects (recall that mediation analyses test possible mechanisms, see section IV.A); others did not. These inconsistent results are precisely why systematic reviews and metanalyses were invented: as a means to synthesize and reconcile different studies with varied results (section IV.A). A

[29] Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. *Journal of Computer-Mediated Communication*. 2024;29(1)doi:10.1093/jcmc/zmad055

comprehensive metanalysis of 141 studies that examined passive vs. active use was performed in 2024.[30] Collectively, the studies yielded 897 effect sizes (508 active and 134 passive) drawn from over 145,000 participants.

The analyses in the studies included some that were between subjects and some that were within subjects. As the names suggest, between subject comparisons involve looking at effects of one type of user versus another. The problem with this comparison is that it is potentially confounded: underlying differences in users' mental health might be associated both with their type of use, and with their effect. Within subject comparisons, on the other hand, compare the same individuals' usage pattern and their outcomes at different time points and thus explicitly control for differences in individuals. The people are the same; only their usage and affect changes.

The results of the within subject analyses are presented in Figure 7. In all cases except wellbeing, the vast majority of studies found negligible effects based on type of usage. The authors conclude "All within subjects effects tested in this metanalysis were negligible."[31]

[30] Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. *Journal of Computer-Mediated Communication*. 2024;29(1)doi:10.1093/jcmc/zmad055

[31] Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. *Journal of Computer-Mediated Communication*. 2024;29(1)doi:10.1093/jcmc/zmad055

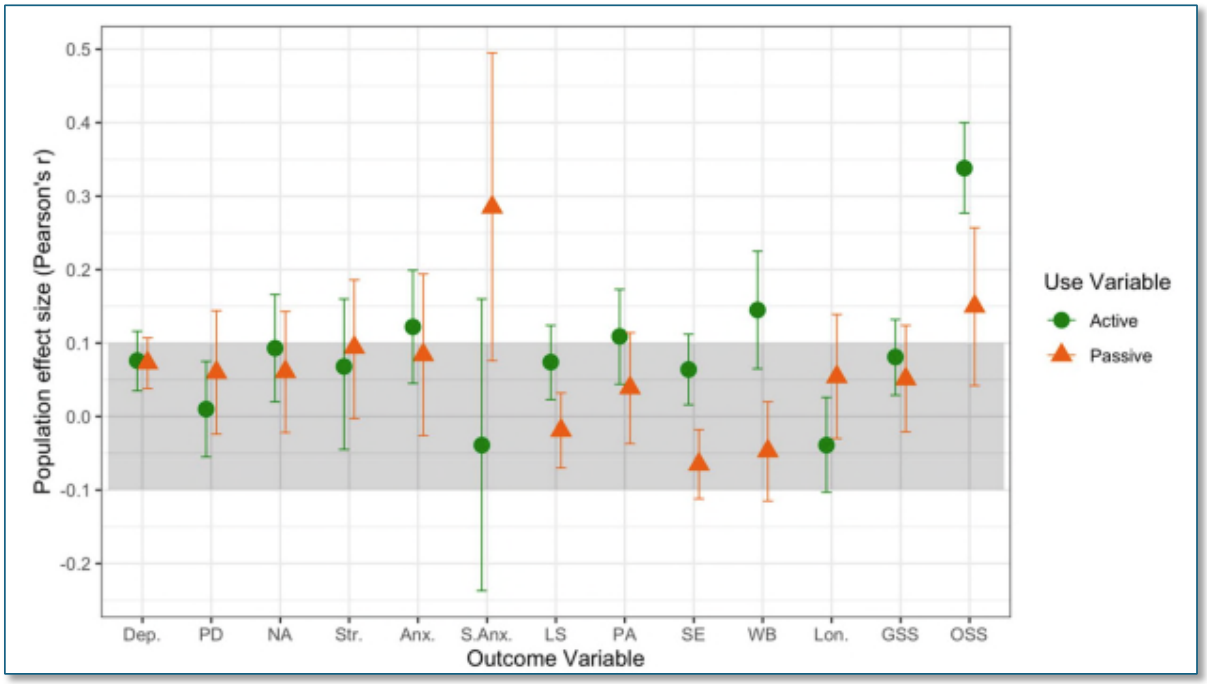
Figure 7: Results of Within Subject Analyses – Active vs. Passive Use

Variables	Associations with wellbeing outcomes		
	Worse (%)	*Negligible*(%)	*Better*(%)
Active use			
Illbeing	9 (29)	21 (68)	1 (3)
Wellbeing	1 (6)	12 (71)	4 (24)
Social wellbeing	0 (0)	5 (83)	1 (17)
Passive use			
Illbeing	2 (11)	15 (83)	1 (6)
Wellbeing	10 (43)	11 (48)	2 (9)
Social wellbeing	0 (0)	6 (86)	1 (14)

Note: Worse effects defined as $r \leq -.10$ for positive outcomes (e.g., life satisfaction) and $r \geq .10$ for negative outcomes (e.g., depressive symptoms). Negligible effects defined as $-.10 < r < .10$. Better effects defined as $r \geq .10$ for positive outcomes (e.g., life satisfaction) and $r \leq -.10$ for negative outcomes (e.g., depressive symptoms).

Next, the authors summarized the effects across 13 distinct psycholgical outcomes. Those results are presented in Figure 8 below.

Figure 8: Effects of Active vs Passive Use Across Psychological Outcomes



Dep (depressive symptoms); PD (psychological distress); NA (negative affect); Str (stress); Anx (anxiety); S. Anx (social anxiety); LS (life satisfaction); PA (positive affect); SE (self-esteem); WB (wellbeing); Lon (loneliness); GSS (global social support); OSS (online social support). Gray areas indicate negligible effect sizes.

As can be seen, most of the effects are in the gray, negligible effect size range and not statistically different from each other. And in all but two of them—wellbeing and online social support—active vs. passive use are statistically indistinguishable. Let's discuss each in turn. The difference in effect size for wellbeing is .15 (small); as discussed above, and noted by the authors of the paper, that minimal difference could be accounted for by better wellbeing *causing* more active usage rather than the other way around. The difference in online social support is slightly larger (.20). However, this too is not surprising since part of online social support entails having exchanges (active use) with other individuals, making the findings somewhat tautologic. Having reviewed the paper, I concur with the authors' conclusions that "the mostly negligible associations

between active and passive social media use and mental health and wellbeing highlight that the public must remain cautious of overly simplistic or enthusiastic statements about the benefits of active or the harms of passive social media use.[3233]

iii) Measuring "Screen Time"

For independent scientists, robust estimates of the time teens spend on social media are difficult to attain. Teen self-reporting of social media use is generally accepted as not fully accurate. Without industry collaboration, the most precise estimates of how children spend time on their phones are derived from data acquired through passive sensing—seamlessly and invisibly measuring what sites are visited, what apps are used, and for how long they are deployed during the course of a given day. Common Sense Media did such a study in 2022.[34] They installed a passive sensing technology on the Android phones of 203 children ages 11-17. The results are summarized in the following figures.

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[32] Mr. Zuckerberg has made such statements on numerous occasions. For instance, on January 11, 2018 he posted on Facebook: "The research shows that when we use social media to connect with people we care about, it can be good for our well-being. We can feel more connected and less lonely, and that correlates with long term measures of happiness and health. On the other hand, passively reading articles or watching videos -- even if they're entertaining or informative -- may not be as good."
https://www.facebook.com/zuck/posts/10104413015393571?ref=embed_post.
Likewise, in testimony before Congress, he said: "What we find in general is that if you're using social media in order to build relationships, right? So you're — you're sharing content with friends, you're interacting, then that is associated with all of the long-term measures of well-being that you'd intuitively thing of. Long-term health, long-term happiness, long-term feeling connected, feeling less lonely. But if you're using the Internet and social media primarily to just passively consume content, and you're not engaging with other people, then it doesn't have those positive effects and it could be negative." Transcript of Mark Zuckerberg's Senate hearing (Apr. 10, 2018), Washington Post, https://www.washingtonpost.com/news/the-switch/wp/2018/04/10/transcript-of-mark-zuckerbergs-senate-hearing/.

[33] Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. *Journal of Computer-Mediated Communication*. 2024;29(1)doi:10.1093/jcmc/zmad055;

[34] Radesky J, Weeks HM, Schaller A, Robb M, Mann S, Lenhart, Constant Companion: A Week in the Life of a Young Person's Smartphone Use , Common Sense. 2023;

Figure 9: Median and IQR of different app usage

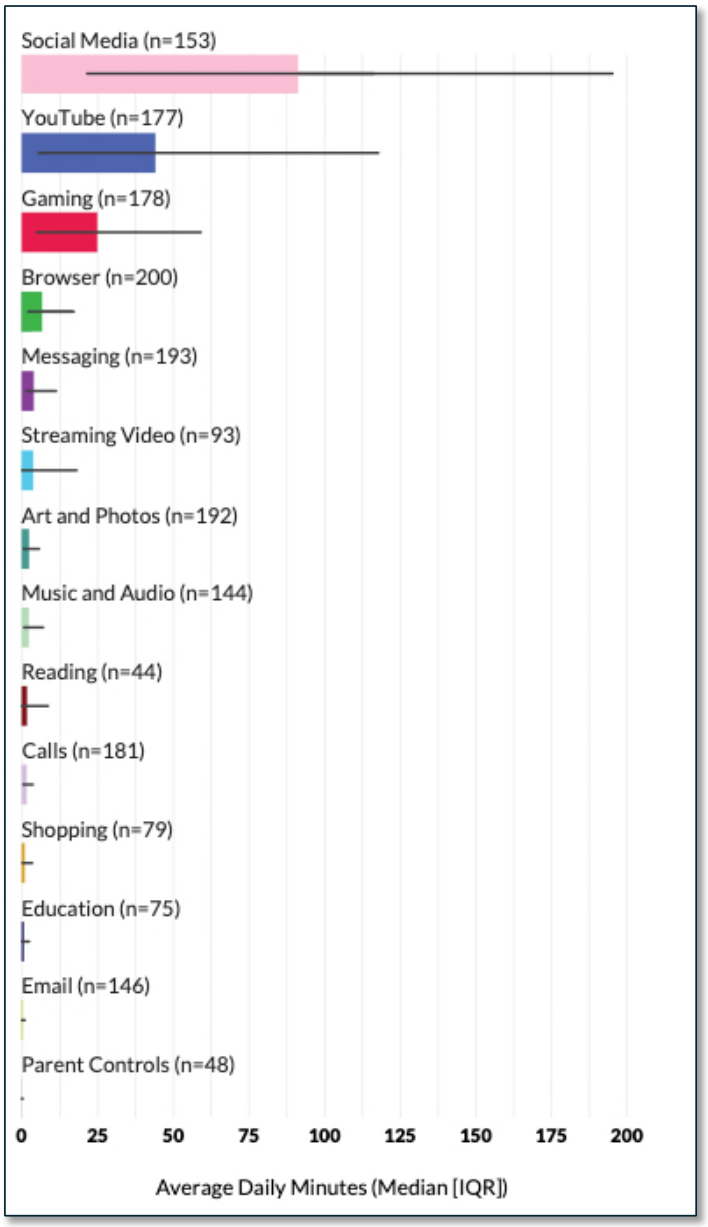


Figure 10: Popular apps, average daily duration, and % of total smartphone usage on a typical day

App name	N (%) users	Average daily duration Median [IQR]**	Range (hour:minutes)	Percentage of daily use (median)***
TikTok	102 (50.2%)	1:52 [0:24 - 2:57]	<0:01 - 7:48	38.4%
YouTube	175 (86.2%)	0:40 [0:05 - 1:52]	<0:01 - 10:13	18.2%
Instagram	70 (34.5%)	0:16 [0:03 - 0:52]	<0:01 - 2:56	5.9%
Snapchat	79 (38.9%)	0:10 [0:02 - 0:36]	<0:01 - 3:13	3.6%
Discord	72 (35.5%)	0:07 [0:02 - 0:24]	<0:01 - 12:20	2.5%
Roblox	74 (36.5%)	0:06 [0:01 - 0:40]	<0:01 - 6:25	2.6%
Chrome	191 (94.1%)	0:04 [0:01 - 0:13]	<0:01 - 1:24	1.5%
Netflix	53 (26.1%)	0:03 [0:01 - 0:17]	<0:01 - 7:31	0.8%
Spotify	81 (39.9%)	0:01 [<0:01 - 0:04]	<0:01 - 0:31	0.6%
Facebook	40 (19.7%)	0:01 [<0:01 - 0:04]	<0:01 - 1:34	0.1%
Google quick search box	180 (88.7%)	0:01 [<0:01 - 0:03]	<0:01 - 0:21	0.6%
Amazon	47 (23.2%)	0:01 [<0:01 - 0:03]	<0:01 - 0:20	0.3%
Pinterest	36 (17.7%)	0:01 [<0:01 - 0:03]	<0:01 - 0:48	0.4%

*Calculated only among participants who used that app.

**Median is the value that 50% of the users are under and 50% are over. IQR is the Interquartile Range, which is the middle 50% of users, with 25% of users under the first value and 25% of users over the second value.

***Percentage of daily use is calculated among those who use the app and as a percentage of all their smartphone use in a day.

Social media (TikTok, Instagram, Facebook, Snapchat, and YouTube) are the most used apps. Over 60% of the median total daily media time is spent on TikTok, YouTube, Instagram, Snapchat, and Facebook. Given that, it is not unreasonable to posit that even studies that focus on the effects of *overall* "screen time" are driven in large part by usage of these apps.

My group has also collected more recent data (2024) using passive sensing in a nationally representative sample of 229 13–18-year-old US children. This study included both iOS and android phones. These results are summarized below.

Figure 11: Android and iOS App usage in US Teens 13-18 years of age[35]

Label	# users	Min	25th%	*Mdn*	75th%	Max	*M*	*SD*	% daily use (Mdn)
TikTok (min)	173	0.08	8.62	70.10	140.31	323.16	85.10	84.62	22.9%
Facebook (min)	170	0.01	0.47	1.92	5.77	210.25	8.27	22.16	0.6%
Instagram (min)	209	0.01	4.71	15.78	53.54	347.88	38.03	54.46	5.2%
YouTube (min)	201	0.00	1.85	13.48	40.83	452.46	46.50	83.39	4.4%
Snapchat (min)	154	0.00	0.85	3.89	15.28	539.53	19.38	58.42	1.3%

Given the relatively small sample sizes of both studies, the two-year difference in time that the data were collected, and the fact that one used both Android and iOs whereas the other was limited to android alone, the inconsistencies in the data are not surprising. The median and interquartile range of TikTok use for example in the CSM sample is 1:52 [24-2:57] whereas in mine it is 1:10 [8.62-2:20]. TikTok's own data reports a median of 1:20 min per day in children 13-17 years of age.[36] I presume that TikTok's data adequately represents the truth given the source and the sample size, but their data are limited to their platform and of course most children are on more than one. All totaled, a sizeable amount of time is spent by the "average" teenager on SM sites and more than enough to profoundly influence mental health and behavior.

VI. Pre-Teen and Teen Brain Development

Pre-teens and teens are particularly vulnerable to mental health harms from social media use due to their biological and psychological development. Children are not simply small adults, and the impact of any experience or exposure must be understood in the context of their ongoing

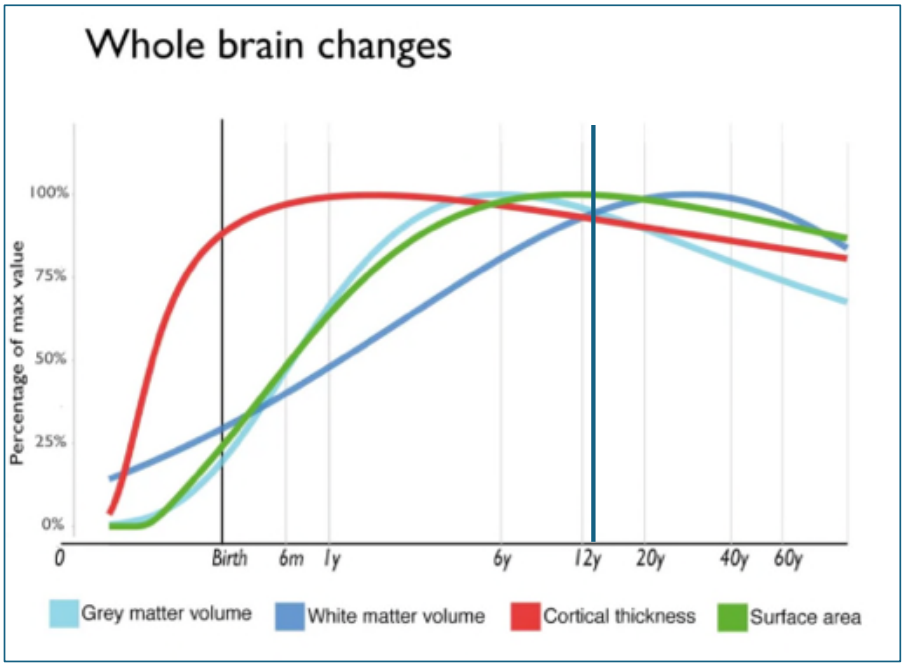
[35] https://jamanetwork.com/journals/jamapediatrics/fullarticle/2829879#:~:text=We%20found%20that%20adolescents%20spent,on%20their%20phone%20during%20school.
[36] TIKTOK3047MDL-002-00098058, -8060

biological and psychological development. Because of their brain development, they are particularly vulnerable to experiences such as “FOMO” and social contagion, both of which are discussed later in this report.

Human brains develop throughout adolescence into early adulthood. Different regions mature at different rates. At birth, the brainstem and cerebellum are highly developed, supporting vital functions like breathing, heart rate, and basic motor control. During infancy and early childhood, the limbic system, particularly the amygdala and hippocampus, rapidly develops, facilitating emotional responses and memory formation. Later, the cerebral cortex, responsible for higher cognitive functions, undergoes significant growth, with sensory and motor areas maturing first, followed by language centers, which develop rapidly in early childhood. The prefrontal cortex, often referred to as the “CEO of the brain” because it is essential for decision-making, impulse control, and complex reasoning, is the last to fully mature, and typically completes development at around age 26. During adolescence, synaptic pruning strengthens important neural connections while eliminating less-used ones, refining cognitive abilities. Myelination, the process of insulating nerve fibers to improve communication between brain regions, progresses throughout childhood and adolescence, with the prefrontal cortex again being the last region to complete the process. This prolonged development explains why teens and emerging adults may struggle with long-term planning and impulse control compared to fully mature adults, and why social media especially can have significant impacts on children and adolescents.

The figure below from the University of Cambridge shows when different brain regions reach 100% capacity. White matter volume (shown in dark blue) is the part of the brain that plays a crucial role in memory, attention, and decision making. I have added a blue vertical line corresponding to age 13.

Figure 12: Brain Maturation[37]



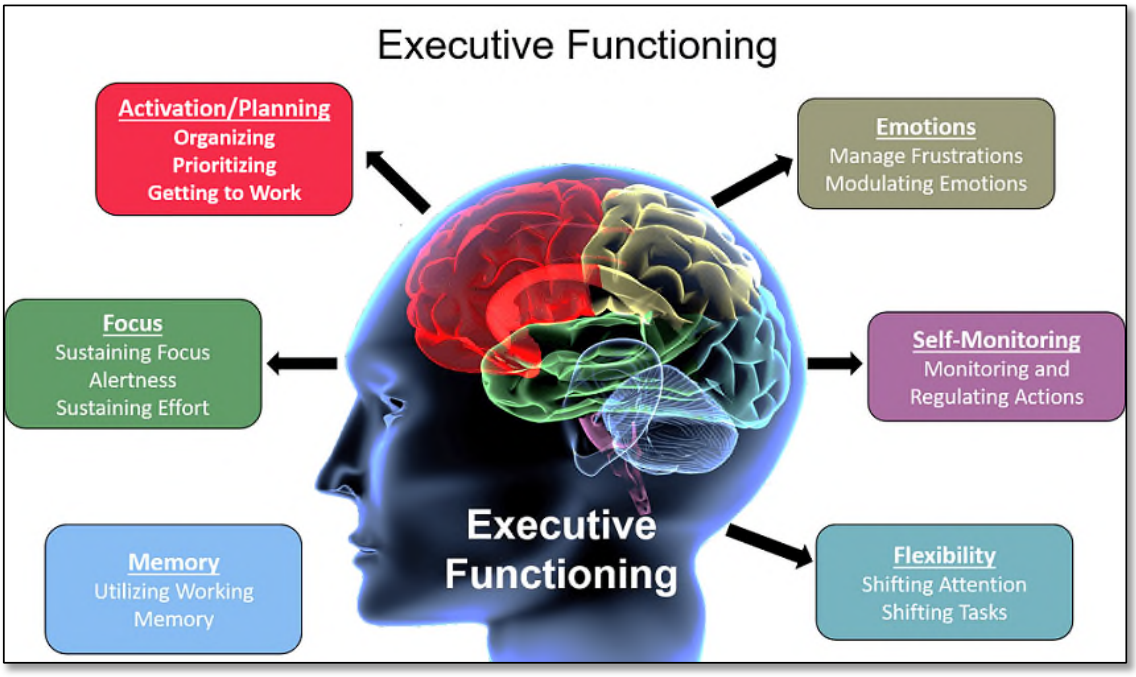
"Executive Function" is a foundational construct used by cognitive psychology and neuroscience to describe a set of skills that emerge as the brain develops. It is comprised of several key capacities, as shown in Figure 12. All these play essential roles in human development and function and underpin both reactions to and effects of environmental stimuli.

Children's developmental trajectories are highly individualized, which is to say there is considerable variability in the age at which these capacities are fully present. When we say that the "typical" 5-year-old can do X it means that as many as ½ to 1/3 cannot do it…. yet. Further, cognitive capacity is modulated by inhibitory control or "self-monitoring" (as shown in Figure 13). What this means is that even if a child "knows" the right thing to choose or to do, their lack of impulse control might make them get it wrong or not act appropriately. Optimal executive function involves a titration of latency (delay) and accuracy, and executive function is essential to

[37] https://www.cam.ac.uk/stories/BrainCharts

sound decision making. This lack of fully developed executive functioning makes adolescents particularly vulnerable to the harmful effects of social media. As noted below, this vulnerability is acknowledged in Defendants' internal documents.

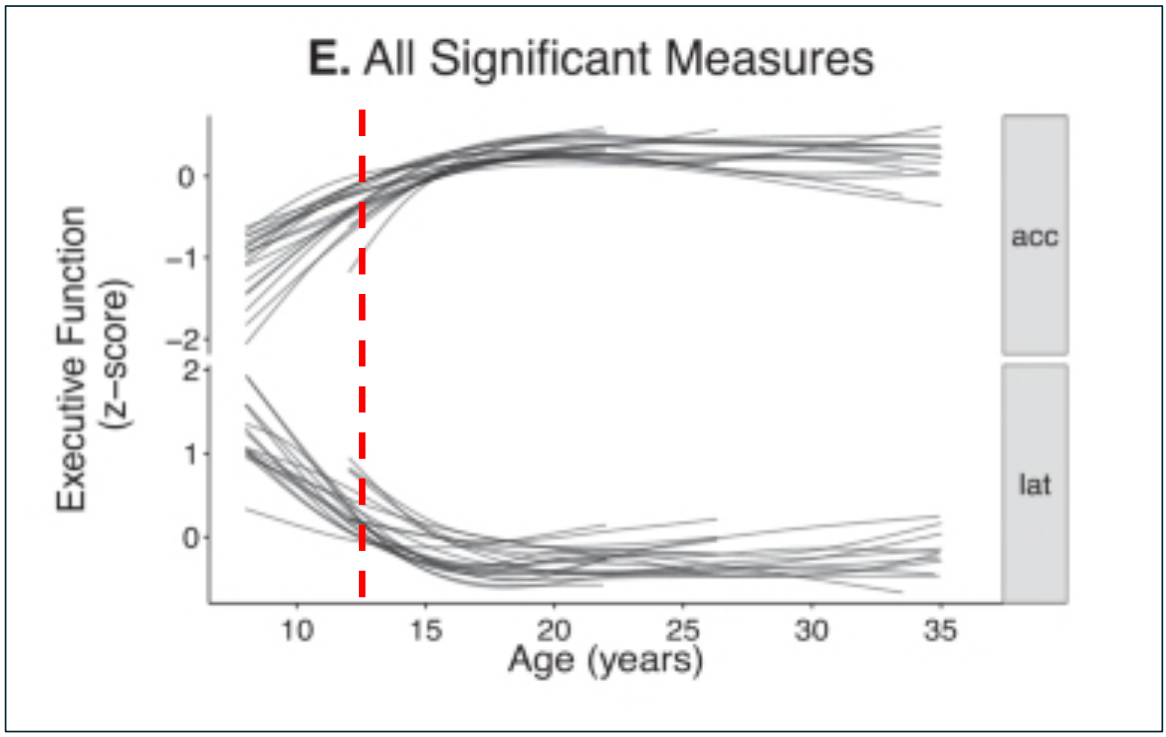
Figure 13: Executive Functioning



A recent paper used multiple population-based data sets to examine the evolution of executive function from adolescence to early adulthood.[38] A summary graph of all of the deployed measures in all the samples is presented below.

[38] Tervo-Clemmens B, Calabro FJ, Parr AC, Fedor J, Foran W, Luna B. A canonical trajectory of executive function maturation from adolescence to adulthood. *Nature Communications*. 2023/10/30 2023;14(1):6922. doi:10.1038/s41467-023-42540-8

Figure 14: Measures of Executive Function[39]



From ages 9 -35 accuracy increases and latency decreases. The trajectories of both are very steep during that period. The red dotted line represents age 13, the current "allowable" age for usage of SMs as set by industry. Again, keeping in mind that the solid lines represent "averages" at any given age, half of all children are *below* that estimate.

This is something that the defendant platforms appear to realize. For example, TikTok found that even among those that enabled their screen management tools, they saw no benefits (i.e. screen time use was not reduced) for their <18-year-old users, which they explained by saying "minors do not have the executive function to control their screen time."[40]

[39] Tervo-Clemmens B, Calabro FJ, Parr AC, Fedor J, Foran W, Luna B. A canonical trajectory of executive function maturation from adolescence to adulthood. *Nature Communications*. 2023/10/30 2023;14(1):6922. doi:10.1038/s41467-023-42540-8

[40] TIKTOK3047MDL-039-LARK-00213033, -3036

VII. Addiction

Addiction is a construct based on directly measurable psychological and physiological attributes related to reliance on and/or withdrawal from a substrate. It is a complex condition characterized by compulsive engagement in rewarding stimuli despite adverse consequences. It often involves substances like drugs or alcohol. Teenagers and young adults who biologically lack higher cortical functioning including impulse control are more vulnerable to potentially addictive substances and behaviors. Epidemiological studies have shown that earlier onset of drug intake is associated with greater likelihood of development of substance use problems.[41] In fact, the majority of problematic substance users (e.g. tobacco and alcohol) begin usage before the age of 21.[42]

Addiction can also be due to tolerance and withdrawal from certain behaviors. Not all behavioral addictions are currently recognized in the Diagnostic and Statistical Manual of Mental Disorder, Fifth Edition, (DSM-5) which is the American Psychiatric Association's (APA) guide to mental and brain-related conditions. However, there is an increasing recognition of the need for the DSM-5 to do so. To date, only a single behavioral addiction, gambling, is officially recognized by the DSM-5. The DSM-5 considered including "gaming disorder" in its 2013 edition but determined it was "in need of further study."[43] I am currently a member of a committee that is

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[41] Crews F, He J, Hodge C. Adolescent cortical development: a critical period of vulnerability for addiction. *Pharmacol Biochem Behav*. Feb 2007;86(2):189-99. doi:10.1016/j.pbb.2006.12.001

[42] *See* Goldstein RB, Dawson DA, Grant BF. Antisocial Behavioral Syndromes in Adulthood and Alcohol Use Disorder Treatment over Three-Year Follow-Up: Results from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. *J Am Psychiatr Nurses Assoc*. Jul 2010;16(4):212-26. doi:10.1177/1078390310375846; King KM, Chassin L. A prospective study of the effects of age of initiation of alcohol and drug use on young adult substance dependence. *J Stud Alcohol Drugs*. Mar 2007;68(2):256-65. doi:10.15288/jsad.2007.68.256.

[43] American Psychiatric Association. *Desk reference to the diagnostic criteria from DSM-5*. American Psychiatric Publishing; 2013:xlviii, p. 395

proposing that gaming disorder be included in a revision (DSM-5-TR). Meta has rightly recognized in an internal document that "medical diagnoses change definitions over time based on new evidence."[44] In 2022, the World Health Organization (WHO) did recognize the existence of "gaming disorder" as a clinical entity, and it is included as a diagnosis in the International Classifications of Disease 11 (ICD-11) which is the manual that physicians use to diagnose patients.[45]

Recently, the American Psychiatric Association has recognized "technology addiction" as "excessive and compulsive use of the internet or online activities [that] can lead to negative consequences in various aspects of an individual's life."[46] "Social media addiction" is recognized as its own condition, characterized as "involv[ing] problematic and compulsive use of social media; an obsessive need to check and update social media platforms, often resulting in problems in functioning and disrupted real-world relationships."[47] The APA further recognizes that "children and adolescents are particularly vulnerable to technological addiction because their brains are still developing" and "excessive problematic use of social media" has the potential to develop into a behavioral addiction for children and adolescents.[48]

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[44] META3047MDL-014-00359270, -9278

[45] Organization WH. *International Classification of Diseases Eleventh Revision (ICD-11)*. World Health Organization; 2022.

[46] American Psychiatric Association, What is Technology Addiction?, https://www.psychiatry.org/patients-families/technology-addictions-social-media-and-more/what-is-technology-addiction (last accessed Apr. 14, 2025).

[47] American Psychiatric Association, What is Technology Addiction?, https://www.psychiatry.org/patients-families/technology-addictions-social-media-and-more/what-is-technology-addiction (last accessed Apr. 14, 2025).

[48] American Psychiatric Association, What is Technology Addiction?, https://www.psychiatry.org/patients-families/technology-addictions-social-media-and-more/what-is-technology-addiction (last accessed Apr. 14, 2025).

Because of the increased risks of social media to youth, several national associations and reports have been published with recommendations for actions that can be taken to help reduce the risk of mental health injury. Some of these reports include recommendations made in the textbook I edited, *Handbook of Children and Screens*, as well as the "Social Media and Youth Mental Health" Report by the U.S. Surgeon General in 2023;[49] "Social Media and Adolescent Health" by the National Academies of Sciences, Engineering, and Medicine in 2024[50]; "Health Advisory on Social Media Use in Adolescence" by the American Psychological Association in 2023[51]; and a report by the Jed Foundation in 2024.[52][53]

The American Academy of Pediatrics also recognizes problematic use and social media addiction and advises parents that "It's also important to recognize that it's not something wrong with the teen using the platform causing them to feel this way; many interactive technologies are specifically designed to capture and hold a user's interest. It can be hard for children and teens to overcome those design features."[54] The National Eating Disorders Association also recognizes that "research is increasingly clear that media does indeed contribute and that exposure to and pressure exerted by media increase body dissatisfaction and disordered eating."[55] Taken together, these

[49] Office of the Surgeon General, *Social Media and Youth Mental Health: The U.S. Surgeon General's Advisory* (2023), available at https://pubmed.ncbi.nlm.nih.gov/37721985/
[50] https://nap.nationalacademies.org/catalog/27396/social-media-and-adolescent-health
[51] https://www.apa.org/topics/social-media-internet/health-advisory-adolescent-social-media-use
[52] https://jedfoundation.org/the-jed-foundation-jed-recommendations-for-safeguarding-youth-well-being-on-social-media-platforms/
[53] Many of these reports readily recognize the deleterious effects of social media on children. I would note that the 2023 NASEM report takes an improbably conservative approach to the literature recognizing harms to children – a body of literature that has only grown since its publication.
[54] https://www.aap.org/en/patient-care/media-and-children/center-of-excellence-on-social-media-and-youth-mental-health/qa-portal/qa-portal-library/qa-portal-library-questions/problematic-technology-use/?srsltid=AfmBOorKPQQSzENMf3PnJhedPK39d89jvoL7LLSIH9OsEUa5MZ6624M7
[55] https://www.nationaleatingdisorders.org/media-and-eating-disorders/

consensus statements leave little doubt that leading professional medical and psychological organizations recognize that social media and its problematic and addictive usage is harming children and teenagers today.

A. Validated Social Media Addiction Scales

A variety of screening instruments for what has been called "Social Network Use Disorder" have been developed. A systematic review of the scales revealed that two of them have the best validation data to support them: the Social Media Disorder Scale (SMDS) and the Bergen Social Media Addiction Scale Short Form (BSMAS-SF).[56] Both of these measure features of substance abuse disorder including: salience, tolerance, preoccupation, impaired role performance, loss of control, and withdrawal symptoms. These features are consistent with those considered by the DSM-5.

Validation of scales includes collecting normative data from a large and diverse sample of people and then developing a clinical cutoff (the details of how that is done are beyond the scope of this report). One might rightly ask if this usage pattern constitutes pathology or simply enthusiastic usage. To test this, researchers assess "convergent validity." Specifically, how does the measured construct correlate with other outcomes we would expect it to predict. For example, we would predict that people with problematic social media usage would have increased risks of other mental health disorders (as is the case with other addictions). To that end, a recent metanalysis of 18 studies that assessed "problematic social media usage" with anxiety and

[56] Schlossarek S, Schmidt H, Bischof A, et al. Psychometric Properties of Screening Instruments for Social Network Use Disorder in Children and Adolescents: A Systematic Review. *JAMA Pediatr*. Apr 1 2023;177(4):419-426. doi:10.1001/jamapediatrics.2022.5741

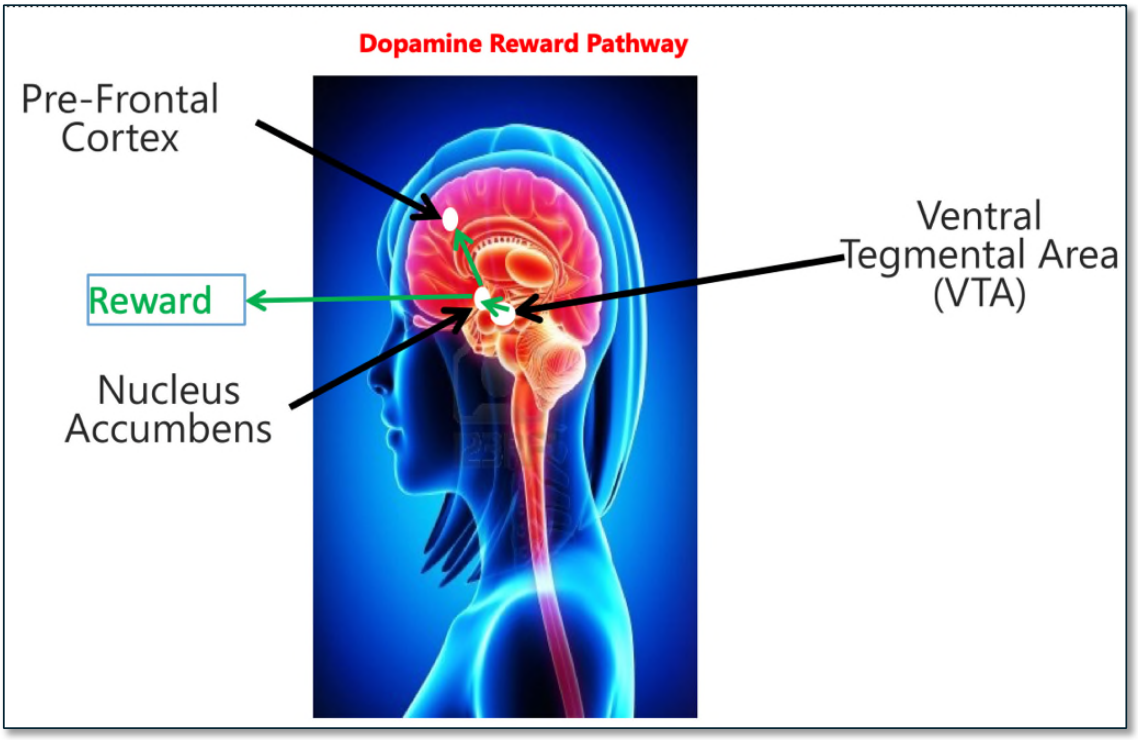
depressive symptoms found a correlation of .348 (“medium”) and .273 (almost “medium”) respectively.[57]

B. The Mechanism of Addiction

Addiction (both behavioral and substance-based) is grounded in the brain's dopamine reward system. Exposure to a stimulus is processed in the Ventral Tegmental Area (VTA) of the mid-brain that releases dopamine. When that stimulus is “favorable,” the VTA signals the nucleus accumbens (the pleasure center of the brain) which in turn signals the Pre-Frontal Cortex (the executive center of the brain as discussed before) effectively saying “I liked that” so “do it again” or “get more of it.”

[57] Shannon H, Bush K, Villeneuve P, Hellemans K, Guimond S. Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-analysis. *JMIR Ment Health*. 2022;9(4).

Figure 15: The Dopamine Reward Pathway



This is a generic pathway; it is activated for example when parents praise children for behaviors (e.g. saying "thank you") thereby increasing the probability (hopefully) that they will act that way more often. In pathological circumstances, given prolonged exposure to intensely pleasurable stimuli, the brain's natural reward pathways can be altered, making it increasingly difficult to experience pleasure from other activities. At a neurobiological level then, behavioral and substance-based addictions have a final common pathway. Functional magnetic resonance imaging (fMRI) studies have demonstrated that social media usage (and Facebook in particular) activates the nucleus accumbens.[58] Indeed, Meta documents acknowledge that Facebook "does

[58] *See* Meshi D, Morawetz C, Heekeren HR. Nucleus accumbens response to gains in reputation for the self relative to gains for others predicts social media use. Original Research. *Frontiers in Human Neuroscience*. 2013-August-29 2013;7doi:10.3389/fnhum.2013.00439; Wadsley M,

activate the brain's reward system."[59] Moreover, a three year longitudinal study of 6th and 7th grade students found changes in functional activation of the brain based on reported habitual checking of social media sites at baseline.[60] Specifically, habitual checkers' brains demonstrated hypoactivation of specific regions in anticipation of social cues compared to non-habitual checkers. This suggests that their brains may be requiring more intense stimuli to activate as a result of repeated activation. Put another way, they may be developing tolerance (a feature of addiction).

The causes of addiction are multifaceted, involving a combination of genetic, environmental, and psychological factors. Although not determinative, genetics may predispose individuals to addiction, while environmental factors such as peer pressure, stress, or trauma can trigger problematic substance use or behaviors. Mental health conditions like depression and anxiety are also linked to addiction, as individuals may turn to substances or behaviors as a form of self-medication. Early exposure to addictive substances, particularly during childhood, increases the likelihood of addiction later in life.

C. The Formation of Habit—Distinguishing Addiction from Habit

Addiction can be distinguished from habit. Although both involve repeated behaviors and activation of the dopamine reward center, they differ in terms of control, dependence, and consequences. A habit is a routine that is performed regularly (brushing one's teeth for example) and often unconsciously. People can typically stop habits without experiencing withdrawal. But

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Ihssen N. A Systematic Review of Structural and Functional MRI Studies Investigating Social Networking Site Use. *Brain Sciences*. 2023;13(5):787.

[59] META3047MDL-014-00359270, -9288

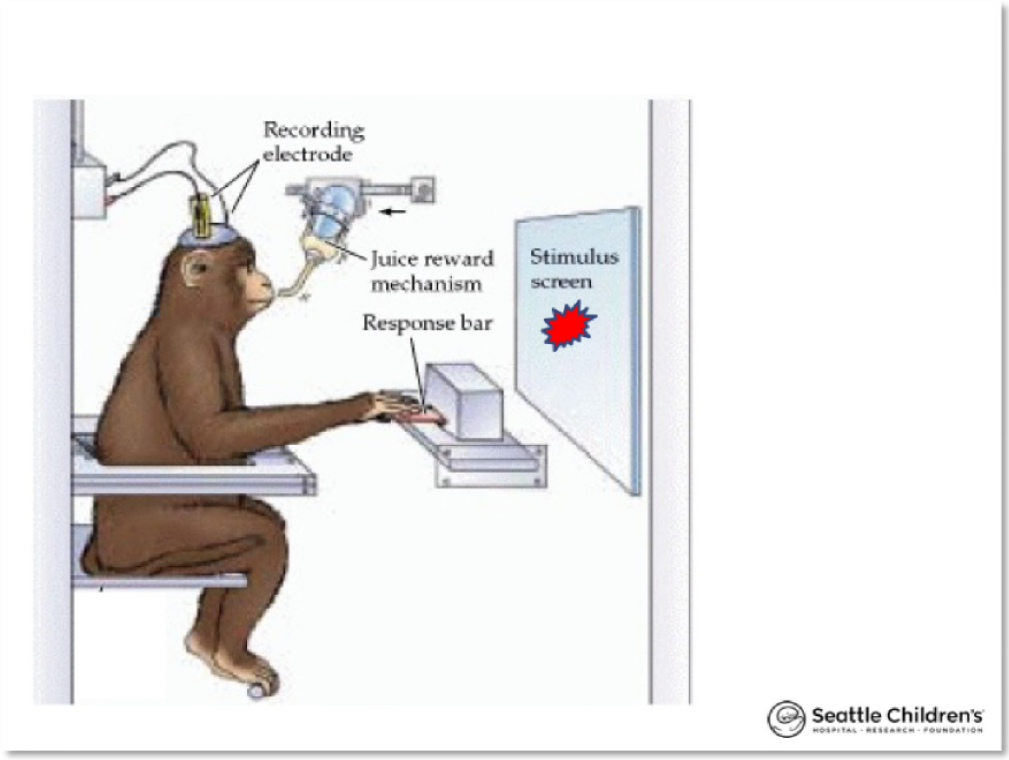
[60] Maza MT, Fox KA, Kwon S-J, et al. Association of Habitual Checking Behaviors on Social Media With Longitudinal Functional Brain Development. *JAMA Pediatrics*. 2023;177(2):160-167. doi:10.1001/jamapediatrics.2022.4924

habits can become addictions. A habitual use of alcohol after work can progress to alcohol abuse, for example.

Much of what we know about the emergence of habit comes from seminal work done by a neuroscientist named Wolfram Schultz with his colleagues and a *Macaque* monkey named Julio. In a typical experiment, Julio was seated in a chamber with a device that recorded activity in his Nucleus Accumbens (the pleasure center as detailed above). He would stare at a blank screen while being given access to a response bar. At random periodic intervals, a shape would appear on the screen and if he pushed the lever when it did, a juice reward dispenser delivered blackberry juice (his favorite libation).[61]

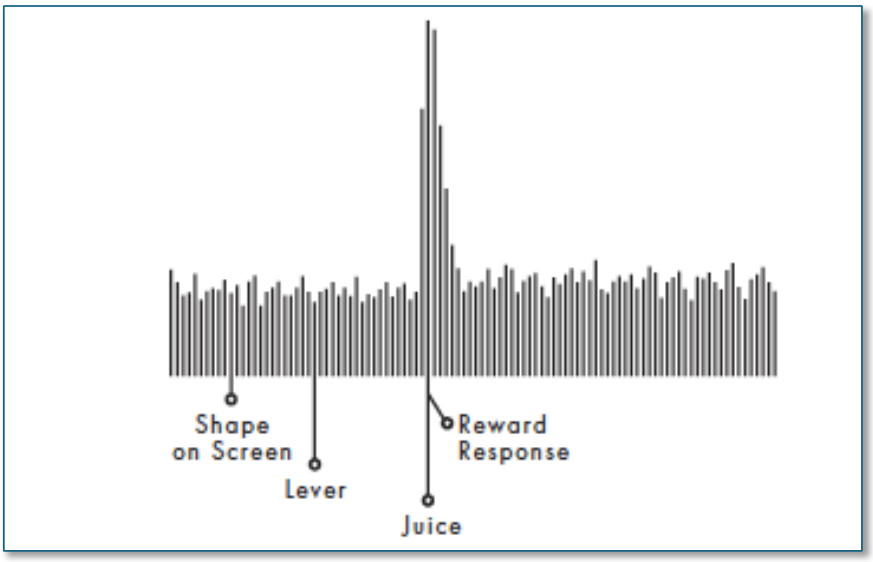
[61] Ljungberg T, Apicella P, Schultz W. Responses of monkey dopamine neurons during learning of behavioral reactions. *J Neurophysiol*. 1992;67(1):145-63.

Figure 16: Picture Simulating Electrode Dopamine Experiment



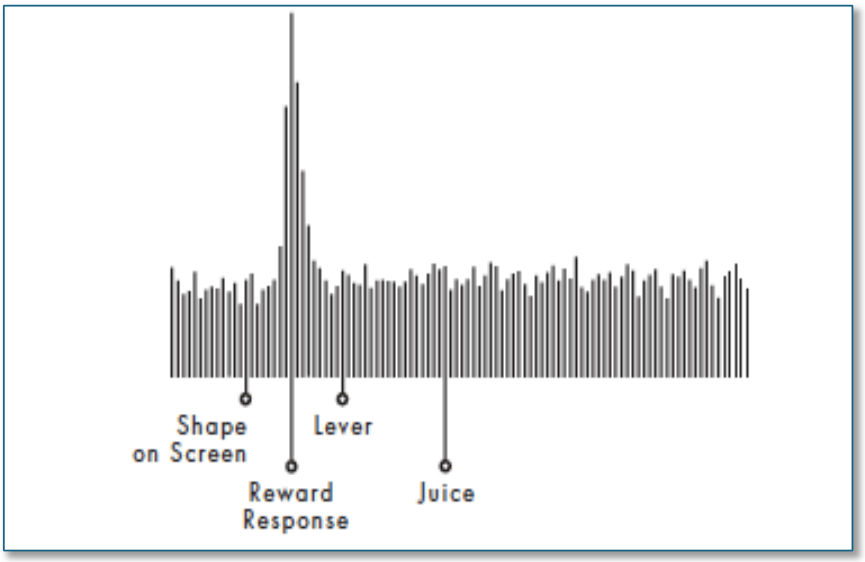
The figure below shows the activity recorded in Julio's nucleus accumbens during the training session during which he was effectively learning that pushing the response lever *when* a shape appeared led to a reward. What can be seen is a spike in activity, a "reward" response, when the juice is delivered, which happens after the shape appears on the screen and the lever is pushed.

Figure 17: Nucleus Accumbens Activity during "Training"

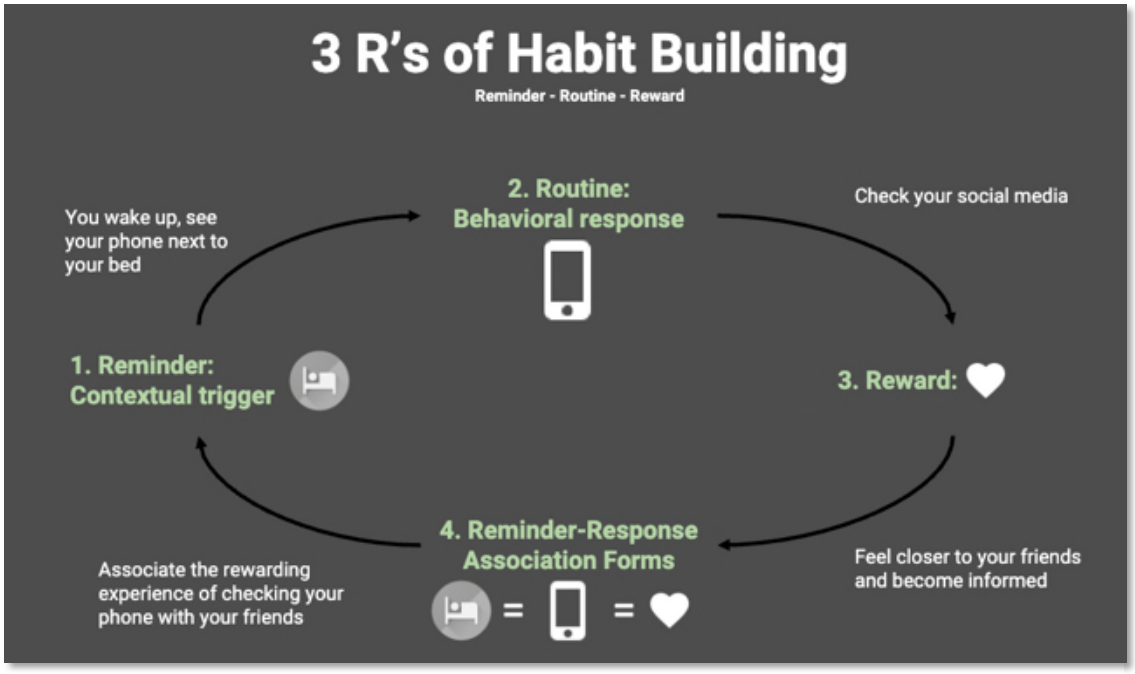


The next figure shows the pattern after Julio is "trained." The reward response occurs the moment he sees the shape appear on the screen and *before* the juice is actually dispensed—which is to say he experiences the reward activation simply because he anticipates it given that he *associates* the shape with pleasure.

Figure 18: Nucleus Accumbens Activity once "Trained"

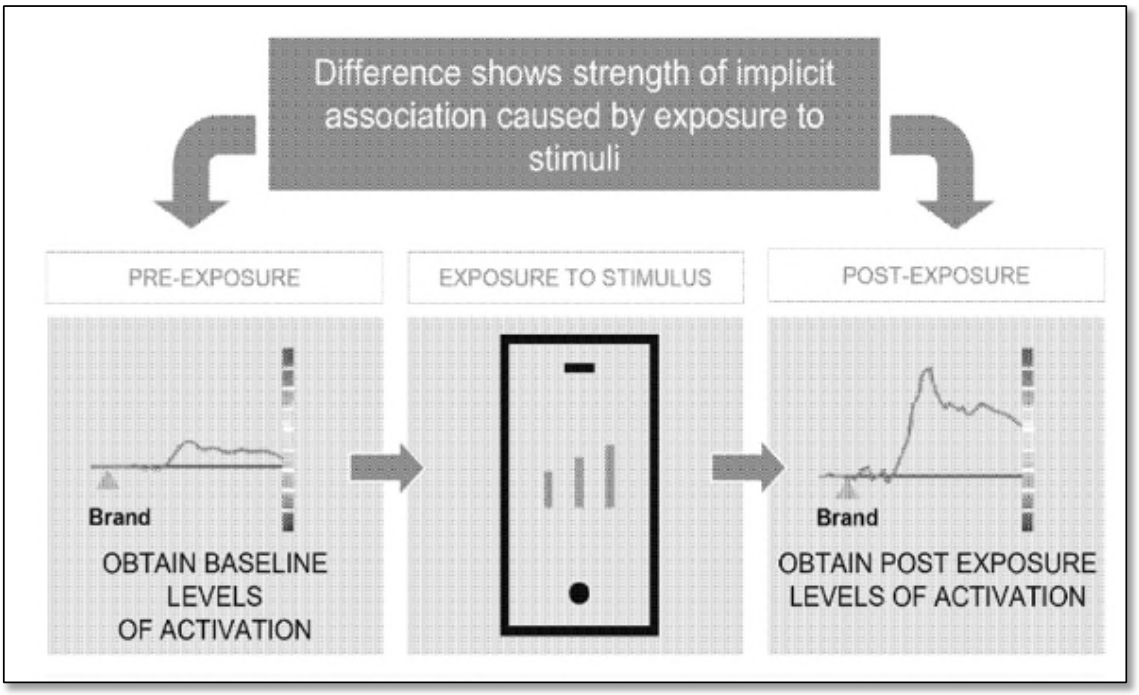


YouTube is keenly aware of the science behind habit formation as it appeared to use it to help build its brand. In a December 2024 presentation by [redacted] (User Experience Researcher on the growth team) the following slide appears:



Document 6: GOOG-3047MDL-01268284 at Slide 6

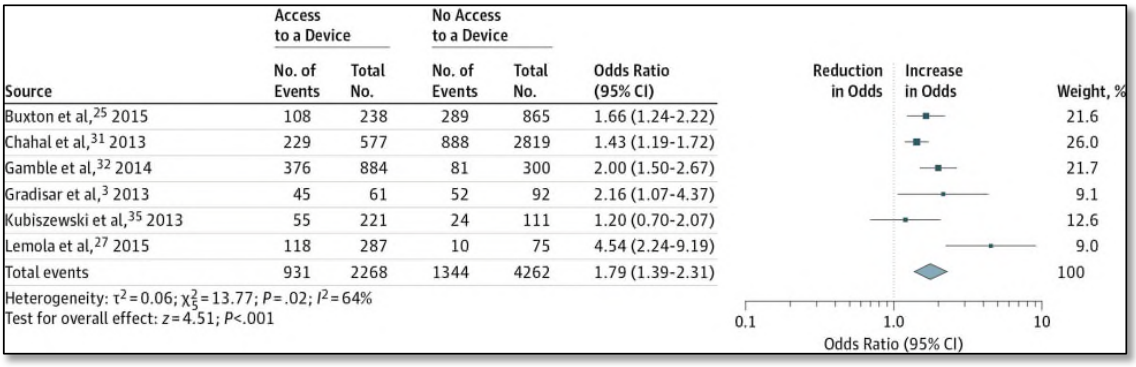
TikTok also engaged Nielson Consumer Neuroscience to explore deploying the habit paradigm to associate their videos with a particular product advertised in tandem with it. In an approach reminiscent of Schulz's work, except with humans, they monitor before and after brain activation and ultimately pair it with an advertisement.



Document 7: TIKTOK3047MDL-020-00376995, -7003

The formation of habit explains, in part, how many adolescents associate the mere presence of their device with pleasure to such a great enough extent that it can be difficult to resist. This "habitual" reaction has been documented in studies that assess the *presence* of a phone in a child's bedroom and the occurrence of sleep problems. Figure 19 (below) shows data from a metanalysis (as explained above, metanalyses provide a summary estimate of multiple different studies).

Figure 19: Summary of Metanalysis Assessing Effect of the Presence of a Phone in a Child's Bedroom and the Occurrence of Sleep Problems[62]



Source	Access to a Device: No. of Events	Access to a Device: Total No.	No Access to a Device: No. of Events	No Access to a Device: Total No.	Odds Ratio (95% CI)	Weight, %
Buxton et al,[25] 2015	108	238	289	865	1.66 (1.24-2.22)	21.6
Chahal et al,[31] 2013	229	577	888	2819	1.43 (1.19-1.72)	26.0
Gamble et al,[32] 2014	376	884	81	300	2.00 (1.50-2.67)	21.7
Gradisar et al,[3] 2013	45	61	52	92	2.16 (1.07-4.37)	9.1
Kubiszewski et al,[35] 2013	55	221	24	111	1.20 (0.70-2.07)	12.6
Lemola et al,[27] 2015	118	287	10	75	4.54 (2.24-9.19)	9.0
Total events	931	2268	1344	4262	1.79 (1.39-2.31)	100

Heterogeneity: $\tau^2 = 0.06$; $\chi^2_5 = 13.77$; $P = .02$; $I^2 = 64\%$
Test for overall effect: $z = 4.51$; $P < .001$

The summary estimate shows that the mere presence (not necessarily the *usage*) of a device in a bedroom is associated with a 79% increased risk of sleep problems. However, as discussed below, there is evidence that social media on its own is also increasing sleep problems. One plausible explanation is that the habitual usage of phones is activating the reward reflex – for example, by inducing the teen to think of "likes" on the SM platform – and thereby impeding sleep initiation and quality. This will be discussed in greater detail in the "Sleep" section of this report (Section X.C).

D. Problematic Social Media Use Can Occur as Habitual, Compulsive, or Addictive

Whether it's called compulsive or addictive, problematic usage of digital media is an untoward outcome of its own as it impedes daily functioning. But it also exacerbates all the other direct effects of social media sites since it drives increased exposure to the platforms.

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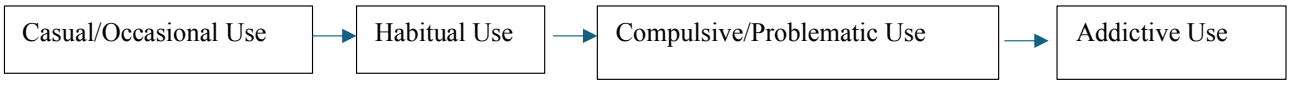
[62] Carter B, Rees P, Hale L, Bhattacharjee D, Paradkar MS. Association Between Portable Screen-Based Media Device Access or Use and Sleep Outcomes: A Systematic Review and Meta-analysis. *JAMA Pediatr*. Dec 1 2016;170(12):1202-1208. doi:10.1001/jamapediatrics.2016.2341

The consequences of addiction extend beyond the individual, affecting their relationships, career, and overall well-being. Psychologically, addiction often results in feelings of isolation, guilt, or shame, further perpetuating its cycle. An essential feature of "addiction" is that it impedes activities of daily living such that one chooses to indulge in the activity or substance rather than work or socialize for example. Social media addiction can lead to diminished sleep and missed school. Attempts at reducing usage can cause anxiety, depression, and irritability and conflict when attempted by exogenous agents e.g. parents.[63]

Addiction lies at one extreme of a usage and behavior continuum as depicted below:

Figure 20: Social Network Site Usage Continuum



While addiction is a clinical diagnosis and typically based on established and accepted expert criteria derived from the scientific literature, anything to the "right" of casual usage in the schema above increases the likelihood of untoward mental and physical health effects. One needn't meet criteria for a clinical diagnosis of addiction *per se* to be negatively impacted by a behavior. In that sense, addiction is an identifiable harm resulting from the larger umbrella of problematic usage, which also causes anxiety, depression, and other mental health harms. For example, one

[63] Radesky J, Weeks HM, Schaller A, Robb M, Mann S, Lenhart, Constant Companion: A Week in the Life of a Young Person's Smartphone Use (2023), available at https://www.commonsensemedia.org/sites/default/files/research/report/2023-cs-smartphone-research-report_final-for-web.pdf

need not be diagnosed with "alcoholism" per se to suffer negative health effects of "excessive" drinking. Increases in all-cause mortality can be seen even at "medium" level drinkers.[64]

For example, in the case of substance abuse, decades of research established a taxonomy that is more nuanced than simply alcohol "abuse" vs "use." The National Institute of Alcohol Abuse and Alcoholism (NIAAA) has established different usage patterns that have been studied both for their independent effects on functioning and how each might ultimately lead to the clinical entity of Alcohol Use Disorder (Table 1). Any behavior beyond "moderate drinking" i.e. below the thick black line is viewed as problematic and can lead to untoward health effects including but not limited to Alcohol Use Disorder itself. In a recent viewpoint in *JAMA*, I proposed developing an analogous taxonomy for "Media Use Disorder."

[64] Zhao J, Stockwell T, Naimi T, Churchill S, Clay J, Sherk A. Association Between Daily Alcohol Intake and Risk of All-Cause Mortality: A Systematic Review and Meta-analyses. *JAMA Network Open*. 2023;6(3):e236185-e236185. doi:10.1001/jamanetworkopen.2023.6185

Table 4: Comparison of NIAAA Alcohol Drinking Pattern Definitions with Provisional Cutpoints from SBU MEDiA Study Patterns

NIAAA Alcohol Drinking Patterns	SBU MEDiA Study Usage Patterns
Moderate Drinking	**Moderate Media Use**
Two drinks or less in a day for men and one drink or less in a day for women, when alcohol is consumed. Drinking less is better for health than drinking more.	Less than 5 hours per day (<50th percentile)
Binge Drinking	**Binge Media Use**
Five or more drinks (male) or four or more drinks (female), in about two hours.	More than 4 hours in a continuous session*
High-Intensity Drinking	**High-Intensity Media Use**
10 or more standard drinks (or alcohol drink equivalents) for males and eight or more for females.	12 hours or more in one day (95th percentile)
Heavy Drinking	**Heavy Media Use**
• Consuming five or more drinks on any day or 15 or more per week (male) • Consuming four or more on any day or eight or more drinks per week (female)	9 hours or more per day (85th percentile) or 60 hours per week (85th percentile)
Alcohol Misuse	**Media Misuse**
Alcohol misuse refers to drinking in a manner, situation, amount, or frequency that could cause harm to the person who drinks or to those around them. Alcohol misuse includes binge drinking and heavy alcohol use.	Media misuse entails binge, high-intensity, and heavy viewing that include inappropriate timing (e.g., school or sleeping hours), inappropriate content (e.g., cyberbullying, pro-eating disorder content), or viewing during dangerous situations (e.g., distracted driving).
Alcohol Use Disorder	**Media Use Disorder**
AUD is a medical condition characterized by an impaired ability to stop or control alcohol use despite adverse social, occupational, or health consequences. It encompasses the conditions that some people refer to as alcohol abuse, alcohol dependence, alcohol addiction, and the colloquial term, alcoholism.	MUD is characterized by an impaired ability to stop or control media use despite adverse social, occupational/school-related, or mental health consequences. Various validated measures exist related to social media use.

*The definition of binge smartphone use should be empirically derived. This provisional cut point of 4 hours of continuous viewing is based on a systematic review of definitions of binge-watching overall media use.

E. Social Contagion via Social Media Platforms

A design aspect of social media that is related to problematic or addictive use is the way in which the platforms utilize social contagion. Social contagion refers to the phenomenon where ideas, emotions, behaviors, or attitudes spread through social networks, much like a virus. It highlights the interconnected nature of human societies, where individuals unconsciously or consciously influence one another. For example, laughter in a group can quickly become contagious, even among those who do not know why others are laughing. Similarly, trends, such as fashion styles or internet challenges, often spread rapidly because individuals adopt behaviors observed in others to feel connected or accepted within a group.

The mechanisms behind social contagion are rooted in psychological and sociological principles. Mirror neurons in the brain play a role by enabling individuals to mimic others' emotions or actions, fostering empathy and shared experiences. Additionally, conformity and peer pressure amplify the spread of behaviors, particularly in tight-knit social circles. While social contagion can have positive effects, such as the adoption of healthy habits or the rapid dissemination of valuable information, it can also perpetuate harmful behaviors like panic during crises or the spread of misinformation. Understanding social contagion is crucial for designing interventions in areas such as public health, education, and online media, where both positive and negative influences can scale rapidly.

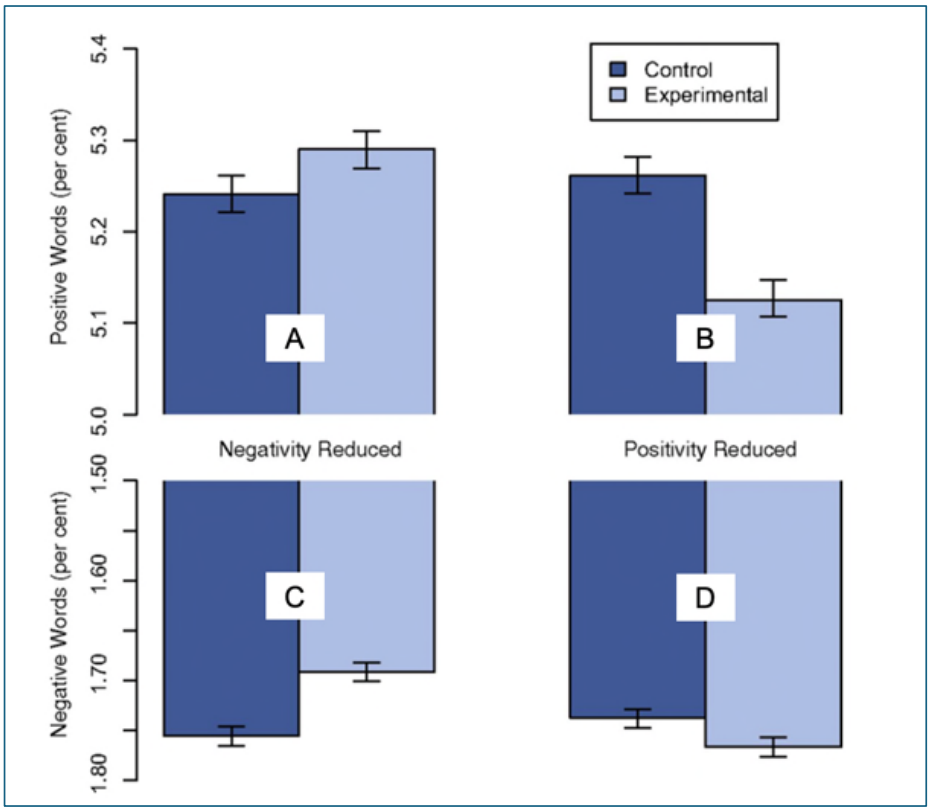
A 2014 study tested the social contagion phenomenon on social media. It assessed the effects of rainfall on an individual's social media posts and found (unsurprisingly) that rainfall increased the probability of negative posts. But the study also found that it increased the probability of negative posts of rainy-day city people's friends who lived in cities where it was *not* raining on

a given day.[65] While this study was observational, it deployed what is known as an instrumental variable design. Specifically, the rainfall in "City A" can cause negative affect in that city but it cannot directly cause negative affect in "City B" where it is ***not*** raining. Therefore, rain cannot be a confounder and the negativity of an individual in City B can be attributed to their connection with an individual in City A whose mood is more dreary because of the precipitation. "Instrumental variable" approaches such as this are among the strongest observational designs because of the way they circumvent potential confounding.

Most prominently – in a yet to be repeated publicly available study the likes of which only the social media industry itself could do – Facebook tested social contagion theory on their site using an experimental design in which 689,003 people's news feeds were randomized to show fewer positively and fewer negatively worded posts.[66] The outcome of interest was the valence of the content they subsequently posted. In other words, they tested the hypothesis that seeing more positive content induced one to post more positive content and seeing less negative content induced one to post less negative content.

[65] Coviello L, Sohn Y, Kramer AD, Marlow C, Franceschetti M, Christakis NA, Fowler JH. Detecting emotional contagion in massive social networks. PLoS One. 2014 Mar 12;9(3):e90315. doi: 10.1371/journal.pone.0090315. PMID: 24621792; PMCID: PMC3951248.
[66] Kramer ADI, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. *Proceedings of the National Academy of Sciences*. 2014;111(24):8788-8790. doi:doi:10.1073/pnas.1320040111

Figure 21: Figure from Facebook's Emotional Contagion Study[67]



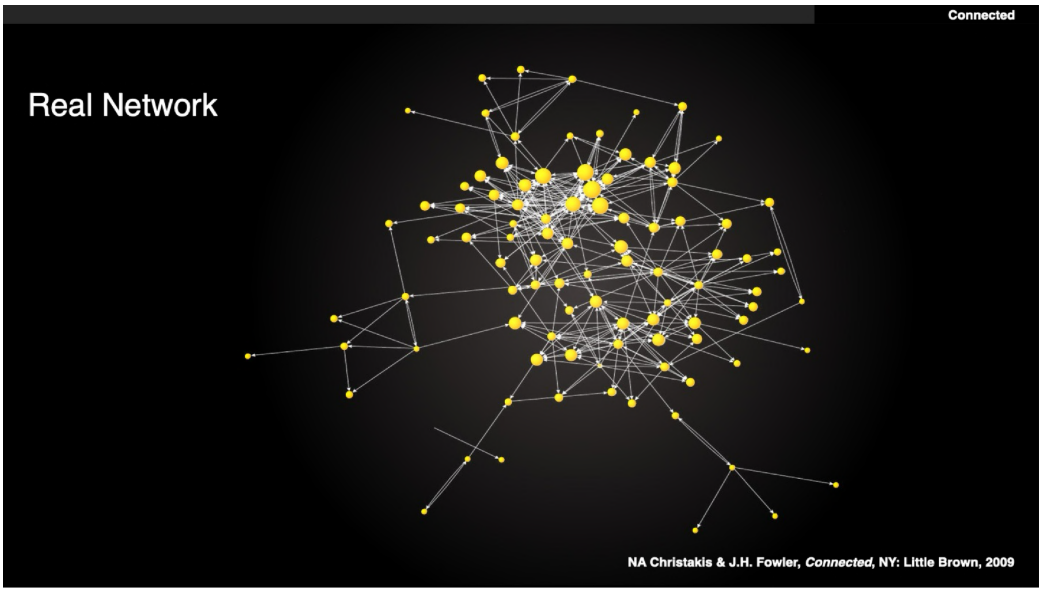
As Panel C to the left shows, reducing the frequency of negative posts on someone's feeds results in fewer negative words posted by the "experimental" group compared to the "control" group. Conversely, as Panel B shows, reducing positive posts results in fewer positive words posted (again experimental vs control). But as Panels A & D demonstrate, reduced negative words results in more positive ones and reduced positive posts results in more negative ones.

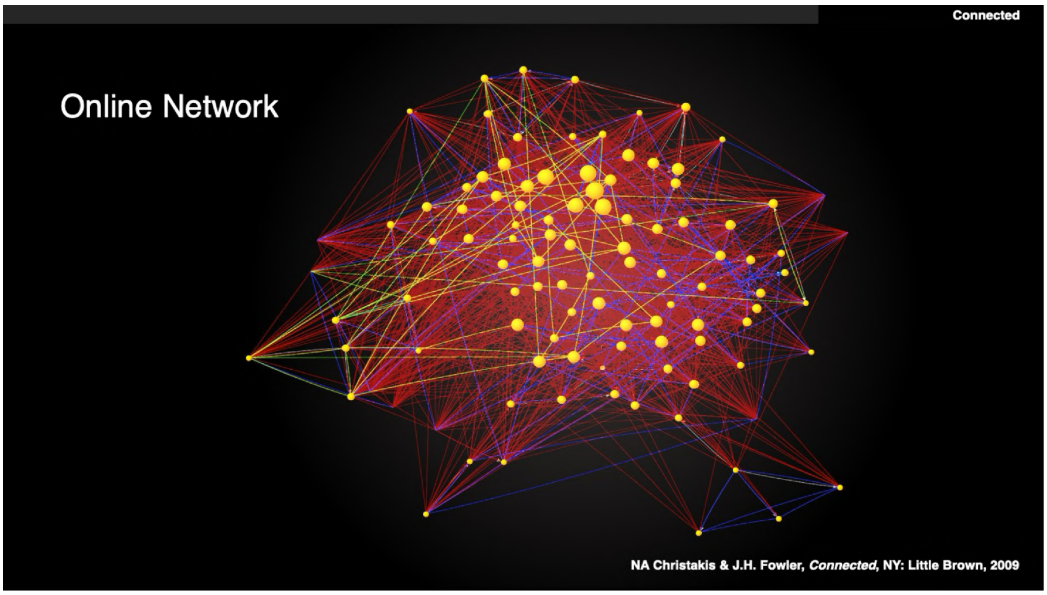
Social media platforms did not create the phenomenon of social contagion, but they provide an extraordinary mechanism to amplify it. In the real world, the negative affect of individuals

[67] Kramer ADI, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. *Proceedings of the National Academy of Sciences*. 2014;111(24):8788-8790. doi:doi:10.1073/pnas.1320040111

spreads via the people they have direct contact with and then to the people that those individuals have direct contact with. The online world is decidedly different. The figures below illustrate the social networks of college students in the real-world vs those on Facebook:

Figures 22 & 23: Real and Online Networks of College Students[68]





Each yellow dot represents a student, and each line represents a connection between that student and a "friend." Yellow lines represent "real world" connections and red lines represent

[68] Nickolas A. Christakis and James H. Fowler (2009), Connected: The Surprising Power of our Social Networks and How they Shape our Lives, Little, Brown, New York, NY. 353 pages.

online ones. The average number of "friends" students listed in their real-world network is 6.6 whereas in their online network it is 110. While it is true that a real-world interaction has more impact on another individual than an online one on *average*, the sheer number of interactions is so much greater online that the potential for social contagion effect from a societal perspective is considerably larger.

F. Fear of Missing Out (FOMO)

"Fear of Missing Out" (FOMO) is a relatively recently defined construct (circa 2004) whereby affected individuals are apprehensive that not checking social media sites will result in missing opportunities afforded to one's "friends" online. It has been defined as "the uneasy and sometimes all-consuming feeling that you're missing out – that your peers are doing, in the know about, or in possession of more or something better than you."[69] FOMO can result in a compulsive need to maintain connection to social media to mitigate it although paradoxically frequent checking of one's social media profile can confirm that, in fact, others are having fun that does not include the affected individual. Several design aspects of social media—including notifications, likes, infinite scroll, and friends' maps or friends you may know features—take advantage of this psychological phenomenon to drive usage. FOMO-driven social media usage can at once provide reassurance (or even opportunities for engagement) and distress. Accordingly, and not surprisingly, higher levels of FOMO are associated with both more positive and negative attitudes about social media use.[70] Although it clearly is contiguous with and has features in common with

[69] A. Przybylski, et. al., *Motivational, Emotional, And Behavioral Correlates Of Fear Of Missing Out*, 29 COMPUTERS IN HUMAN BEHAVIOR 1841-1848 (2013), located at https://www.sciencedirect.com/science/article/abs/pii/S0747563213000800

[70] Przybylski AK, Murayama K, DeHaan CR, Gladwell V. Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*. 2013/07/01/ 2013;29(4):1841-1848. doi:https://doi.org/10.1016/j.chb.2013.02.014

addiction or habitual usage, I specifically call it out as its own construct as it supports the complicated and heterogenous relationship between individuals and social media use.[71]

The original and most widely used scale for FoMo was developed in 2010 by Przybylski and it is presented below:

Figure 24: The Final 10-Item of the Fear of Missing Out Scale

Table 3: The final 10-item version of the Fear of Missing Out scale (FoMoS)

Below is a collection of statements about your everyday experience. Using the scale provided please indicate how true each statement is of your general experiences. Please answer according to what really reflects your experiences rather than what you think your experiences should be. Please treat each item separately from every other item.

Not at all true of me	Slightly true of me	Moderately true of me	Very true of me	Extremely true of me
1	2	3	4	5

1. I fear others have more rewarding experiences than me.
2. I fear my friends have more rewarding experiences than me.
3. I get worried when I find out my friends are having fun without me.
4. I get anxious when I don't know what my friends are up to.
5. It is important that I understand my friends "in jokes".
6. Sometimes, I wonder if I spend too much time keeping up with what is going on.
7. It bothers me when I miss an opportunity to meet up with friends.
8. When I have a good time, it is important for me to share the details online (e.g. updating status).
9. When I miss out on a planned get-together it bothers me.
10. When I go on vacation, I continue to keep tabs on what my friends are doing.

It is notable that only a single item from the scale, (#8), makes specific reference to being "online." In fact, as a construct, FoMo could very well have existed before or despite the internet. To that end, some have argued that FoMo should be viewed as being both a "trait" (something that

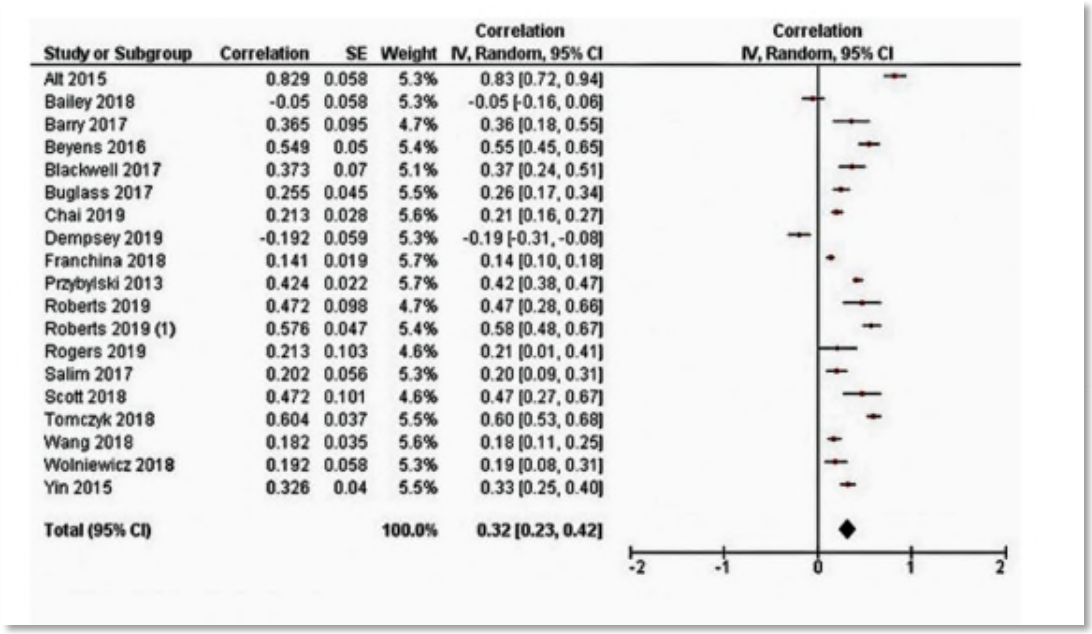
[71] Akbari M, Seydavi M, Palmieri S, Mansueto G, Caselli G, Spada MM. Fear of missing out (FoMO) and internet use: A comprehensive systematic review and meta-analysis. *Journal of Behavioral Addictions*. 31 Dec. 2021 2021;10(4):879-900.

is stable and enduring) and a "state" (something that is temporary and situational).[27] Humans have likely, for example, worried that their friends "were having fun without them" for decades (if not millennia) but there was no ready way to either deliberately or inadvertently check if any or all of them were. What is more, design features of apps (e.g. friend locations and alerts) do something that was previously impossible: passively and seamlessly track your friends so as to alert you when they may have congregated without you at a fun location near you. So while SM's may not have created FoMo, they use of SM can greatly exacerbate it, increase its prevalence, or induce it at least temporarily.

Conceptually, FOMO and social media use are mutually reinforcing. That is, the drive to compulsively check SM to reduce FOMO leads to problematic SM use and in turn additional FOMO. In support of this, a 2020 metanalysis of 33 studies included 13 which analyzed the relationship between FOMO and social media use, 14 which analyzed the relationship between FOMO and problematic social media use and the remaining six studies which examined both relationships.[72] The metanalytic results are summarized in the figures below. FOMO had a moderate correlation with SM use (r=.32) and a moderate/strong correlation with problematic SM use (r=.49).

[72] Fioravanti G, Casale S, Benucci SB, et al. Fear of missing out and social networking sites use and abuse: A meta-analysis. *Computers in Human Behavior*. 2021/09/01/ 2021;122:106839. doi:https://doi.org/10.1016/j.chb.2021.106839

Figure 25: FOMO and Problematic Social Media Use



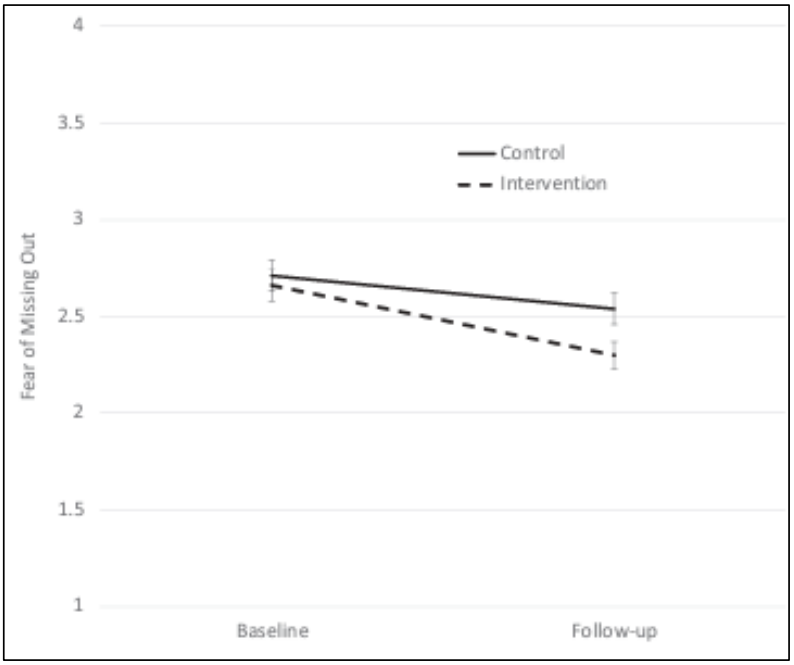
The stronger effect size for problematic usage is consistent with FOMO being a driver of excessive social media use.

A recent (2025) randomized controlled trial of social media reduction (too recent to be included in any metanalyses to date) conducted in 220 college students with at least two symptoms of anxiety or depression asked participants in the intervention arm to reduce social media use to no more than 1 hour per day (the control arm could continue as usual).[73] The researchers used daily screen shots of phone screentime reports to measure social media usage and assessed FOMO, depression, anxiety, and sleep as outcomes after 3 weeks of treatment. FOMO results using the

[73] Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. *Psychology of Popular Media*. 2025;14(1):1-11. doi:10.1037/ppm0000536

Przybylski measure are presented below; depression, anxiety and sleep outcomes are presented in their respective sections later in this report.[74]

Figure 26: FOMO Results Using Przybylski measure

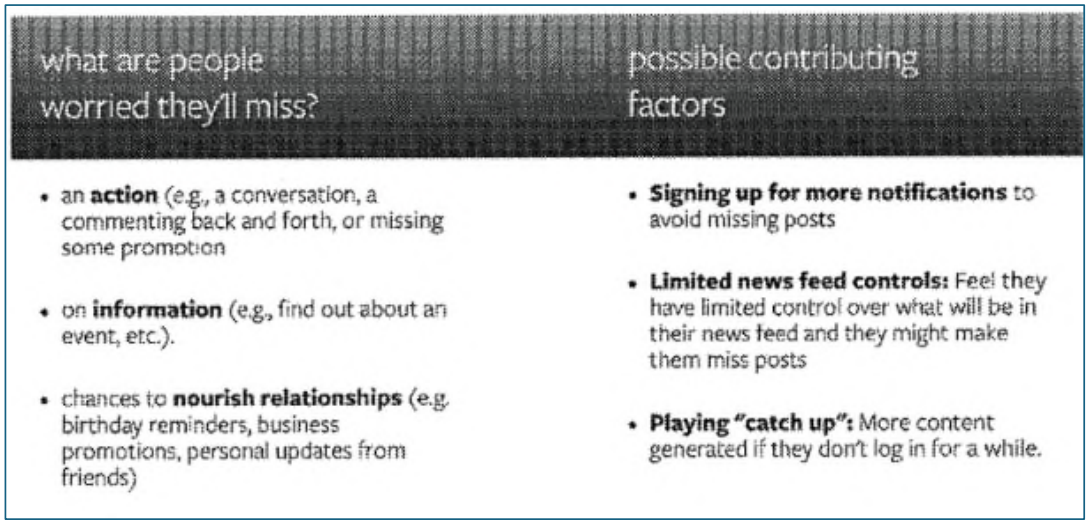


Students in the control arm used social media 188.76 min per day and students in the intervention arm used social media an average of 78.25 min per day (a reduction of approximately 50%).[75] As can be seen in the figure, FOMO was significantly reduced in the intervention compared to the control. The experimental design of this study presents a very strong causal argument that social media use plays a causal role in FOMO for people with underlying depression or anxiety.

[74] Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. *Psychology of Popular Media*. 2025;14(1):1-11. doi:10.1037/ppm0000536

[75] Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. *Psychology of Popular Media*. 2025;14(1):1-11. doi:10.1037/ppm0000536

An internal presentation by Shruti Bhutada, wellbeing lead at Meta, illustrated what Meta's research showed regarding what teens perceived to be the sources and causes of FOMO.



Document 8: META3047MDL-019-00106590, -6593

The above conclusions were based on Meta's own survey research of ~2,500 Instagram users (evenly split between US and UK) ages 13-17.[76] Ultimately, Bhutada noted in the presentation that: "Young people are acutely aware that Instagram can be bad for their mental health yet are compelled to spend time on the app for fear of missing out on cultural and social trends."[77] Similarly, internal Snapchat documents acknowledge that FOMO is a "negative" that "people report about Social Media": "It's easy to feel left out" and there is "Pressure to be always reachable."[78] Snapchat's qualitative research into parent perceptions revealed parental concerns about the Snap Map feature in particular (which identifies for users where their friends are located):

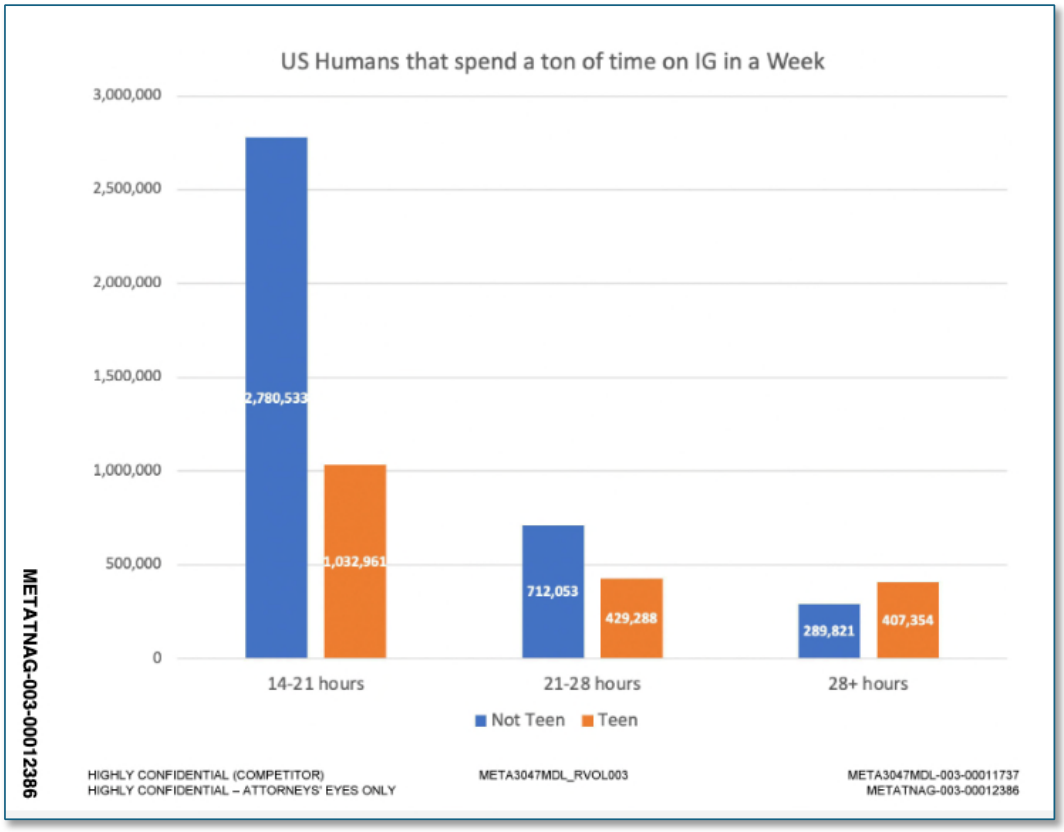
[76] META3047MDL-003-00000029, -0031
[77] META3047MDL-003-00000029, -0053
[78] SNAP1924968 at -5012,

"parents cited anecdotal evidence of their teens seeing that their friends were gathering together without them and feeling upset or experiencing FOMO (fear of missing out)."[79]

G. Internal Documents from Defendant Platforms Recognizing Problematic And Addictive Usage Among Users

i) Meta

Meta's internal documents reveal the company's awareness of a very high amount of time spent by certain users of its platforms. Internal studies of time on Instagram confirmed a "ton of time" being spent per user:



Document 9: META3047MDL-003-00011737

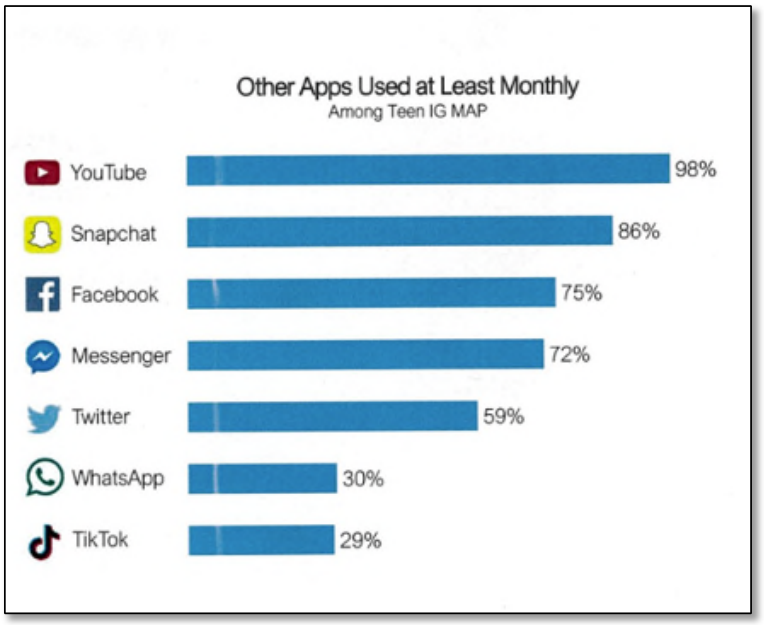
[79] SNAP0019128 at -9140

Other Meta documents reported similar numbers internally in a document from 2021: "On a given day, 0.1% of DAP spend >6.83 hours …. Within a given month, 0.1% of MAP spend >127.43 total hours, i.e. they average >4.55 hours per day for the entire month."[80]

This data, directly measured by Meta, suggests that there are over 407,000 teens in the US who are spending more than 4 hours per day on Instagram alone. Keeping in mind that they should be awake for no more than 16 hours per day to have adequate sleep, they are either spending more than 25% of their waking hours on Instagram (to the likely detriment of their attentiveness during school) or forgoing sleep to do so.

And of course, this is only time spent on Instagram and does not include additional time on other social media platforms. Meta's commissioned study (~1000 users) from 2019 queried teens specifically about non-Instagram site usage and revealed that the vast majority regularly use other ones as well.

[80] META3047MDL-031-00048771, -8771

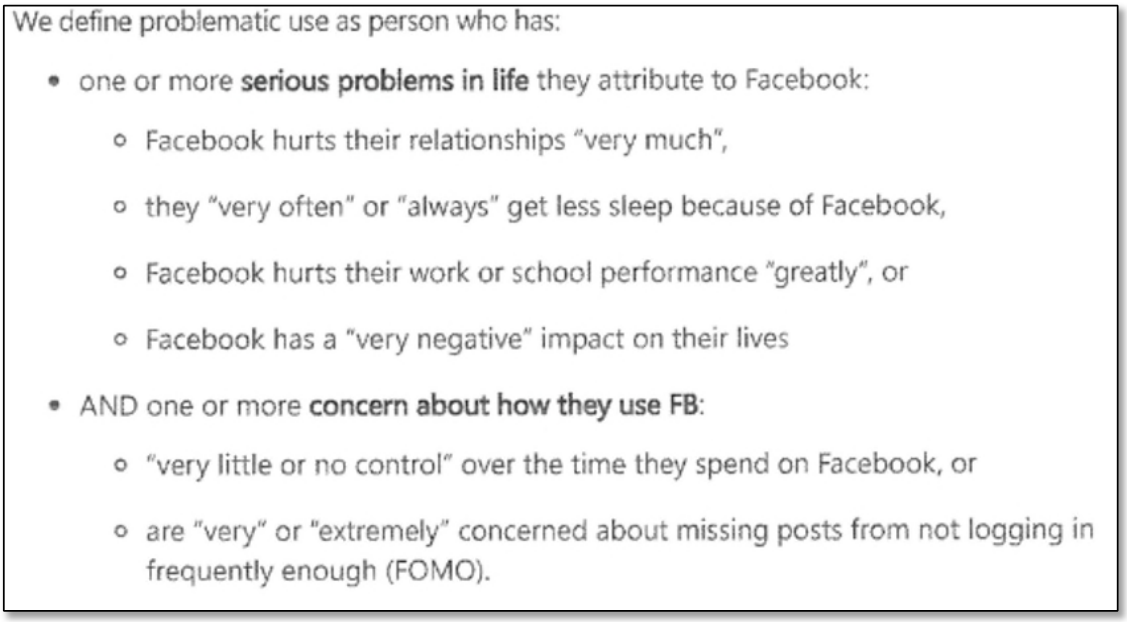


Document 10: Wendy Gross Deposition Exhibit 6 at Slide 3

Understandably, given these usage statistics, Meta was concerned about "problematic usage." Internal documents reflect employees discussing "creating a world of addicted monsters"[81] and "making people's mental health deteriorate slowly over time."[82] In a 2017 internal Meta document, Matt Killingsworth states that "1-10% of college students exhibit a high-degree of Facebook addiction."[83] While other Meta internal documents argue that "addiction" to Facebook has not yet been established, they concede that "there are parts of the addictive process that may be at play and contributing to common issues for people."[84] Relevant here, an internal Meta document concluded that "[a] large fraction of users struggle with their Facebook/Instagram use….A significant minority report serious difficulties."[85]

[81] META3047MDL-003-00011718, -1718
[82] META3047MDL-072-00304285 at -4288.
[83] META3047MDL-005-00000001, -0001
[84] META3047MDL-014-00359284
[85] Haugen_00010114, -0120

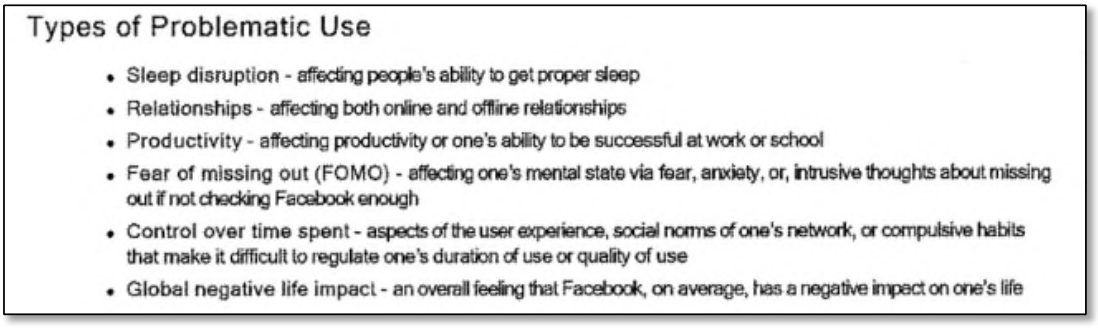
One of the more insightful studies of "problematic usage" from within Meta was conducted in 2019 by Moira Burke, PhD, a Meta UX Research scientist, and her colleagues. Dr. Burke conducted a survey study of 20,000 US users and linked the responses to actual platform use. (Again, this is the kind of study that requires proprietary access to data and hence can only be done well by the industry itself.) They defined "problematic use" based on their review of the literature:


We define problematic use as person who has:

- one or more **serious problems in life** they attribute to Facebook:
  - Facebook hurts their relationships "very much",
  - they "very often" or "always" get less sleep because of Facebook,
  - Facebook hurts their work or school performance "greatly", or
  - Facebook has a "very negative" impact on their lives
- AND one or more **concern about how they use FB**:
  - "very little or no control" over the time they spend on Facebook, or
  - are "very" or "extremely" concerned about missing posts from not logging in frequently enough (FOMO).

Document 11: META3047MDL-020-00588361, -8363

Meta researchers also developed a taxonomy of different types of "Problematic use."


Types of Problematic Use

- Sleep disruption - affecting people's ability to get proper sleep
- Relationships - affecting both online and offline relationships
- Productivity - affecting productivity or one's ability to be successful at work or school
- Fear of missing out (FOMO) - affecting one's mental state via fear, anxiety, or, intrusive thoughts about missing out if not checking Facebook enough
- Control over time spent - aspects of the user experience, social norms of one's network, or compulsive habits that make it difficult to regulate one's duration of use or quality of use
- Global negative life impact - an overall feeling that Facebook, on average, has a negative impact on one's life

Document 12: META3047MDL-019-00106590, -6591

Meta studied the prevalence and severity of problematic use. The results of two such studies are below:

	Sub-Area	Description	Prevalence
1	Problematic Use	Serious, negative impact on sleep, relationships, work, or lives, combined with lack of control over FB use.	3.1% severe*, 55% mild
2	Social Comparison	Evaluating yourself negatively to others whom you perceive as better off. Happens online and offline, though amplified on FB.	5% chronic, 40% mild
3	Loneliness	Difference between quality of friendships person has and wants. People who are already feeling lonely turn to FB to feel better, and reducing FB use can improve loneliness.	7% chronic, 36% mild

* Represents US only, other stats are global FB MAP.

Document 13: Jennifer Guadagno Deposition Exhibit 29 at Slide 9

	Sub-Area	General Prevalence (extreme/moderate)	FB Associated Prevalence (extreme/moderate)	Priority
1	Problematic Use	na / 55%	12%/being estimated	H
2	Social Comparison	5%/ 40%	1.8%/4.3%	H
3	Loneliness	7%/37%	1.2%/6.8%	H
4	Measurement work (overall well-being)	n/a		H
5	Other areas (e.g. Mental Health, Conflict, MLEs, Social Support, etc.)	n/a		-

Document 14: Jennifer Guadagno Deposition Exhibit 32 at Slide 10

It is not clear from what I have seen how these prevalences were estimated and why they are divergent. It seems Document 13 is "general prevalence" whereas Document 14 includes Facebook prevalence. In her deposition, when queried about this discrepancy, Burke responds

"This study presents a larger statistic because it's a very different set of survey questions and it's a different set of people that were asked. So this looks like it's an international survey."[86] When asked if this "other," larger prevalence statistic was ever publicly disclosed by Meta, she responds "No."

In either case, Meta's studies found that between 3-12% of its users have "severe" or "extreme" "problematic use," and that 55% have "mild" or "moderate" problematic use. This is consistent with the metanalytic global estimated range of 5-13%[87]

Importantly, Meta understood that the prevalence of "problematic use" per their data varies by age as shown in the below graph:

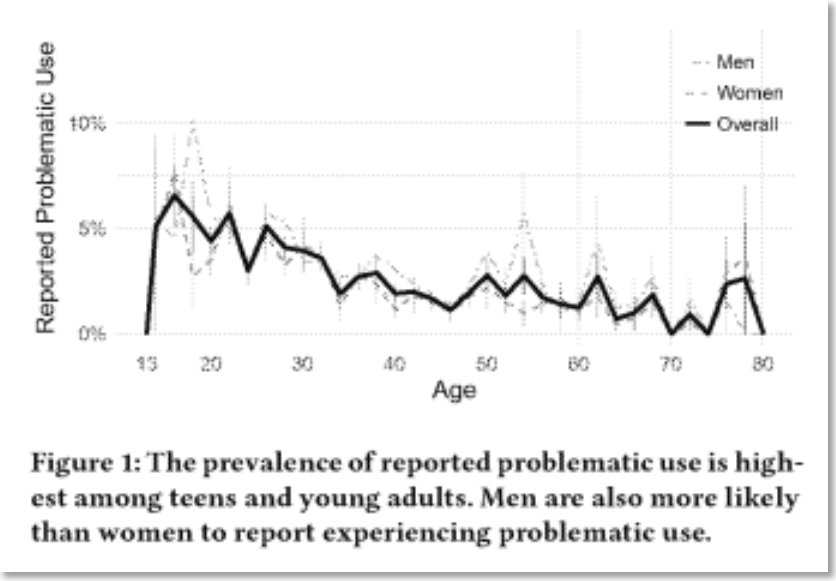


Figure 1: The prevalence of reported problematic use is highest among teens and young adults. Men are also more likely than women to report experiencing problematic use.

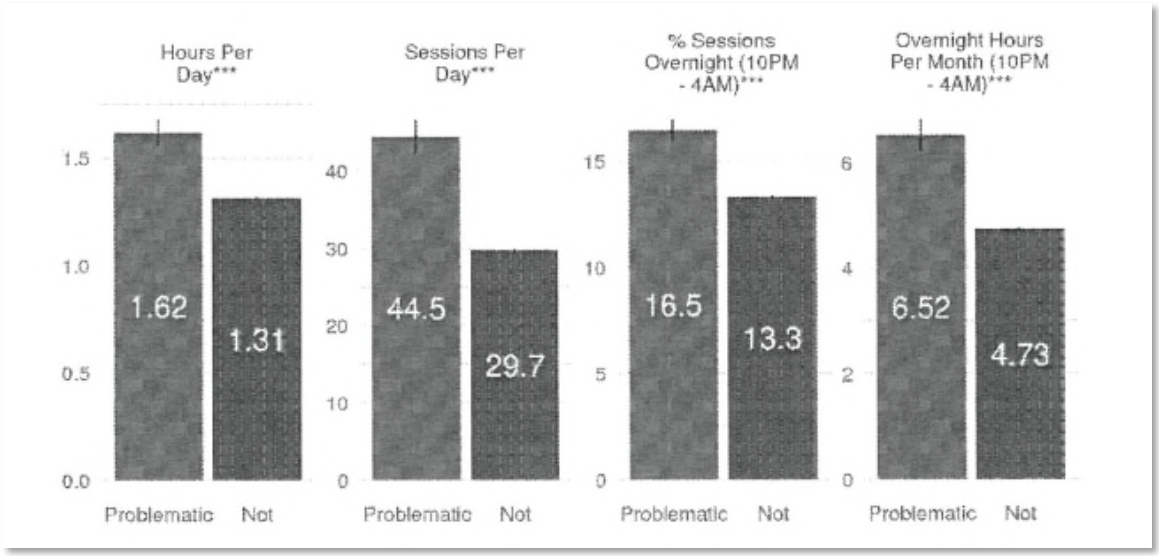
Document 15: META3047MDL-014-00046411, -6416

[86] Moira Burke Dep. Tr. at 175:16-21

[87] Cheng C, Lau Y, Chan L, Luk JW. Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors*. 2021/06/01/ 2021;117:106845. doi:https://doi.org/10.1016/j.addbeh.2021.106845

Consistent with the "increased vulnerability" of younger people, the prevalence is "highest among teens and young adults."

The same study does what can be construed as some validation by examining differences in usage among those that have problematic usage versus those that do not. Those results are presented below:



Document 16: META3047MDL-020-00588361, -8366

Consistent with what one would predict, people with "problematic usage" have different usage patterns all favoring increased use. Most striking is the number of sessions per day (a difference of 15 sessions per day), and overnight use (a difference of almost 2 hours per month). During his deposition, former Meta data scientist George Volichenko credited the idea that late night usage constituted problematic use "More than four hours after midnight, I -- I feel like it's hard to argue that that's a problematic amount, right?"[88]

[88] George Volichenko Deposition Transcript at 81:1-4

Unfortunately, documents I have reviewed indicate that Meta failed to adequately resource teams to address problematic usage and related wellness concerns, at least compared to the resources devoted to new "product" or "growth" objectives. In April 2017, then-head of Instagram Kevin Systrom asked for 13 additional engineering headcounts to make good on his "public commitment to making Instagram a place where people feel safe to be themselves, without criticism or harassment" and to address "critical areas for safety on IG." In response, Mr. Zuckerberg noted that he would add Instagram to a "mix" of other teams seeking access to a pool of unallocated engineers—but due to "more extreme issues on FB right now" "probably can't get you 13 engineers in the near term."[89] In an Instagram quarterly review several months later, Mr. Zuckerberg was told (perhaps not surprisingly given his decision) that "Instagram PAC [Protect and Care] is far behind FB PAC and we could become a major liability for FB Inc."[90] Specifically: "We're continuing to see an increase in high intensity abuse….However, the PAC team is only 22 engineers. We aren't staffed to both integrate with FB and do IG specific work to stay ahead of all potential PAC related issues."[91]

A couple years later, in April 2019, David Ginsberg sent an email to Mr. Zuckerberg "requesting additional headcount to fund the 'Well-Being 10x' initiative;" specifically, 17 heads for Facebook and 7 heads for Instagram.[92] These resources were needed, Mr. Ginsberg explained, to "move quickly in the areas we have confidence in our understanding," specifically "problematic use [g]iven its prevalence and our confidence around product interventions." However, Mr. Ginsberg was informed by Meta's CFO that the request "was not funded," with Instagram's CEO

[89] META3047MDL-014-00378084, -8085.
[90] META3047MDL-050-00331333, -1334.
[91] META3047MDL-050-00331333, -1334; *see also* META3047MDL-050-00331327 (transmission of document to Mr. Zuckerberg)
[92] META3047MDL-003-00145472, -5472

Adam Mosseri remarking, "I don't see us funding this from Instagram any time soon."[93] Separate documents confirm that the "skeleton crew" in wellbeing did not obtain the resources needed to tackle problematic use successfully: "We asked Mark for incremental HC to fund it with more research/DS [data scientists] and a few eng [engineers] to tackle problematic use a few months ago but didn't get it."[94]

Two more years after that, even Mr. Mosseri had to concede that the lack of resources to well-being efforts had become a problem. He acknowledged in a private message from October 2021 to another executive, "I'm really worried about this…We've been talking about this for a long time but have made little progress."[95] And yet Mr. Zuckerberg still continued to deny resource requests. On November 10, 2021, Nick Clegg (a Meta executive) wrote Mr. Zuckerberg to "circl[e] back" on an earlier email seeking "investment needed to strengthen Meta's position on well-being," specifically an additional 25 cross-functional head count to form a "central well-being product pod" and noting "the increased urgency of all this." Naomi Gleit responded to the chain, informing Mr. Zuckerberg, "Mark FWIW this is my #1 'below the line' project to fund on Social Impact."[96] Once again, the funding did not materialize.[97]

Consistent with all of these episodes, Dr. Allison Lee in her deposition acknowledged that there was only one team dedicated to integrity and 15 or more dedicated to Reels.[98]

In certain documents I have reviewed, Meta employees have been candid that safety tools rolled out by the company were built principally to address public relations problems, and that

[93] META3047MDL-003-00145472, -5472
[94] META3047MDL-046-00477173 -7175
[95] META3047MDL-003-00171401, -1403
[96] META3047MDL-003-00190950, -0950
[97] Kang-Xing Jin Dep. Tr. at 471:23-473:10 ("no incremental headcount would be forthcoming for the work" and "the lack of headcount certainly impeded progress.").
[98] Alison Lee Dep. Tr. at 163:16-22.

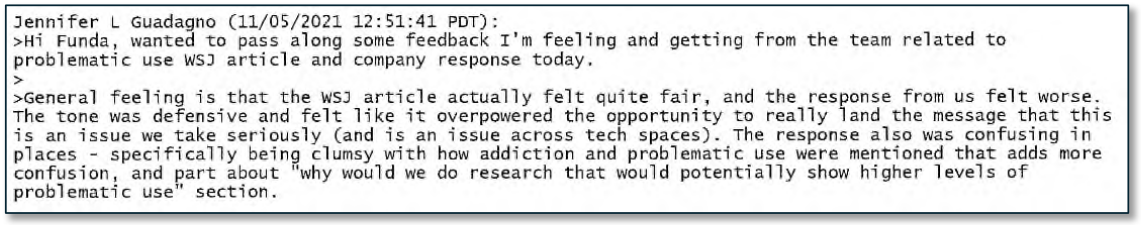
their efficacy was limited by the company's desire not to curtail growth of their user base. As recently as 2018, problematic usage was viewed internally by some leaders at Meta not as a public health issue but rather as a "public relations issue" for which a "pushback" strategy needed to be developed.[99] In a July 2018 email, Kate Rouch (Global Head of Brand and Product Marketing) acknowledged to other executives that safety tools were part of this "pushback"—and, as such, calibrated in a matter to prevent impact on the company's bottom line: "We're building the tools/controls to benefit policy or reputation outcomes… but in implementation we're optimizing for business / growth outcomes. That's a fine decision and I understand very clearly why we're making it. That said we shouldn't still expect to get sustained reputation 'credit' for these developments, which is what I do think Mark [Zuckerberg] and Chris [Cox] expect."[100] An internal product audit from 2022 stated all this plainly: "[t]he stance we have historically taken is to give people control, but not in a way that hurts metrics."[101]

In his deposition, George Volichneko recalled only "one" safety feature Meta initiated for teen problematic use while he was at the company—the "Take a Break" feature which, when turned on, would prompt users to step away from social media after a prespecified period of time (e.g. 10, 20, 30 min etc.). Consistent with Meta optimizing these features to ensure minimal or zero impact on user engagement, Volichenko testified that Meta's goal for adoption of this feature was reduced in the first half of 2022 to 0.25% –down from 0.6%—of teen users activating the feature.[102] The actual number achieved was 0.18%. In other words, despite touting "Take a Break" as a way for users to set limits on the length and frequency of their sessions, Meta knew that

[99] *See* META3047MDL-003-00082165
[100] META3047MDL-040-00317980, -7980.
[101] META3047MDL-047-01167629, -7644
[102] George Volichenko Deposition Transcript at 98:2-102:4; *See also* George Volichenko Dep. Exhibit 3 at 1.

99.82% of teen users simply didn't turn it on. The reasons for this low usage rate appear, per the deposition, both because it was difficult to find the feature and easy to ignore it. In light of that, there was consideration given to making it "opt out," rather than "opt in," meaning that the default would be to prompt teens to take a break at some pre-determined interval—but Volichenko testified that this was rejected because it would have affected core metrics negatively.[103]

Meta's orientation towards problematic use as a public relations problem ultimately resulted in an aggressive effort by the company to push back on the *Wall Street Journal* after it leaked internal company documents indicating, among other findings, that "Facebook researchers have found that 1 in 8 of its users report engaging in compulsive use of social media."[104] Notably, internal researchers did not share this same orientation, with Dr. Guadagno for one acknowledging the *Journal* presented an accurate and balanced story.


Jennifer L Guadagno (11/05/2021 12:51:41 PDT):
>Hi Funda, wanted to pass along some feedback I'm feeling and getting from the team related to problematic use WSJ article and company response today.
>
>General feeling is that the WSJ article actually felt quite fair, and the response from us felt worse. The tone was defensive and felt like it overpowered the opportunity to really land the message that this is an issue we take seriously (and is an issue across tech spaces). The response also was confusing in places - specifically being clumsy with how addiction and problematic use were mentioned that adds more confusion, and part about "why would we do research that would potentially show higher levels of problematic use" section.

Document 17: META3047MDL-040-00533279, -3279

ii) TikTok

For its part, TikTok documents repeatedly assert that their product induces compulsive if not addictive usage. As one document succinctly puts the issue: "In sum, compulsive usage on TikTok is rampant and our users need better tools to understand their usage, manage it effectively, and ensure being on TikTok is time well spent."[105] TikTok also appears to have understood that

[103] George Volichenko Deposition Transcript at 114:5-116:5
[104] Jennifer Guadagno Deposition Exhibit 33 at 1[105] TIKTOK3047MDL-002-00091634, -1636.
[105] TIKTOK3047MDL-002-00091634, -1636.

their especially young user base was at increased risk of experiencing such compulsive usage. "TikTok is particularly popular with younger users, who are particularly sensitive to reinforcement in the form of social reward and have minimal ability to self-regulate effectively."[106] "Adolescents [are] more easily persuaded, there is a large population of them on TikTok (~30% DAU), and they likely don't understand [the] risks of unhealthy usage as well as older users."[107]

Given the draw of their platform and the demographics of their users, it is not surprising that people spend an inordinate amount of time on the app. TikTok's internal data provide a level of granularity that would be the envy of any independent scientist who has labored to estimate the amount of time teens spent on any app.

Average time spent - Age groups [Age Gate Data]

Age level	Avg Daily Active Users	Avg Daily Accumulated Duration (minutes)	50th percentile	66th percentile	75th percentile	90th percentile
L1 (13-15)	27,928,801	106.36	79.58	123.98	156.43	243.80
L2 (16-17)	41,622,675	106.78	81.25	124.17	155.63	241.10
L12 (13-17)	**69,551,476**	**106.61**	**80.60**	**124.10**	**155.95**	**242.18**
L3 (18-24)	205,994,552	96.12	69.00	109.17	139.50	224.17

Document 18:TIKTOK3047MDL-002-00098058, -8060

The median time 13–17-year-olds spend on TikTok is a little more than 1.3 hours per day. The 90th percentile for them is more than 4 hours per day or more than 25% of their waking hours.

[106] TIKTOK3047MDL-002-00091634, -1639
[107] TIKTOK3047MDL-002-00091634, -1640

Perhaps because of this considerable usage, TikTok conducted a survey in 2023 that revealed that 59% of teens feel they need a screen management tool.[108] In light of that, TikTok developed one that activates after 60 minutes of daily usage for teens 13-17 years of age. At that point, a prompt informs them that they have reached that "limit" and asks them if they want to continue. To do so, they must enter the "PIN" 1234 which is preset and universal and unalterable.[109] The logic behind the "PIN" is to provide some but not too much "friction" to bypassing the prompt. In fact, TikTok deliberately changed to this simple "1234" default setting from a "custom" PIN so as to avoid the "frustration" that comes from the "memory" problem of people forgetting their PIN and being blocked from the app until they reset it.[110]

TikTok internally acknowledges that their product is "addictive," or that "compulsive use" is "rampant" as evinced below:

[108] TIKTOK3047MDL-010-00329585, -9594
[109] TIKTOK3047MDL-010-00329585, -9599
[110] TIKTOK3047MDL-010-00329585, -9600

We have learned from Project Who that our users' biggest usage deterrent is that they think the platform is addictive. We also see many app store reviews that echo the following sentiment, "Do not download this app unless you're able to spent at least two hours a day on it. It's addicting!" (Appendix D).

This issue is further supported by external research and reveals other more concerning effects as well. According to a study of 1600 8-18 year olds, 8-12 year olds use almost 5 hours of entertainment screen media per day and teens use just over 7 hours per day, with 62% over 4 hours and 29% over 8 hours (Common Sense Media). This compulsive usage correlates with a slew of negative mental effects like loss of analytical skills, memory formation, contextual thinking, conversational depth, empathy, and increased anxiety (Pew 2018). Various similar studies to Pew's also conclude that compulsive usage interferes with essential personal responsibilities like sufficient sleep, work/school responsibilities, and connecting with loved ones (Europe PMC).

In sum, compulsive usage on TikTok is rampant and our users need better tools to understand their usage, manage it effectively, and ensure being on TikTok is time well spent (Interviews).

Document 19:TIKTOK3047MDL-002-00091634, -1636

Their own commissioned focus group study of teens fleshed out further qualitative details:

TikTok is really engaging and they spontaneously declare they spend a lot of time on it, this usually involves scrolling videos from the For You Feed. The majority voices a sense of discomfort for being on TT too much, often with no awareness of the time they spent. This becomes a sort of estrangement from reality, falling into another dimension, well expressed in some teens' words (losing the dimension of time, addiction, being like "suspended").

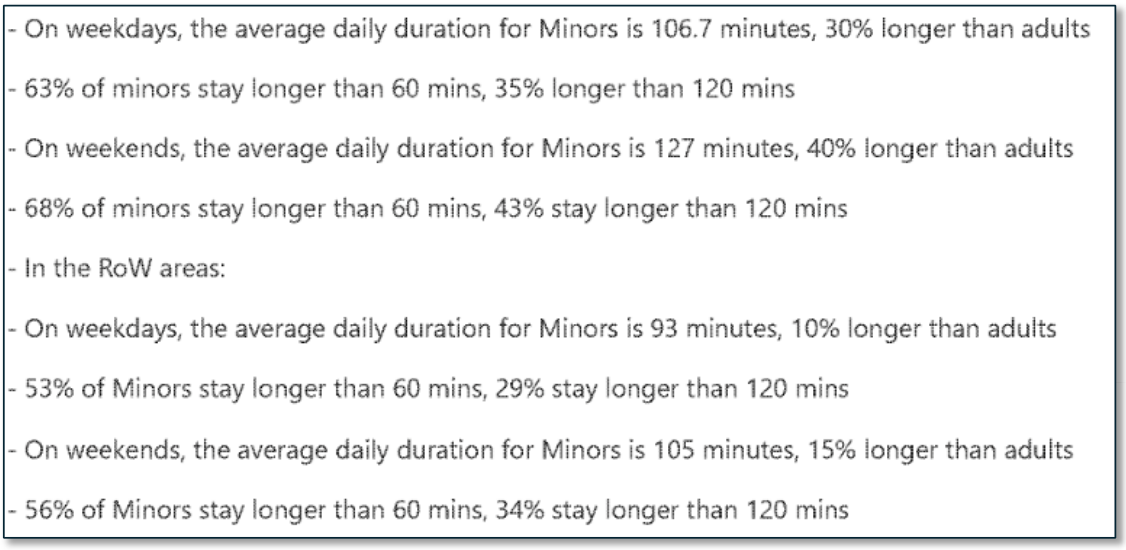
Most of the teens say that "*too much TikTok*" puts them in a state of mental and physical stress. They report feeling stupid, guilty, lost, also isolated and sad. Sometimes they physically feel some drawbacks (eyes ache, head ache).

Document 20: TIKTOK3047MDL-099-LARK-04759856, -9857

With respect to time teens spent on Tik Tok, on December 15, 2022, Jordan Furlong (Digital Wellbeing Group Product Manager) queried on a group chat about the implications of setting a hard cap on minors' daily time on the app of 60, 90, or 120 minutes.[111] Isha Sha (Senior

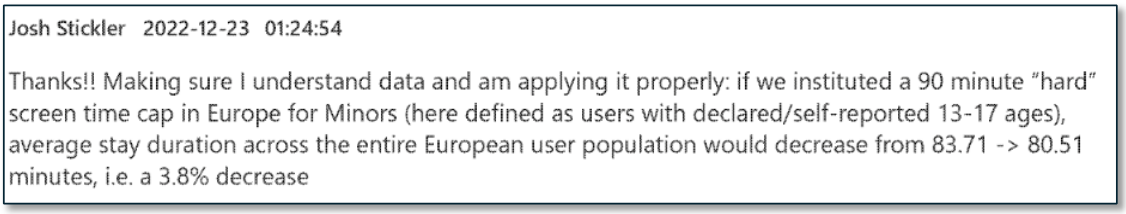
[111] TIKTOK3047MDL-015-00342728

Data Scientist) immediately asked, "Can you please give more context as to why we want to aggressively curb minor's screen time?"[112] Josh Stickler (Director of Product Management) replied, "There is intensifying criticism at the highest levels of US and EU politicians about addiction-related harm among teens on TikTok.[113] After some back and forth to refine the query, data were shared to the group chat and are as follows:


- On weekdays, the average daily duration for Minors is 106.7 minutes, 30% longer than adults
- 63% of minors stay longer than 60 mins, 35% longer than 120 mins
- On weekends, the average daily duration for Minors is 127 minutes, 40% longer than adults
- 68% of minors stay longer than 60 mins, 43% stay longer than 120 mins
- In the RoW areas:
- On weekdays, the average daily duration for Minors is 93 minutes, 10% longer than adults
- 53% of Minors stay longer than 60 mins, 29% stay longer than 120 mins
- On weekends, the average daily duration for Minors is 105 minutes, 15% longer than adults
- 56% of Minors stay longer than 60 mins, 34% stay longer than 120 mins

Document 21:TIKTOK3047MDL-015-00342728, -2736

Later in the chat, Stickler reports:


Josh Stickler 2022-12-23 01:24:54

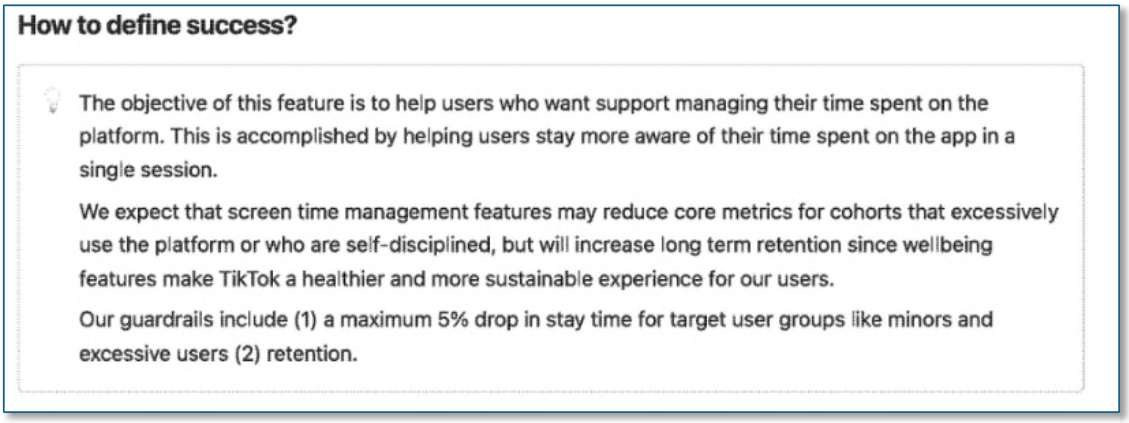
Thanks!! Making sure I understand data and am applying it properly: if we instituted a 90 minute "hard" screen time cap in Europe for Minors (here defined as users with declared/self-reported 13-17 ages), average stay duration across the entire European user population would decrease from 83.71 -> 80.51 minutes, i.e. a 3.8% decrease

Document 22:TIKTOK3047MDL-015-00342728, -2736

[112] TIKTOK3047MDL-015-00342728 at -2729.
[113] TIKTOK3047MDL-015-00342728 at -2729.

Several things are notable in this exchange. First, average daily weekday usage is considerable (93-107 minutes). Further 29-43% of teens spend more than 120 minutes per weekday on TikTok, exceeding the 2016 *total* recreational daily screen time limit set by the American Academy of Pediatrics (guidelines I helped author).[114] Second, the motivation for exploring the deployment of the cap appears to be entirely reactive and intended to provide cover for external political concerns about "addiction." The initial push back from Shah confirms that there is no inherent interest (at least on her part) to curb teen usage. Third, the implications are framed entirely in terms of how much time spent on the platform was reduced (3.8%) and hence how much ad revenue might decrease.

In the end, when TikTok did explore their "Screen Limit Management" tools, they set a "maximum 5% drop-in stay time" cap as shown below.



How to define success?

The objective of this feature is to help users who want support managing their time spent on the platform. This is accomplished by helping users stay more aware of their time spent on the app in a single session.

We expect that screen time management features may reduce core metrics for cohorts that excessively use the platform or who are self-disciplined, but will increase long term retention since wellbeing features make TikTok a healthier and more sustainable experience for our users.

Our guardrails include (1) a maximum 5% drop in stay time for target user groups like minors and excessive users (2) retention.

Document 23: TIKTOK3047MDL-001-00004654, -4659

[114] Reid Chassiakos YL, Radesky J, Christakis D, Moreno MA, Cross C. Children and Adolescents and Digital Media. *American Academy of Pediatrics*. Nov 2016;138(5)doi:10.1542/peds.2016-2593

> After discussing these potential tradeoffs with Wenjia, he proposed that we can accept a 5% drop in stay time for Screen Time Management features for special user groups like minors and excessive users. This should however not come at the expense of retention. That said, we don't expect significant impact to stay time with this feature since it is only improving awareness and is not an intervention.

Document 24: TIKTOK3047MDL-078-LARK-01711316, -1322

Consistent with their corporate strategic approach, the new screen time management system was subjected to a rigorous A/B test protocol.

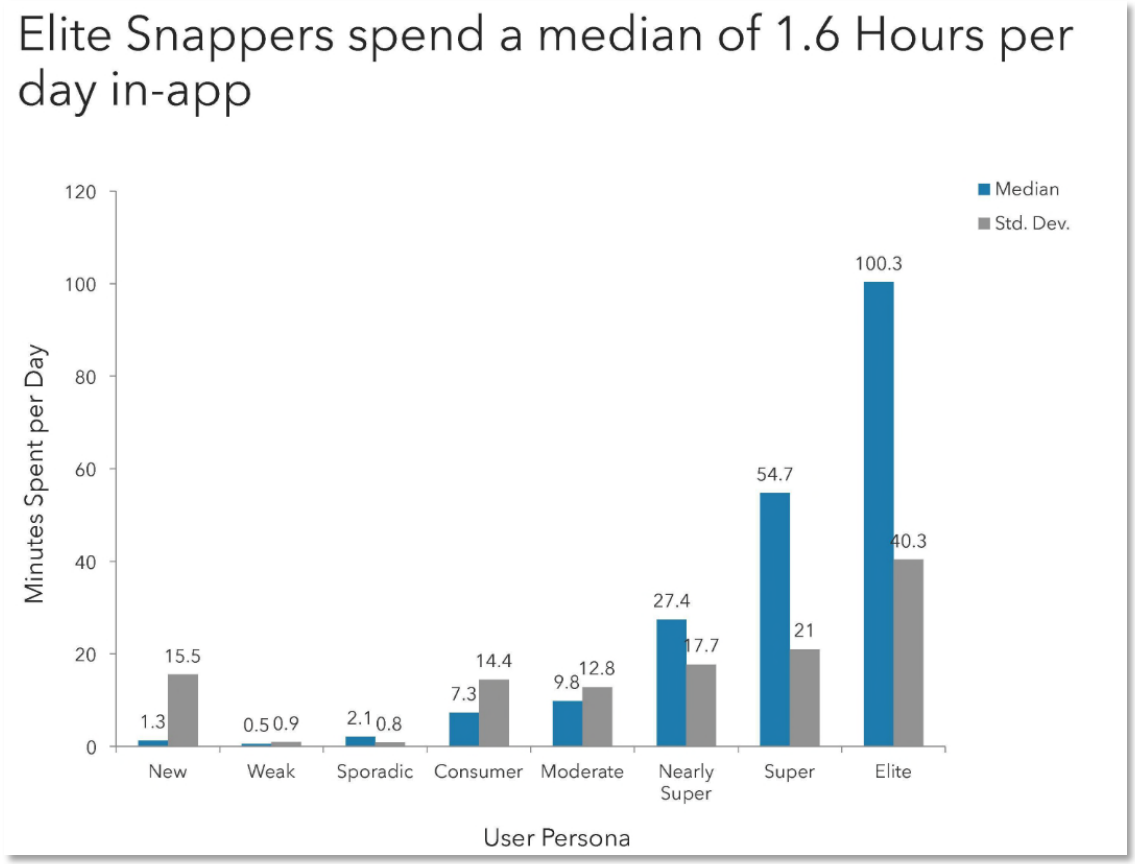
iii) Snap

Snapchat documents reflect that many users found Snapchat to be addictive and harmful to their mental health. In 2013, just two years after Snap was founded, an email to Evan Speigel—Snap's founder and CEO—observed that kids "that have the snapchat addiction have no room for anything else. Snaps dominate their life."[115] The email goes on to say, "Lucky for Snapchat that England is the home of Europe's best boarding schools. Kids from the rest of the world here [sic] about snapchat from a friend that is in an English boarding school."[116] In this exchange, the "Snapchat addiction" is a product selling point.

Subsequent user interviews conducted by Snap bore out this early observation about addiction, showing that some children were opening the app hundreds of times a day.[117] But to Snap, this behavior remained a positive, with Snap characterizing those in the 90th percentile of time spent on Snap as "elite."[118] "Elite" users were also disproportionately young and

[115] SNAP2324154, -4154.
[116] SNAP2324154, -4154.
[117] SNAP2372970 at -2971.
[118] SNAP3121196, -1205.

female.[119] Among this group, the median amount of time spent was 100 minutes per day.[120] Over the course of a month, that adds up to 50 hours, the equivalent of these users spending a fulltime workweek every month just on Snapchat.



Document 25: SNAP3121196, *-1221*

Snap also recognized compulsive use in the context of Snapstreaks. Snapstreaks occur when friends "Snap back and forth with each other at least once a day, every day," at which point

[119] SNAP3121196, -1197.
[120] SNAP3121196, -1221

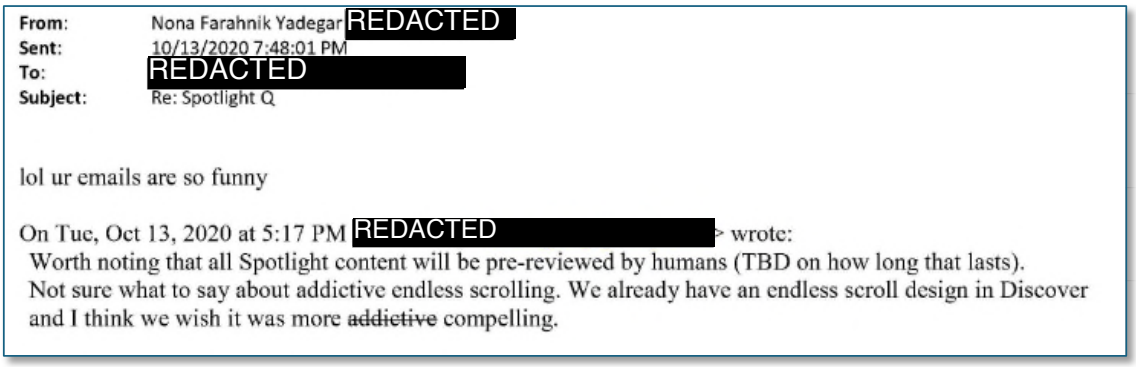
the platform rewards the users with various trophies such as a fire emoji on their Chat screen.[121] In 2018, Evan Spiegel, Snap's CEO, referred to streaks as "toxic behavior" that Snap shouldn't reinforce.[122] Indeed, Snap employees often recognized the addictive nature of Streaks in the same breath that emphasized how important streaks are to Snap's business model, such as this email from Josh Siegel, a senior Snap product manager:

> The general product stance on Streaks is that we don't love them (it was an accidentally addictive, somewhat unhealthy feature that gamifies friendships in a weird way), but they're too delicate to touch right now. 50M+ users have streaks, a few million probably only use the app for streaks. We definitely don't want to invest in or exacerbate the problem right now, but I'm hoping it's something we can get to in 2019 via other ways to encourage daily behaviors.

Document 26: SNAP4389271, -9271

Snap's Spotlight feature is another attribute of the platform that contributes to addictive use. Spotlight showcases viral videos to a broad audience (even to individuals who are not connected to the poster). "Spotlight" was in addition to their "Discover" tab which allowed people to search for specific content of interest to them. Nona Yadegar (Director of Public Policy) communicated with REDACTED (Head of Platform Policy) about the introduction of Spotlight as follows:

[121] Snapchat Support, *How do Snapstreaks work and when do they expire*?, https://help.snapchat.com/hc/en-us/articles/7012394193684-How-do-Snapstreaks-work-and-when-do-they-expire (last accessed Apr. 14, 2025)
[122] SNAP7140925, -0925



From: Nona Farahnik Yadegar REDACTED
Sent: 10/13/2020 7:48:01 PM
To: REDACTED
Subject: Re: Spotlight Q

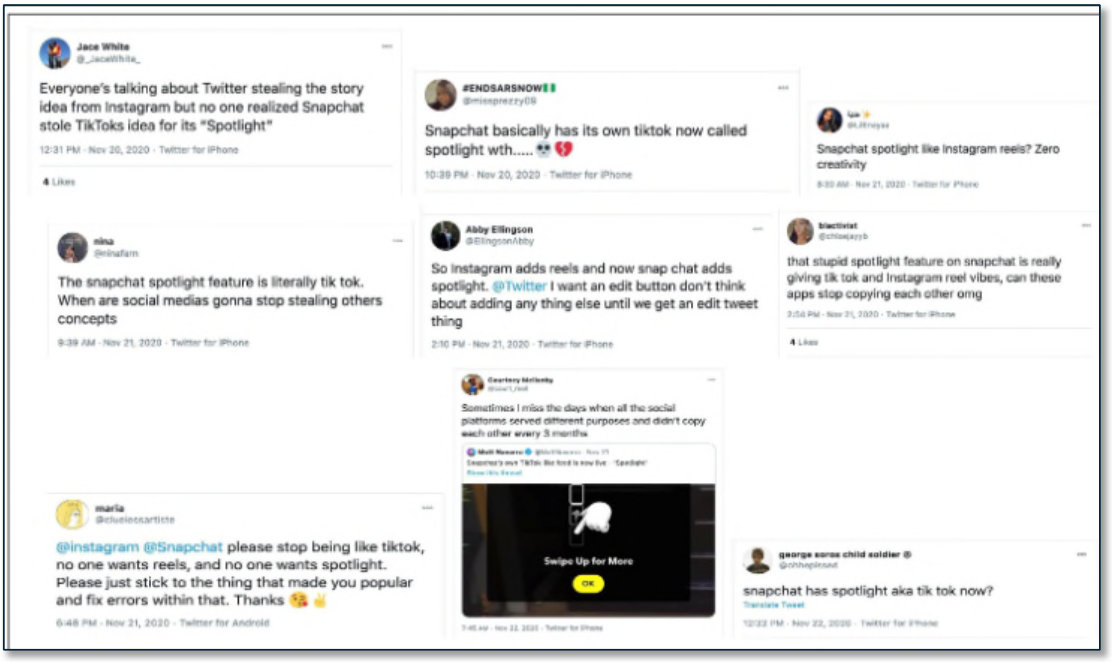
lol ur emails are so funny

On Tue, Oct 13, 2020 at 5:17 PM REDACTED > wrote:
Worth noting that all Spotlight content will be pre-reviewed by humans (TBD on how long that lasts).
Not sure what to say about addictive endless scrolling. We already have an endless scroll design in Discover and I think we wish it was more ~~addictive~~ compelling.

Document 27: SNAP1393050, -3050

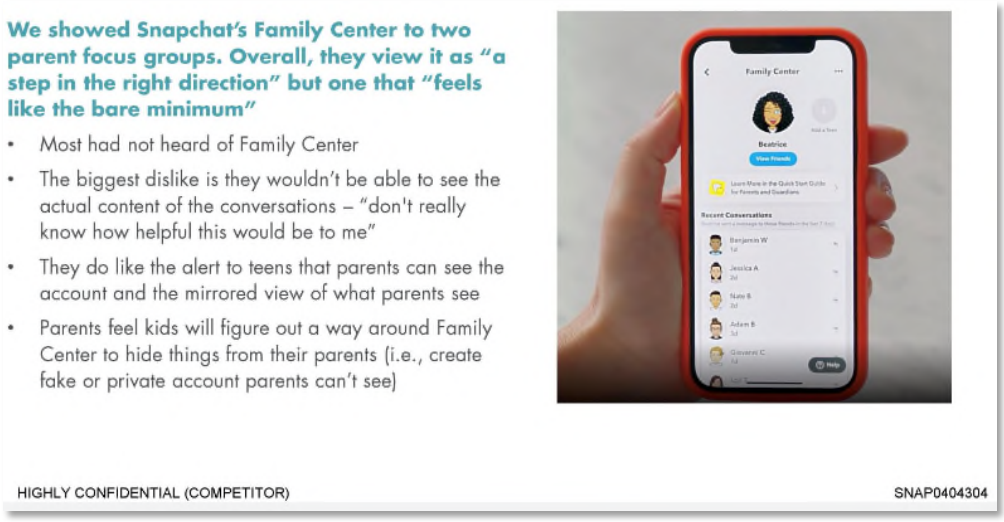
Making light of a serious concern, REDACTED presents Spotlight's endless scroll design as inspired by Discover (an earlier feature), noting for humorous or perhaps ironic effect that the company wishes that design were more "compelling" (striking out "addictive"). But once Spotlight debuted, many saw it for what it was, a blatant knockoff of the highly addictive TikTok For You feed (and the very similar, itself-derivative Instagram Reels feature).[123] And there was considerable "blow back" presented within Snap documents.

[123] SNAP0188592, -8605-06 ("A lot of chatter about all platforms copying each other, mainly TikTok…")



Document 28: SNAP0188592, -8613

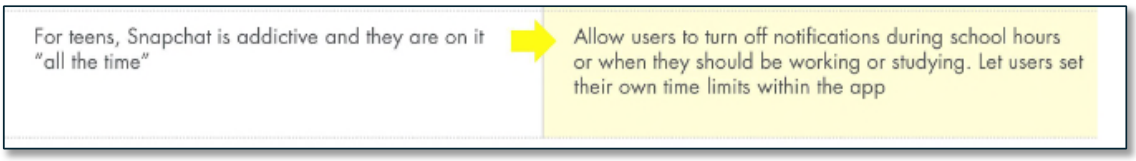
Recognizing how addictive its product could be, Snap explored and implemented some remediation strategies. In 2022, later than some of its competitors, Snap launched its "Family Center," designed to give parents more control over their teen's usage of the site. But their focus group research on this proved equivocal at best:



Document 29: SNAP0404262, -4304

Overall, the response was similar to that of other social media parental controls: Cumbersome to find (or use), limited information, and too easy for teens to circumvent.

Another remediation strategy that Snap considered but did not deploy was turning off notifications during certain times such as school hours. At the time of my report, this option is not available to users.



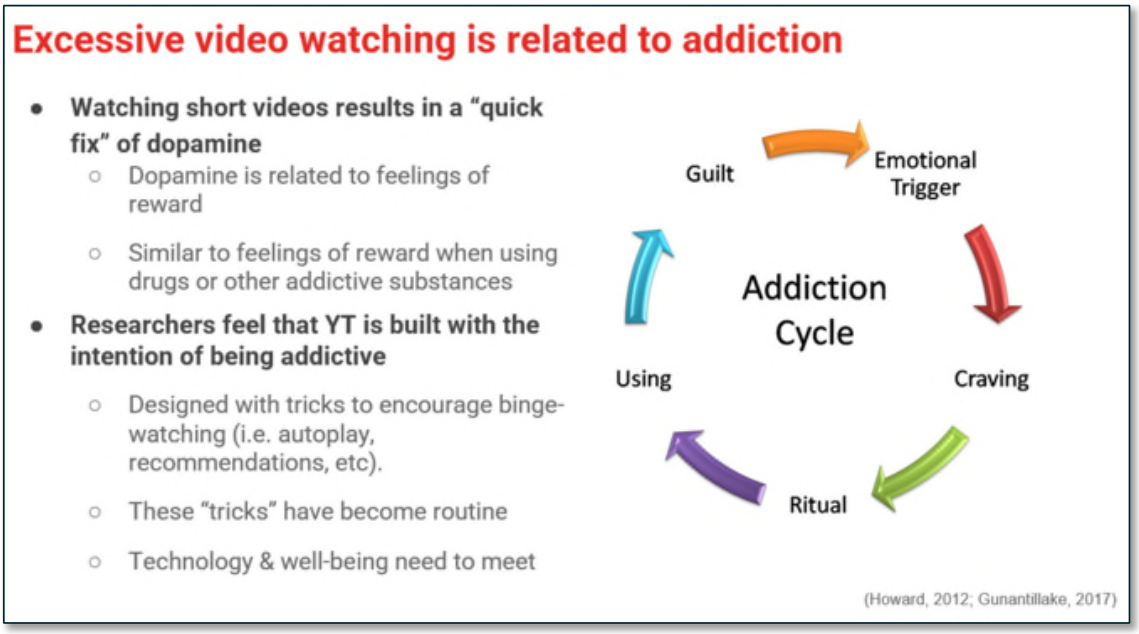
Document 30: SNAP0404262, -4288

It is particularly notable that this fix was not implemented given that it was identified as a solution to the problem that "Snapchat is addictive and [teens] are on it 'all the time.'"

iv) **YouTube**

YouTube documents reflect a similar continuum of problematic usage including addiction. A 2019 Google report found that 45% of survey respondents "unintentionally stay on YT longer

than they want," a core feature of "addiction." The "insight" accompanying that finding was that "YouTube is designed around increasing users' engagement, not maintaining user's intention."[124] Promoting "engagement" at the expense of "intention" by design is a very effective strategy to build an addictive product. That same 2019 report estimated that 5% of 13–24-year-olds watch 3 hour per day "habitually" and 1-2% watch 4 or more.[125]



Document 31: GOOG-3047MDL-04918852 at Slide 12

At that time, Google estimated that there were 69 million teens on its platform meaning that over 4 million teens were watching more than 3 hours per day. That amount of video consumption per day should be viewed as "problematic" to say the least and YouTube acknowledged as much, proposing "targeted alerts and active education depending on the pattern of use." In 2018, a YouTube presentation stated that "gaming content is popular on their platform"

[124] GOOG-3047MDL-00236723 at Slide 11
[125] GOOG-3047MDL-00236723 at Slide 41

and that if "DSM criteria were applied to watching gaming videos, 1 in 5 teens would be diagnosed with addiction."[126]

YouTube has a "digital wellbeing" group that among other things offered "take a break" and "bedtime" reminders. On January 30, 2023, Erin Turner, YouTube Group Product Manager queried what "the success of those" were. The actual numbers are not provided in the document, rather a list of links to view them is:

- # of users who see a take a break reminder: http://shortn/_2pMkNjFDgP
- # of users who see a bedtime reminder: http://shortn/_7jZd1GJYTw
- # of users who check their time watched stats: http://shortn/_kaPh1alY4h
- We also check topline YTT metrics when rolling out new features to make sure we didn't break anything. They're expected to be neutral though.

Document 32: GOOG-3047MDL-02486605, 6605

Importantly, the effects of these safeguards, which are being monitored, is "expected to be neutral" on overall viewing time. That is a bit counterintuitive. An intervention designed to induce breaks, or set nighttime stop times, should, if effective, *reduce* total time on the platform—suggesting that, like their competitors' similar time-limiting features, these were engineered to be *in*effective in practice.

Indeed, as the foregoing shows, each of the four platforms, while internally recognizing and conceding that their product had addictive design features driving some percentage of its clients to develop problematic usage patterns, took minimal if any steps to mitigate those features. And even insofar as they did deploy mitigation strategies, they were always evaluated in the context of how they might affect the company's bottom line currently and in the future.

[126] GOOG-3047MDL-00874191 at Slide 27

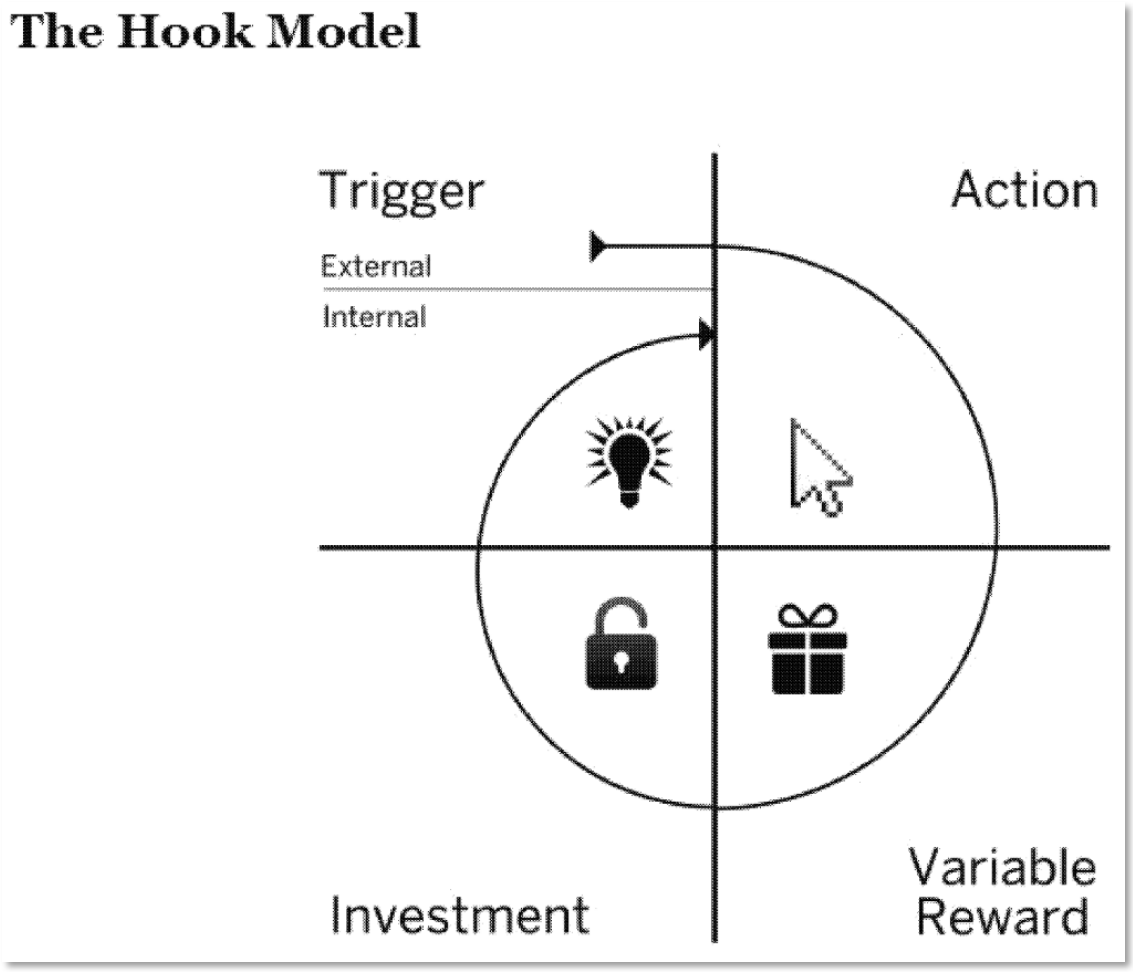
VIII. Design Features of Social Media that Drive Usage and Addictive Behavior

Social Media platforms embody numerous design features that promote addiction, problematic use, and attendant harms. This includes design features that exploit intermittent reward, social comparison metrics, and "flow" state. I will discuss each of these in turn, but they all work in tandem to keep users hooked and have their foundations in behavioral psychology, the "father" of which is BF Skinner.

Skinner (1904 –1990) was an American psychologist, and the Edgar Pierce Professor of Psychology at Harvard University until 1974. He conducted foundational research related to how behaviors are reinforced through the "Skinner" box he invented. Briefly, rats were placed in a box that had a light, a loudspeaker, a response lever, a food dispenser and an electrified grid. The lights and the loudspeaker provided stimuli. These conditioned the rat to pay attention and press the lever when they were activated. Pressing the response lever would in turn dispense (or not dispense) food. The electrified grid could be used to "punish" failure to press the response lever when a stimulus had been delivered.

Skinner found that rewarding reaction to the stimulus, by dispensing food if the rat pushed the lever when the light flashed, made the rat more attentive to the light. Conversely, "punishing" the rat for failing to respond to the stimulus by delivering a low-level shock via the grid also made it more attentive. Neither of these results are especially surprising (at least not now) to us. But the most interesting of Skinner's findings were that intermittent unpredictable rewards were more effective than predictable ones. In other words, the rat became more attentive to a stimulus if not every reaction yielded a reward. This unexpected finding was long ago incorporated into such things as slot machines, where gamblers cannot predict which pull will result in payouts, and as they play they are constantly hearing others around them win, reminding them that their next pull

might be a jackpot. All three of these addictive design features are "built in" to social media sites and are reflected in the "hook model" studied by Meta's researchers (*see* below).



Document 33: META3047MDL-020-00342155, -2155

This figure, which is taken from a book by Nir Eyal titled *Hooked: How to Build Habit Forming Products*.[127] It also appears in Snap's documents.[128] The figure is annotated as follows:

[127] Eyal N. *Hooked: how to build habit-forming products*. Portfolio/Penguin; 2014:242 pages.
[128] SNAP5486213, -6214

Internal Trigger: users need a reason to come back to Snapchat (vs going to another social app). If we can get things like the actions/UI and rewards right, the internal triggers become things like FOMO, wanting to get the news, and staying in touch with all friends. Additionally, internal triggers should play on what users are already doing - things like community meetups (e.g. school network), affinity groups (e.g. run club), and family engagement (e.g. sharing photo albums).

Document 34: SNAP5486213, SNAP5486214

The *Handbook of Children and Screens*, of which I was the editor, examined several features that promote problematic usage or addictive usage of the platforms. Below, I will summarize some of our findings.

A. Likes, Comments, and other Metrics

Scientists have found that receiving "likes" on social media platforms are very similar to the "rewards" that researchers have associated with addiction research for decades.[129] Likes can include the like button on Facebook but can also include "hearts" on Instagram and TikTok. Similar metrics include the number of shares on a post, number of comments, and number of followers or friends for a user. While seemingly innocuous, users' quest for these publicly-visible "rewards" has been linked to a number of secondary harms such as reduced sleep efficiency and duration due to "routine check[ing]" behaviors during the night.[130] They have also been associated with reinforcing addictive behaviors in order to encourage users to spend more time on these

[129] Handbook of Children and Screens at pdf p. 59, 153; *See also* Sherman LE, Payton AA, Hernandez LM, Greenfeld PM, Dapretto M, *The power of the like in adolescence: effects of peer influence on neural and behavioral responses to social Media*, Psychol Sci. 2016;27(7):1027–35. https://doi.org/10.1177/0956797616645673; Sherman LE, Payton AA, Hernandez LM, Greenfeld PM, Dapretto M, *The power of the like in adolescence: effects of peer influence on neural and behavioral responses to social media*, Psychol Sci. 2016;27(7):1027–35, https://doi.org/10.1177/0956797616645673.

[130] Handbook of Children and Screens at pdf p. 134; *See also* Rod NH, Dissing AS, Clark A, Gerds TA, Lund R, *Overnight smartphone use: a new public health challenge? A novel study design based on high-resolution smartphone data*, PLoS One. 2018;13(10):e0204811, https://doi.org/10.1371/journal.pone.0204811.

platforms.[131] It has even been linked to increased feelings of depression, anxiety, and negative social comparison since receiving "fewer likes" is viewed as a form of "negative peer feedback."[132]

Comments are similar to likes in that they provide users with "quantifiable (and qualitative) feedback" about their experiences on the platform.[133] For teens, this means that they are able to quantify the "success" of their posts with many teens reporting that they post "self-oriented images on social media with the goal of obtaining likes and other forms of feedback such as comments."[134] Other studies have found that comments are often seen as a mechanism for "gaining [social] status" and reflect a degree of "digital social approval."[135] As a result, other studies have linked comments to negative social comparison since "not receiving enough likes on one's pictures can negatively affect appearance esteem and prompt delet[ion] of a post.[136]

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[131] Handbook of Children and Screens at pdf p. 210; *See also* Brand M, *Can internet use become addictive?*, Science. 2022;376:798–9, https://doi.org/10.1126/science.abn4189; Starcevic V, Aboujaoude E., *Internet addiction: reappraisal of an increasingly inadequate concept*, CNS Spectr. 2017;22(1):7–13.

[132] Handbook of Children and Screens at pdf p. 248; *See also* Lee HY, Jamieson JP, Reis HT, et al, *Getting fewer "likes" than others on social media elicits emotional distress among victimized adolescents*, Child Dev. 2020;91(6):2141–59, https://doi.org/10.1111/cdev.13422.

[133] Handbook of Children and Screens at pdf p. 445.

[134] Handbook of Children and Screens at pdf p. 447; *See also* Chua THH, Chang L, *Follow me and like my beautiful selfes: Singapore teenage girls' engagement in self-presentation and peer comparison on social media*, Comput Hum Behav. 2016;55:190–7, https://doi.org/10.1016/j.chb.2015.09.011.23; Yau JC, Reich SM, *"It's just a lot of work": adolescents' self-presentation norms and practices on Facebook and Instagram*, J Res Adolesc. 2019;29(1):196–209. https://doi.org/10.1111/jora.12376.

[135] Handbook of Children and Screens at pdf p. 448; *See also* Chua THH, Chang L, *Follow me and like my beautiful selfes: Singapore teenage girls' engagement in self-presentation and peer comparison on social media*, Comput Hum Behav. 2016;55:190–7, https://doi.org/10.1016/j.chb.2015.09.011. 23.

[136] Handbook of Children and Screens at pdf p. 448; *See also* Baker N, Ferszt G, Breines JG, *A qualitative study exploring female college students' Instagram use and body image*, Cyberpsychol Behav Soc Netw. 2019;22(4):277–82, https://doi.org/10.1089/cyber.2018.0420.

B. Algorithmic Recommendations

At the heart of every social media platform's engagement driven strategy is their proprietary recommendation algorithms. These algorithms are optimized to maximize engagement rather than healthy interactions with a person's social network.[137] They accomplish this in a variety of ways. One way they drive time spent on social media is by inferring the interests of the user (which may or may not be expressed by the user in any direct way) and feeding the user an aggregation of posts that, while most likely to keep the user using, may lead the user down problematic rabbit holes.[138] Another way they drive time spent on social media is by utilizing the intermittent variable reward mechanism that Skinner discovered (*e.g.*, likes, notifications, comments) which contribute to addiction to the platforms themselves.[139]

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[137] Tom Cunningham Dep. Tr. at 50:11-19 ("[T]here's now in the public domain two or three well-run experiments which show that comparing between chronological ranking where you rank items by the point at which they were posted versus ranking by engagement, the rank by engagement tends to increase a lot of metrics of user retention and time spent and almost by definition viewport views."); Josh Simons Rough Dep. Tr. at 67:12-21 ("[G]iven that the whole News Feed system is aimed at engagement, that's a set of repeated patterns of behavior – clicking, liking, sharing and on so – the best way to increase engagement is addiction in some way, you know, is to get people doing those forms of engagement. And so the type of content that the News Feed system made viral was the kind of content that would make you feel, make users feel whatever they needed to feel to produce that type of behavior.").

[138] Tom Cunningham Dep. Tr. at 29:17-30:4 ("Q. What other types of engagement did – to the extent you can recall – did feed take account of? . . . A. Reshares. Exactly. And video views. And what's the right noun? Lingers. The time that someone was lingering or watching a – or examining a post."); Joshua Simons Dep. Tr. at 81:19-25 ("[W]hat the engineers building [News Feed] reported to me is that by defining value in terms of those proxies – clicks, likes, shares, plays – you ended up incentivizing repeated patterns of behavior on the tool that were in the end undesirable, and sometimes actively harmful for the users of the tool themselves."); Joshua Simons Dep. Tr. at 92:1-6 ("The fact that Facebook's models are all trained to predict a proxy for what we really care about was understood by engineers inside the company to be one of the likely drivers for things like divisiveness and filter bubbles that were being actively researched inside the company at the time.").

[139] Social Media and Youth Mental Health, The U.S. Surgeon General's Office, available at https://www.hhs.gov/surgeongeneral/reports-and-publications/youth-mental-health/social-media/index.html (2023) ("According to one recent model, nearly a third (31%) of social media

The addictive power of an engagement-optimized algorithm is recognized within the medical and academic literature. In the chapter regarding "Problematic Internet Use," the authors' consensus was that "Attention focused designs intended to generate, or possibly exploit, potentially addictive features (e.g., "likes") and conditioned responses (e.g., notifications) alongside powerful algorithm-based technologies may lead youth to stay online longer than either intended or recommended."[140]

C. Auto-Play

Academics recognize that autoplay is a feature that is designed to prolong engagement at the cost of displacing "important developmental opportunities for young children" and is even associated with greater child behavioral difficulties."[141] It has also been linked to difficulties controlling device use more broadly.[142] The latter phenomenon has even been observed in Defendants' own research. For example, Meta's researchers learned that clinicians regarded autoplay as not having any "beneficial" role while "detract[ing] from patients' ability to control amount of time spent" using their platforms.[143]

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use may be attributable to self-control challenges magnified by habit formation."); *See also* Allcott, H., Gentzkow, M., & Song, L. (2022). *Digital Addiction*, AMERICAN ECONOMIC REVIEW, 112 (7): 2424-63. https://doi. org/10.1257/aer.20210867

[140] Handbook on children and screens p.182

[141] Handbook of Children and Screens at pdf p. 54; *See also* Munzer T, Torres C, Domoff SE, et al. *Child media use during COVID-19: associations with contextual and social-emotional factors,* J Dev Behav Pediatr. 2022; 43(9):e573, https://doi.org/10.1097/DBP.0000000000001125.

[142] Handbook of Children and Screens at pdf p. 423; *See also* Vanden Abeele MMP, *Digital wellbeing as a dynamic construct*, Com Theory, 2021;31(4):932–55, https:// doi.org/10.1093/ct/qtaa024.

[143] META3047MDL-072-00318089, Slide 38

D. Infinite Scroll

Like autoplay, the Infinite or Endless Scroll feature has also been linked to prolonging engagement at the cost of displacing children's developmental opportunities.[144] This feature is also linked to behaviors that create a user-sided "time distortion" that results in users spending more time on the Defendants' platforms than they originally intended.[145] Some studies cited (and commissioned) by the Defendants have found that these effects are mitigated by "active" use of their platforms—e.g., generating content or posting content. However, this hypothesis has not been widely accepted,[146] particularly since there is evidence that children are more likely to "watch, play, or scroll through content created by others than they are to use their devices to produce their own content.[147]

E. Beauty Filters

Despite being a relatively new social media feature, Augmented Reality ("AR") filters—commonly referred to as "Beauty Filters"—have been thoroughly studied due to the outsized

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[144] Handbook of Children and Screens at pdf p. 54; *See also* Munzer T, Torres C, Domoff SE, et al. *Child media use during COVID-19: associations with contextual and social-emotional factors,* J Dev Behav Pediatr. 2022; 43(9):e573, https://doi.org/10.1097/DBP.0000000000001125.

[145] Handbook of Children and Screens at pdf p. 483; *See also* Flayelle M, Brevers D, King DL, Maurage P, Perales JC, Billieux J, *A taxonomy of technology design features that promote potentially addictive online behaviours,* Nat Rev Psychol. 2023;2(3):136–50, https://doi.org/10.1038/s44159-023-00153-4.

[146] Handbook of Children and Screens at pdf p. 152; *See also* Valkenburg PM. Social media use and well-being: What we know and what we need to know. Curr Opin Psychol. 2022;45:101294. https://doi.org/10.1016/j. copsyc.2021.12.006; Handbook of Children and Screens at pdf p. 187 ("[S]ome scholars suggest that this dichotomy of passive use being negative and active use being positive has too many exceptions to truly understand youths' experiences online and outcomes for well-being.").

[147] Handbook of Children and Screens at pdf p. 541; *See also* Rideout V, Peebles A, Mann S, Robb MB. *Common sense census: media use by tweens and teens*, 2021. Common Sense. 2022; Accessed 24 Mar 2023. https://www.commonsensemedia.org/sites/default/files/research/report/8-18-census-integrated-reportfnal-web_0.pdf

negative impact they could have on users by exacerbating a socio-psychological phenomenon known as "social comparison."[148] Prior to the advent of these Beauty Filters, researchers had already identified that social media may exacerbate social comparison and lead to increased body dissatisfaction and/or disordered eating.[149] However, with the introduction of Beauty Filters—many of which were developed by the Defendants—users are now exposed to "manipulated" photos that depict unrealistic (and in some cases impossible) body image standards.[150]

F. Safer Alternative Design

I have been asked to consider what recommendations would improve the safety of social media platforms for use by teenagers. Based upon the literature and my own research, decreasing the number of addictive design features would reduce harms substantively both because it would reduce problematic use and all of the other attendant untoward events it leads to (e.g. sleep disturbances). This includes removing design features that foster negative social comparison (such

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[148] Handbook of Children and Screens at pdf p. 178; *See also* Thompson JK, Heinberg LJ, Altabe M, TantleffDunn S, *Exacting beauty: theory, assessment, and treatment of body image disturbance*, American Psychological Association; 1999. https://doi.org/10.1037/10312-000.

[149] Handbook of Children and Screens at pdf p. 178; *See also* Holland G, Tiggemann M. *A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes*, Body Image. 2016;17:100–10, https://doi.org/10.1016/j.bodyim.2016.02.008; Roberts SR, Maheux AJ, Ladd BA, Choukas-Bradley S, *The role of digital media in adolescents' body image and disordered eating*, In: Nesi J, Telzer EH, Prinstein MJ, editors. HANDBOOK OF ADOLESCENT DIGITAL MEDIA USE AND MENTAL HEALTH, 1ST ED. Cambridge University Press; 2022. p. 242–63, https://doi.org/10.1017/9781108976237.014; Rodgers RF, *The relationship between body image concerns, eating disorders and internet use, Part II: An integrated theoretical model,* Adolesc Res Rev. 2016;1(2):121–37, https://doi.org/10.1007/s40894-015-0017-5; Perloff RM, *Social media effects on young women's body image concerns: theoretical perspectives and an agenda for research*, Sex Roles. 2014;71(11-12):363–77, https://doi.org/10.1007/s11199-014-0384-6.

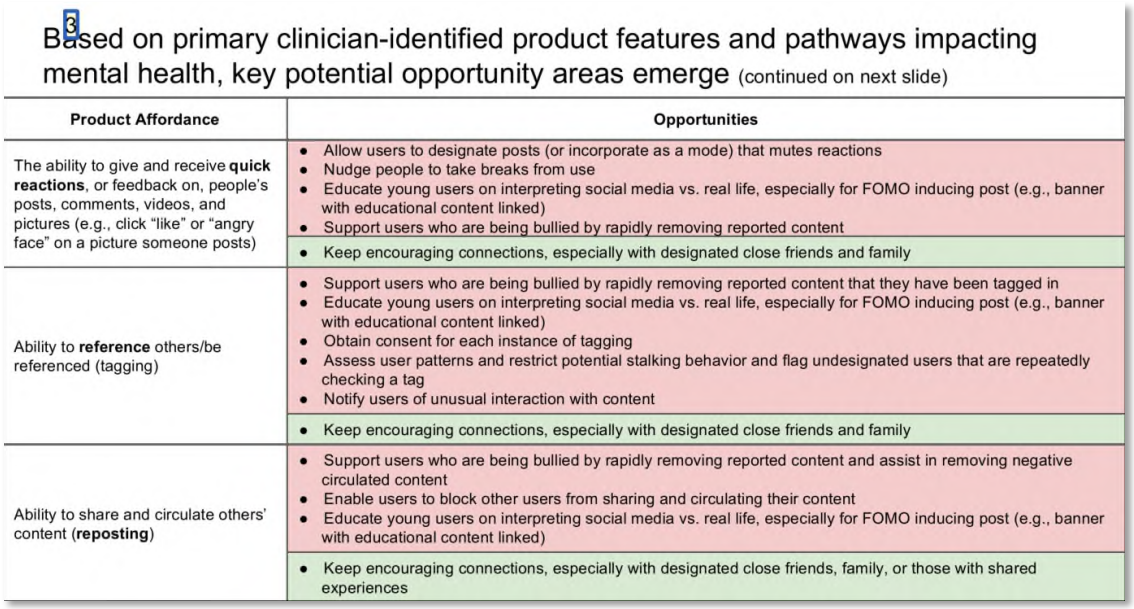
[150] Kleemans, Daalmans, Carbaat, & Anschütz (2018). Picture Perfect: The Direct Effect of Manipulated Instagram Photos on Body Image in Adolescent Girls. *Media Psychology*; Spitzer, Crosby, & Witte (2022). Looking through a filtered lens: Negative social comparison on social media and suicidal ideation among young adults. *Psychology of Popular Media*; *See also* Meta Research Summary: https://docs.google.com/document/d/1w-HOfseF2wF9YIpXwUUtP65-olnkPyWcgF5BiAtBEy0/edit?pli=1&tab=t.0#heading=h.sh24qmab6i4m

as filters), reducing notifications that distract, and removing metrics, such as snap streaks, which are highly addictive.

In addition, platforms that fully disclose the risk of harms to parents and children would increase safety. Based upon my work as a pediatrician, academic, and knowledge of public health, users do not expect social media to be as addictive and harmful as the literature supports and neither parents nor society treat it as such (versus limiting access to adults as we do for alcohol or tobacco).

IX. Internal Documents Connecting Features To Harm

Notably, many of the features recognized in the literature as addictive and/or harmful, were identified in research conducted by Meta and presented in 2021. A Mixed Methods Clinicians study identified product features and pathways impacting mental health, including the following:



Based on primary clinician-identified product features and pathways impacting mental health, key potential opportunity areas emerge (continued on next slide)

Product Affordance	Opportunities
The ability to give and receive **quick reactions**, or feedback on, people's posts, comments, videos, and pictures (e.g., click "like" or "angry face" on a picture someone posts)	• Allow users to designate posts (or incorporate as a mode) that mutes reactions • Nudge people to take breaks from use • Educate young users on interpreting social media vs. real life, especially for FOMO inducing post (e.g., banner with educational content linked) • Support users who are being bullied by rapidly removing reported content
	• Keep encouraging connections, especially with designated close friends and family
Ability to **reference** others/be referenced (tagging)	• Support users who are being bullied by rapidly removing reported content that they have been tagged in • Educate young users on interpreting social media vs. real life, especially for FOMO inducing post (e.g., banner with educational content linked) • Obtain consent for each instance of tagging • Assess user patterns and restrict potential stalking behavior and flag undesignated users that are repeatedly checking a tag • Notify users of unusual interaction with content
	• Keep encouraging connections, especially with designated close friends and family
Ability to share and circulate others' content (**reposting**)	• Support users who are being bullied by rapidly removing reported content and assist in removing negative circulated content • Enable users to block other users from sharing and circulating their content • Educate young users on interpreting social media vs. real life, especially for FOMO inducing post (e.g., banner with educational content linked)
	• Keep encouraging connections, especially with designated close friends, family, or those with shared experiences

Document 35: META3047MDL-040-00049387 at Slide 18

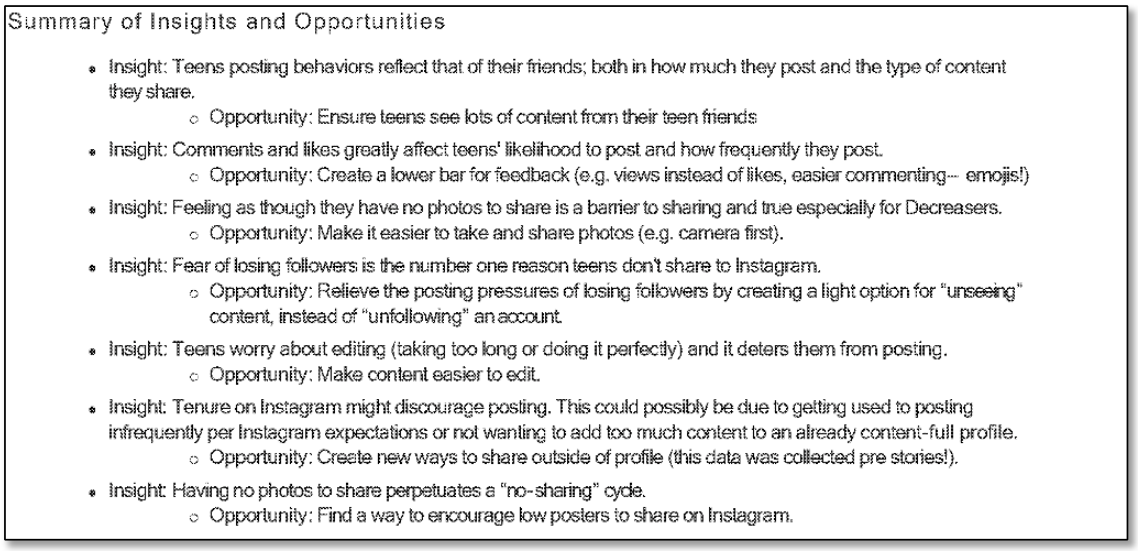
Product Affordance	Opportunities
The ability **play automatically** without pressing a play button	• Nudge people to take breaks from use • Nudge people to reflect on intentions for amount of time they're spending and whether they are meeting that intention • Educate young users on interpreting social media vs. real life, especially for FOMO inducing stories
The ability to **easily click on ads to buy things** (e.g., links that take you to a site to buy a recommended product)	• Enable users to proactively designate modes that mute easily clickable ads • Flag and prevent users engaging in compulsive shopping (i.e. concentrated and accelerated rates of ad engagement) • Identify when people are engaging problematically with ads and add friction
	• Continue to encourage positive and educational content
The fact that people see posts, videos, images, and ads based on what they have **previously done on social media** (i.e., what you've liked, what you've searched for, time you've spent watching certain videos, etc.)	• Nudge people to take breaks from use • Nudge people to reflect on intentions for amount of time they're spending and whether they are meeting that intention • Ensure ranking/recommendations do not promote mental health-related misinformation • Ensure ranking/recommendations do not promote problematic mental health-related content (e.g., "thinspo")
	• Continue to encourage positive and educational content

Document 36: META3047MDL-040-00049387 at Slide 20

Of these features, several were identified as "primarily negative," including Video/Photo filters, location sharing, automatically playing videos, and pop-up notifications.[151]

Internally, Defendants documents recognize that they could increase engagement by changing the design of the social media. As early as 2016, Meta (then Facebook) was exploring ways to keep teens on its site and posting content. An exemplar document reflecting the company findings would include the following:

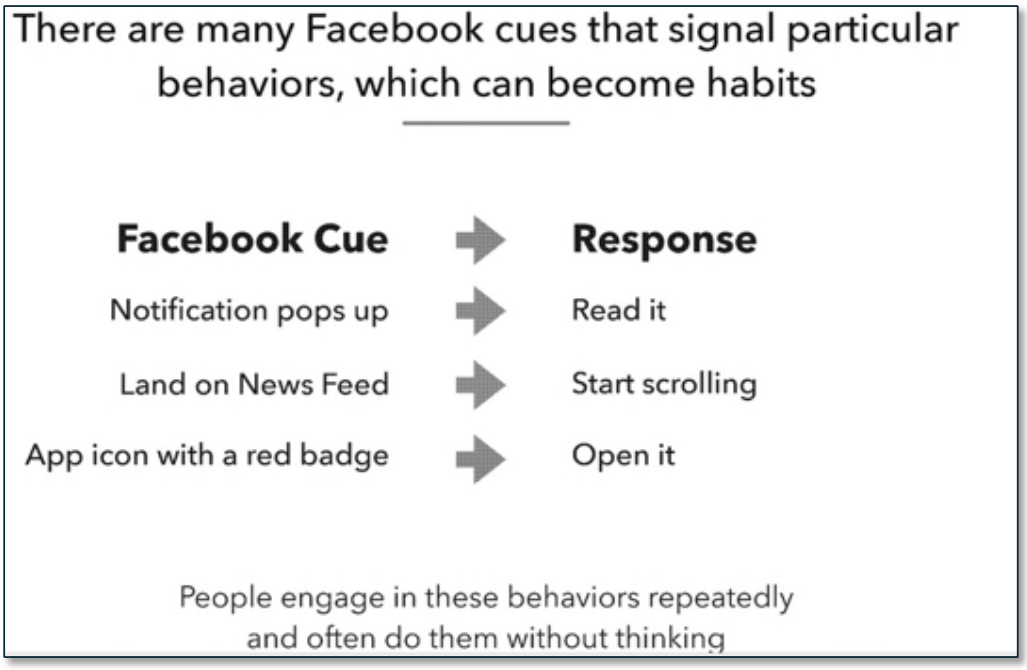
[151] META3047MDL-072-00318089 at Slide 87



Document 37: META3047MDL-031-00096208, -6209

Meta also studied notifications and the ability for this feature to induce habitual or addictive behaviors. For example, one internal document supports the basic addiction principle that "experiencing a reward (or reinforcement) can increase learning and motivation. This contributes to repeated, potentially habitual behaviors."[152] The document included the following figure:

[152] META3047MDL-014-00359270, -9296



Document 38*: META3047MDL-014-00359270, -9302*

It is not surprising then, that among the many metrics Meta tracks, the "success rate" of their notifications, defined as increasing daily usage, is a key one. Darius Kilstein, a Director in Data Science at Instagram, reports:

37% (13.3B daily) of generated IG notifications (~36B, excluding Direct) are received by the user's device while 63% fail. While DM teens have a higher delivery rate to Push Infra (52%) compared to non-teens (40%), both groups behave similarly in the Push infra funnel

Document 39: Darius Kilstein Deposition Exhibit 13 at Slide 47

This is to say that Meta is monitoring (and presumably modulating) the intermittent reward mechanism to ensure that engagement is maximized. As Max Eulenstein, VP of Product, says in a Meta email on Jan 26, 2021, "No one wakes up thinking they want to maximize the number of times they open Instagram that day. But that's exactly what our product teams are trying to do."[153]

[153] META3047MDL-014-00352250, -2251

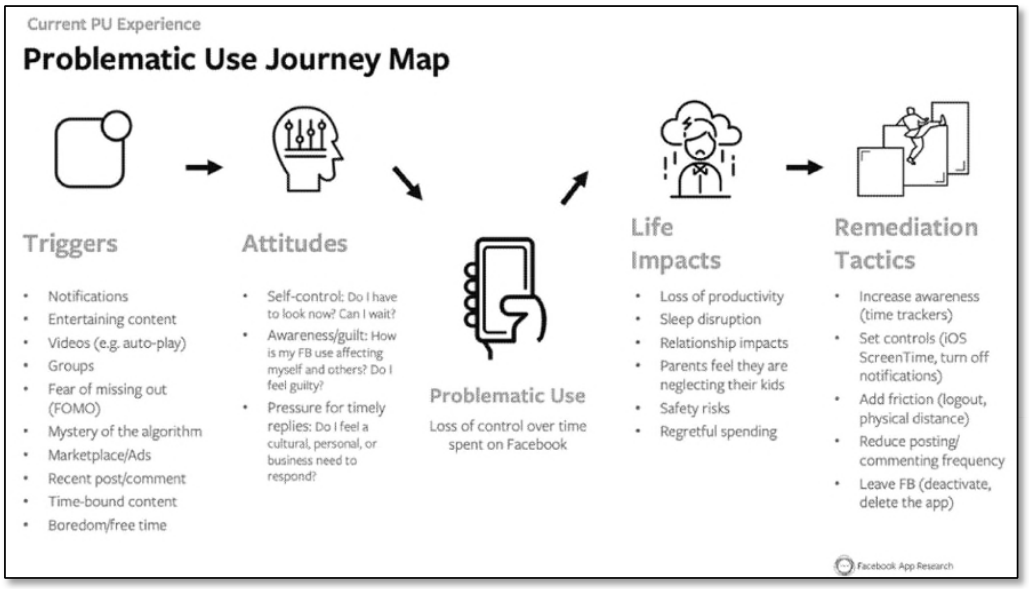
One mechanism that appears to be especially effective at engaging teens (and adults) is the use of "reels" or short videos that repeat. Meta adopted reels from TikTok after seeing how effective they were at promoting usage.[154] Below are Instagram's metrics on the viewing of such reels by teens.

Document 40: Darius Kilstein Deposition Exhibit 14 at Slide 20

The data demonstrated that active daily US teen Instagram users view on average almost 105 reels per day on the platform for a total of 22.5 minutes per day or an average of 20 seconds per reel per day.[155] Briefly watching a short snippet algorithmically curated to one's interest is gratifying via the dopamine reward pathway discussed in section X.

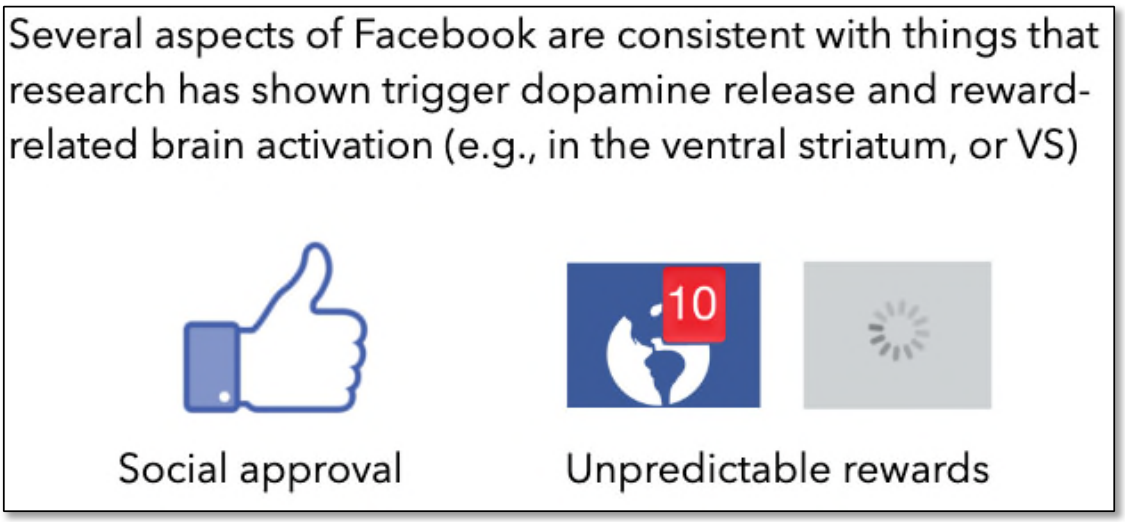
Further, their internal research identified the following "Triggers for Problematic Use on Facebook" which were later included as part of a "Problematic Use Journey Map" as early as 2020 below. [156]

[154] Darius Kilstein Deposition Exhibit 14 at p. 20
[155] Darius Kilstein Deposition Exhibit 14 at p. 20
[156] META3047MDL-079-00000177, -0201

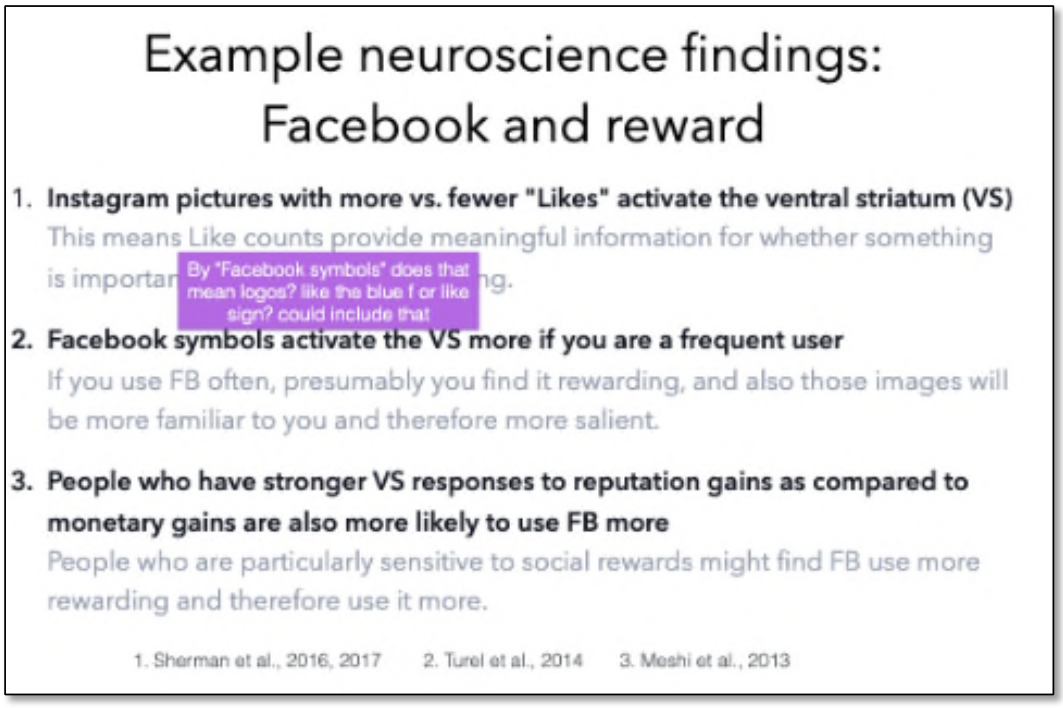


Document 41: META3047MDL-079-00000177, -0200

Each "opportunity" for a reward represents a potential algorithm tweak, and many if not all of these were eventually incorporated in some form into the site. For example, a 2018 Facebook presentation has the following two slides:

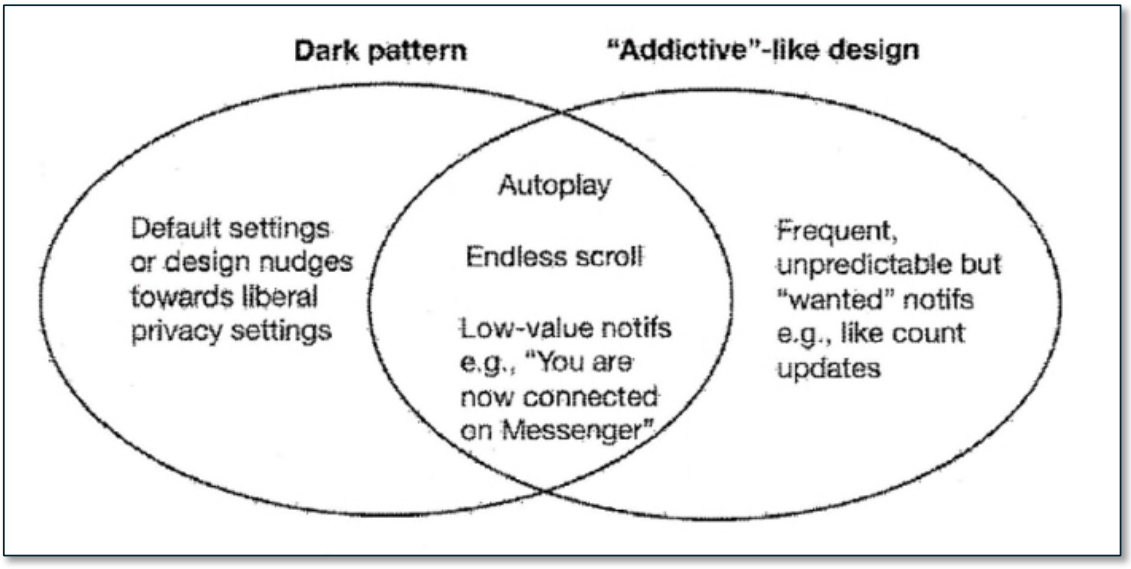


Document 42: META3047MDL-044-00091392 at Slide 24



Document 43: META3047MDL-044-00091392 at Slide 25

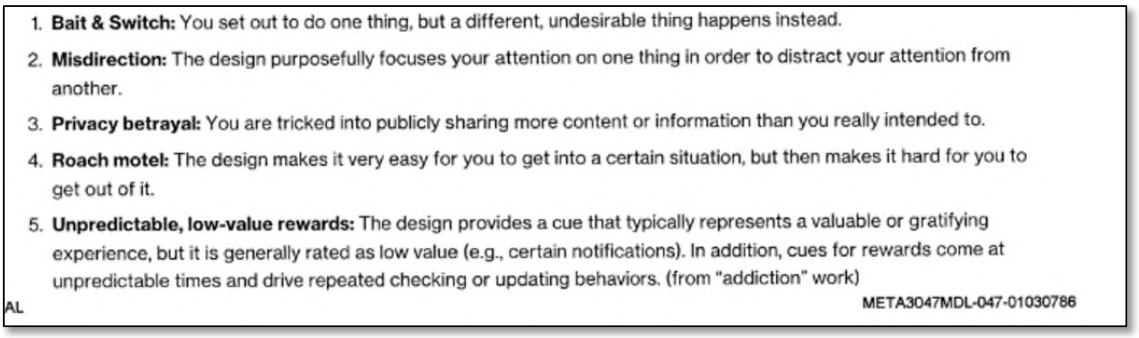
Meta's more recent documents present an interesting Venn diagram portraying one way to conceptualize the usage experience from a design perspective (see below).



Document 44: META3047MDL-044-00108564, -8566

"Dark Pattern is a user experience term referring to interactions that are deceptive, or that trick you into doing something you didn't want to do."[157] Again, this diagram acknowledges that they have "addictive" design features and that some of them are set to "default." Meta documents from Project "Plato" that was intended to study and mitigate "dark patterns" state that "Some [Facebook] UX patterns rob users of their agency."[158] Included among them are:

[157] META3047MDL-044-00108564, 8566
[158] META3047MDL-047-01030786, 0786

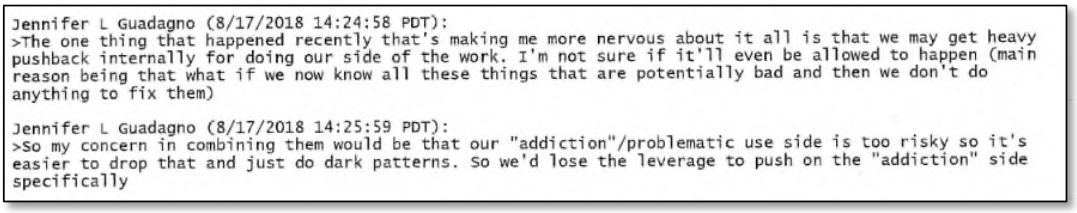


1. **Bait & Switch:** You set out to do one thing, but a different, undesirable thing happens instead.
2. **Misdirection:** The design purposefully focuses your attention on one thing in order to distract your attention from another.
3. **Privacy betrayal:** You are tricked into publicly sharing more content or information than you really intended to.
4. **Roach motel:** The design makes it very easy for you to get into a certain situation, but then makes it hard for you to get out of it.
5. **Unpredictable, low-value rewards:** The design provides a cue that typically represents a valuable or gratifying experience, but it is generally rated as low value (e.g., certain notifications). In addition, cues for rewards come at unpredictable times and drive repeated checking or updating behaviors. (from "addiction" work)

AL META3047MDL-047-01030786

Document 45: META3047MDL-047-01030786

Meta's researchers also knew that being too critical of these design choices could lead to criticism from internal stakeholders. For example, Jennifer Guadagno noted that her wellbeing team's efforts to study Facebook addiction as part of Project Plato could "get heavy pushback internally" and added that she was not "sure if it'll even be allowed to happen" because "if we now know all these things that are potentially bad and then we don't do anything to fix them" it could lead problems for the company externally.[159] Bejar in his deposition flatly attests that Meta did not do enough to warn parents or curtail problematic use of their products.[160]



Jennifer L Guadagno (8/17/2018 14:24:58 PDT):
>The one thing that happened recently that's making me more nervous about it all is that we may get heavy pushback internally for doing our side of the work. I'm not sure if it'll even be allowed to happen (main reason being that what if we now know all these things that are potentially bad and then we don't do anything to fix them)

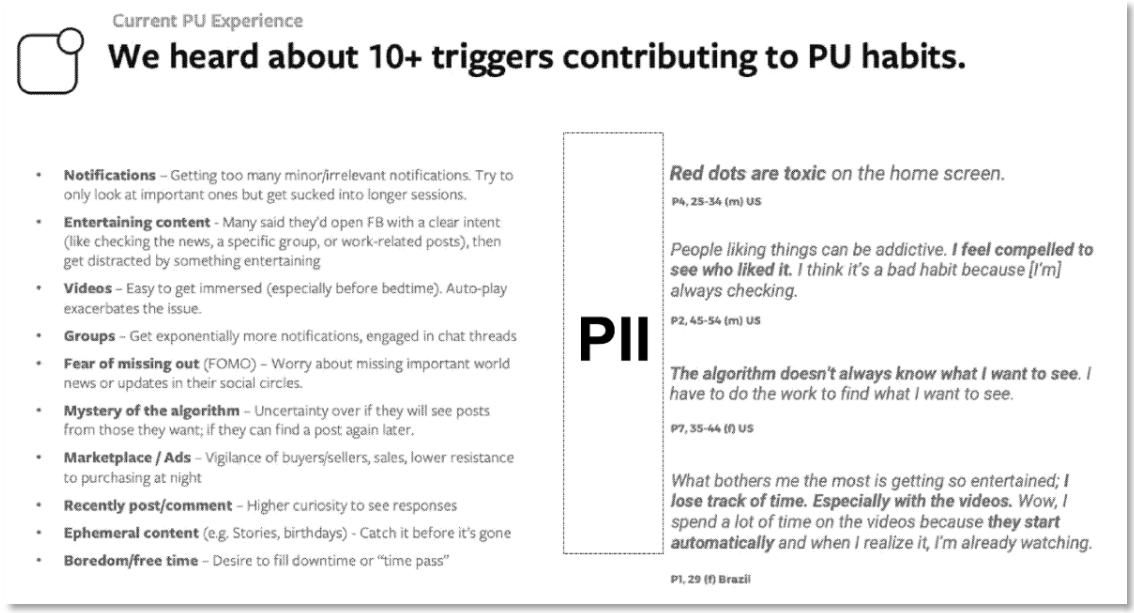
Jennifer L Guadagno (8/17/2018 14:25:59 PDT):
>So my concern in combining them would be that our "addiction"/problematic use side is too risky so it's easier to drop that and just do dark patterns. So we'd lose the leverage to push on the "addiction" side specifically

Document 46: META3047MDL-040-00593848, -3848

Despite learning of these problems as early as 2018, Meta had not made meaningful changes to the platform nearly two years later. A Meta presentation from 2020 arrived at nearly identical conclusions that the Project Plato researchers reached, including the connection

[159] META3047MDL-040-00593848, 3848
[160] Arturo Bejar Deposition at 143.

between design features and problematic usage. One slide from that 2020 presentation stated that research participants reported "10+ triggers contributing to [problematic use] habits" including:



Document 47: META3047MDL-079-00000177, -0201

Meta was not the only social media company to reach these conclusions about their platforms' features. For example, YouTube describes "finding a video on YouTube search" as a "predictable reward" compared to "unpredictable rewards" such as "finding a new favorite song while in a mix."[161] This slide as summarizes latter as "disproportionately [more] delightful compared to predictable rewards because they're unexpected or exceed expectations."[162] YouTube's researchers describing the reason for this dichotomous design have stated:

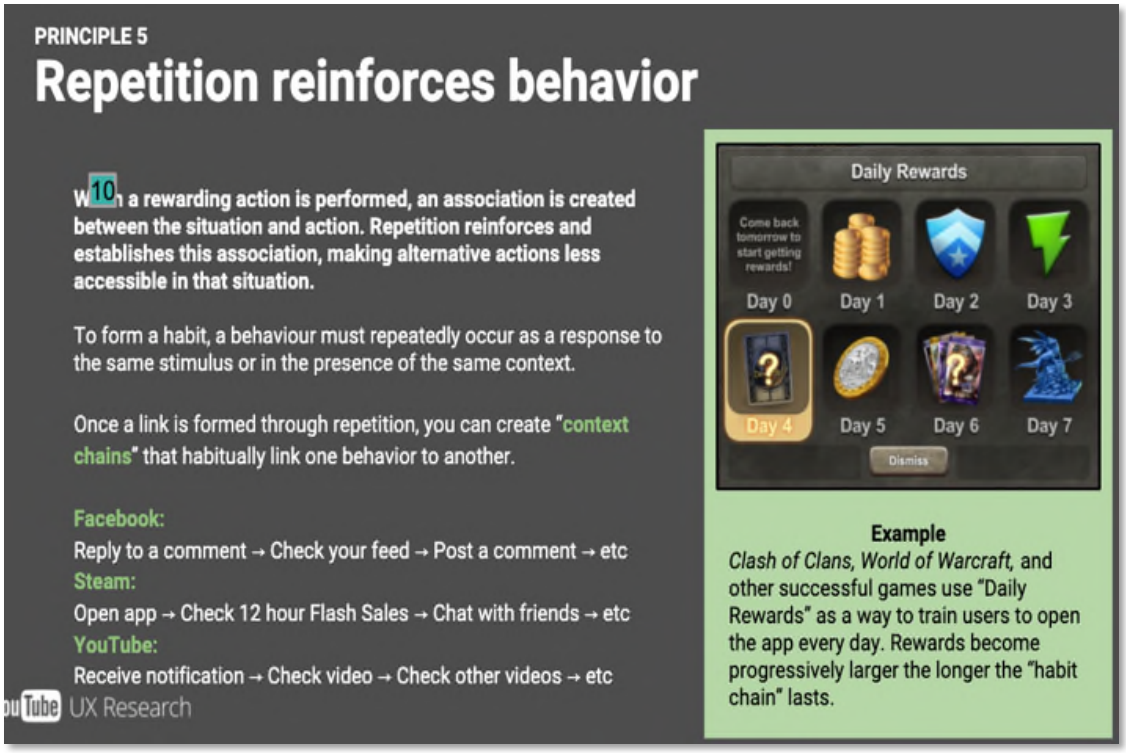
> When thinking about habit building around YouTube, it is important that we reliably fulfill their goal pursuits (reliable reward) while also providing surprising nuggets of reward (variable reward). Ultimately you're giving people more reasons

[161] GOOG-3047MDL-01268284 at Slide 10
[162] GOOG-3047MDL-01268284 at Slide 10

to come back until they can't even remember why they did. When is the last time you had a goal in mind when you went to Facebook?"[163]

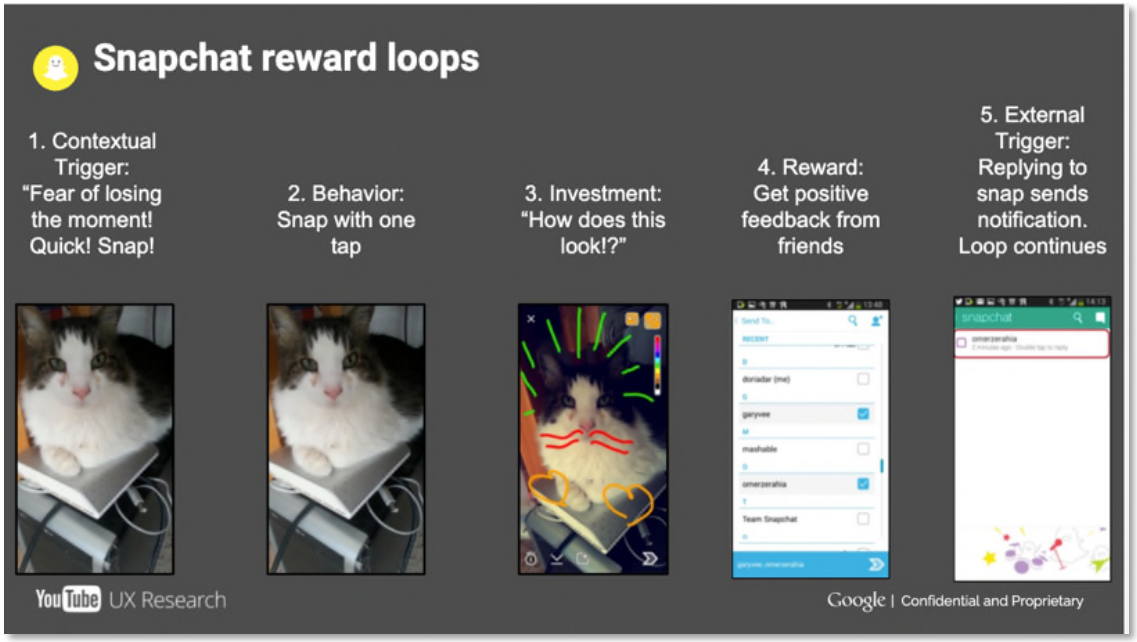
YouTube also recognized the presence of these features in their competitor's platforms as well. For example, in the same presentation, YouTube recognized that "repetition reinforces behavior" and identified that Facebook had created "context chains" in which users would reply to a comment, check their News Feed, post a comment, and then repeat the cycle.[164] They also identified a similar behavioral feedback loop for sending Snaps on Snapchat. [165]

And later in the same presentation, the role that repetition and reward play, as well as the design features deployed by both YouTube and its competitors is reviewed.



Document 48: GOOG-3047MDL-01268284 at Slide 11

[163] GOOG-3047MDL-01268284 at Slide 11
[164] GOOG-3047MDL-01268284 at Slide 11
[165] GOOG-3047MDL-01268284 at Slide 34



Document 49: GOOG-3047MDL-01268284 at Slide 34

Internal documents also reveal that Instagram is tracking usage/engagement by teen users. An email from Darius Kilstein, on February 5, 2022, states that Meta "looked into the long-term decline of feed imp[ressions] for Teens" and discovered that "teens aren't relying on Feed for interest consumption as much as they used to" and hypothesized that this shift might explain "why teens now consume fewer Reels than adults."[166]

- **We looked into the long-term decline of feed imps for Teens and what we found was fascinating:**
  - There may be a generational shift away from Feed. 13yo's average half as many Feed imps/DAU as 17yo's & each new cohort of teens consumes less on Feed than the previous.
  - Among teens, US Home Feed Imps/DAU declined -30% between July 2020 and January 2022, compared to -8% for adults. This finding also explains why teens now consume fewer Reels than adults (they under-consume on RIFU (Reels in Feed Unit) & Chaining from Feed).
  - Teens aren't relying on Feed for interest consumption as much as they used to, and other products aren't sufficiently compensating for the loss, posing a significant headwind for the cohort

Document 50: Darius Kilstein Deposition Exhibit 9, at -7079

[166] Darius Kilstein Dep. Exhibit 9 at -7079

The reported "headwind" for the "cohort" points to Instagram's business need to redesign features to better engage younger children and keep up with their competitors (particularly TikTok) as Kilstein says later in the same email.[167]

Particularly when, as here, Meta has operationalized its "time spent" metric in order to "make projections for monetization."[168] This fact is further supported by Meta's Form 10k submissions to the SEC which state that its "advertising revenue can also be adversely affected by a number of other factors including: decreases in user engagement, including *time spent on our products*."[169] This was even acknowledged during Mark Zuckerberg's deposition in this case where he acknowledged that the amount of money his companies make is directly related to the amount of time users spend scrolling past and interacting with advertisements on the platform.[170]

The purest example of the way in which Meta designed its platforms in order to exploit their users' attention is the changes to the "News Feed" features. In its original form, Facebook's "feed" simply allowed people to update their profiles with new events and presented them in chronological order. Later, it was re-engineered to present information based on what Meta's algorithm predicted a user wanted to see. In 2017, several years after the first algorithm was introduced, a Meta researcher asked whether "algorithms to blame for Facebook addiction?"[171] They concluded that while "research hasn't addressed this [question]," an algorithm that "favor[s]

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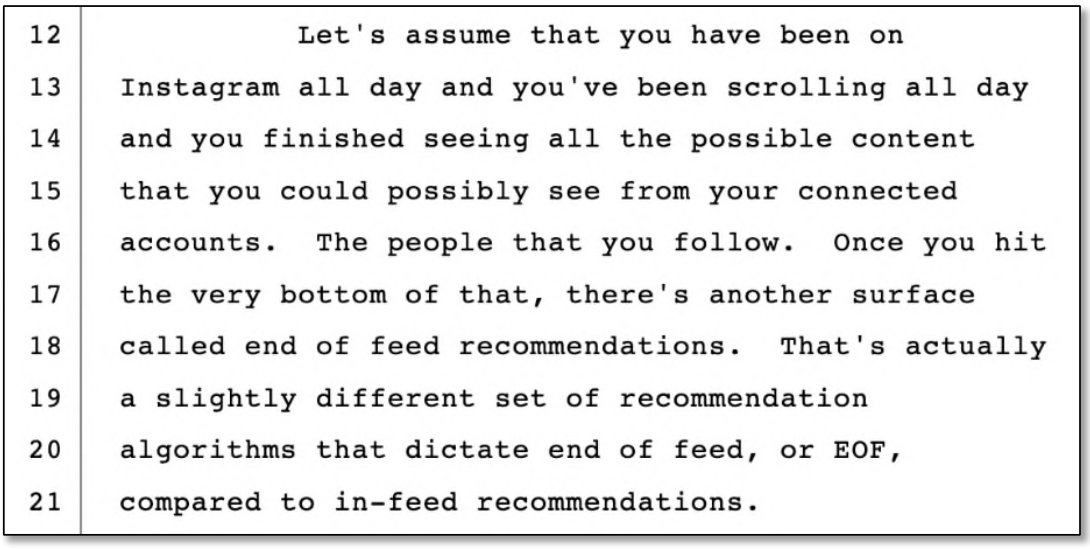
[167] Darius Kilstein Dep. Exhibit 9 at -7080
[168] Darius Kilstein Dep. Tr. at 409:17-20
[169] Meta 2023 Form 10K Filing
[170] Mark Zuckerberg Dep. Tr. at 194:9-12 ("Q. Mr. Zuckerberg, if users spend more time on their Instagram or Facebook Feed, then generally speaking, they'll see more ads, yes… Q. And you don't deny that the more ads get seen, the more ad revenue Meta earns, yes? A. …. In general, the more ads that people see, the more opportunities we have to show people relevant ads. Q. Which means more advertising revenue you have a chance to earn? A. Yeah. In general, from a business perspective, I think that's roughly correct.").
[171] META3047MDL-005-00000001, -0003

content or functionality that encourages people to spend more time on Facebook, then it's possible that this will by its nature tap into addictive mechanisms" and lead to "addictive/compulsive usage more severe and more widespread."[172]

As Kan-Xing states in his deposition "The problem that I think news feed was trying to solve was if you had maybe a hundred or 200 friends, it was actually pretty time-intensive and not that efficient a use of time to --like, if you're just trying to figure out what's new or what's happening with your friends, to go through all 100 or 200 of them."[173] Later in his deposition, reading from an internal Meta document, he quotes "In essence, Facebook users didn't think they wanted constant up-to-the-minute updates on what other people are doing, yet when they experienced this sort of omnipresent knowledge, they found it intriguing and addictive."[174] In 2015, as quoted in the same deposition, Zuckerberg himself states "I've spent a lot of time recently thinking about the decline in content production, and I wanted to upgrade our sense of urgency around this. I think this is the biggest issue we must now address as a company."[175] Teen engagement in particular was optimized by making the default news feed only include posts from people in their age range with the rationale that parental posts would be of less interest.[176] The "infinite feed" invented at Facebook was exported and adapted to Insta. In her deposition, Dr. Lee states:

[172] META3047MDL-005-00000001, -0003
[173] Kang-Xing Jin Deposition Tr. at 169:16-22
[174] Kang-Xing Jin Deposition Tr. at 171:17-22; s*ee also* Kang-Xing Jin Dep. Exhibit 10 at -6106
[175] Kang-Xing Jin Deposition Tr. at 234:23-235:3; *see also* Kang-Xing Jin Dep. Exhibit 17 at -6298
[176] Kang-Xing Jin Deposition Tr. at 236:9-14; *see also* Kang-Xing Jin Dep. Exhibit 17 at -6302



Let's assume that you have been on Instagram all day and you've been scrolling all day and you finished seeing all the possible content that you could possibly see from your connected accounts. The people that you follow. Once you hit the very bottom of that, there's another surface called end of feed recommendations. That's actually a slightly different set of recommendation algorithms that dictate end of feed, or EOF, compared to in-feed recommendations.

Document 51: Alison Lee Deposition Transcript at 30:12-21

The quote starts with the scenario wherein someone has been "scrolling" all day (itself an implicit acknowledgement of overuse) and exhausts their "connected" feeds at which point a new, end of feed algorithm is triggered. Dr. Burke in her deposition talks about the "Friend Paradox" whereby someone's friends have a higher percentage of likes than they do and says "[i]f News Feed is optimized based on how many likes a post gets, then yes, it could make that paradox appear worse."[177] That is exactly how News Feed is optimized per Kan-Xing.

Raskin invented the infinite scroll. This feature allows a user to scroll indefinitely through their feed, receiving endless posts and intermittent variable rewards. At deposition, Raskin testified that infinite scroll was like "digital cocaine" for the user. Jason Eash, who self-identifies as one of the technology leads for Instant Articles on Android at Facebook, reports "we only care about things like time spent, open links etc. That's what we optimized for. That's what we defined as success and failure."[178]

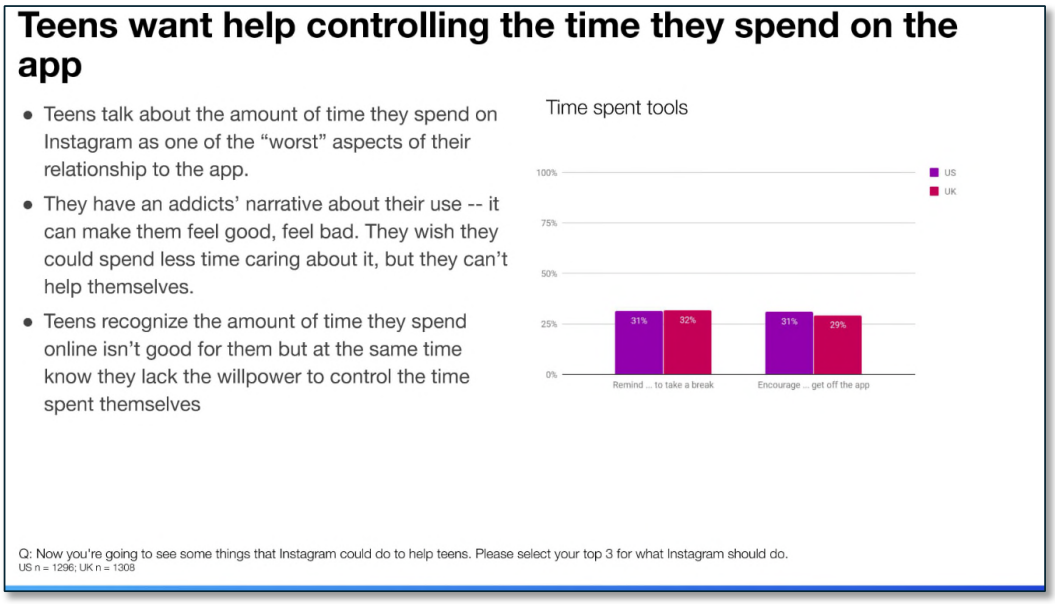
[177] Moira Burke Dep. Tr. at 143:1-4
[178] Haugen_00001033, -1033

Dan Zigmond (Sr. Director of Data Science and Engineering) goes further in 2018 when he poses what he deems a "blasphemous" question: "Is ranking good?"[179] He is apparently referring to the algorithm that determines the sequence of posts on a user's feed. He goes on to write, "The experimental and experiential data in support of ranking is extensive and nearly universal. When we switch a random set of cues to a pure chronologically News Feed, their usage and engagement immediately drops."[180]

This both demonstrates and acknowledges that algorithms are designed to promote and sustain engagement. He goes on to say, "**If we abruptly stopped ranking News Feed Tomorrow, the results would be disastrous for the company by most metrics we care about.**[181] But the design features that maximized engagement were not limited to the news feed alone. In his deposition George Volichenko (Software Engineer) refers to "engagement triggers" and lists as an example a red dot over the app icon on the home screen with a number of notifications.[182]

Even as they actively worked to maximize teen engagement, Facebook's internal documents evince that teens want help managing their time on the app:

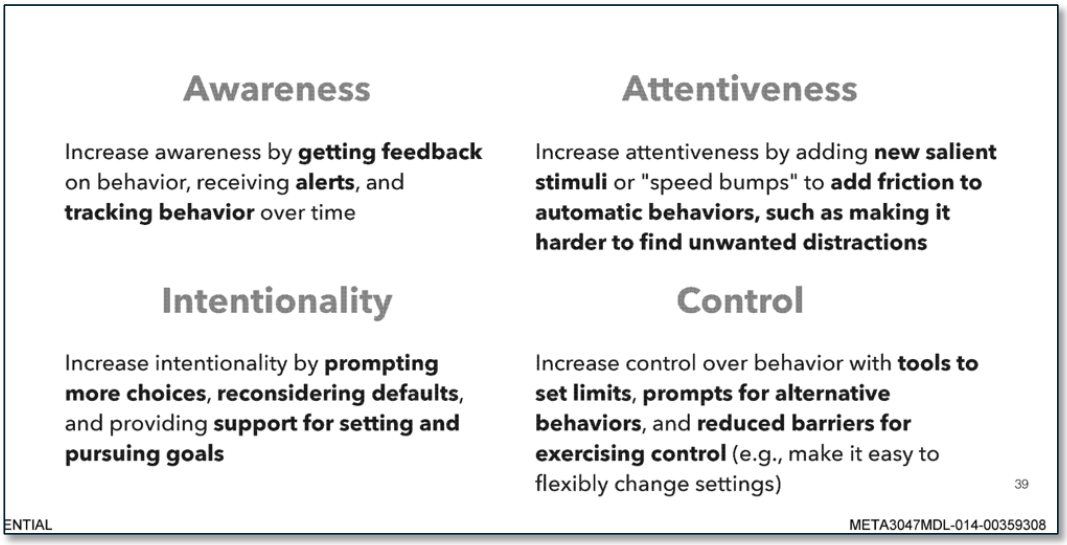
[179] Haugen_00002372, -2372
[180] Haugen_00002372, -2374
[181] Haugen_00002372, -2386d
[182] George Volichenko Deposition Tr. at 131:13-24



Document 52: META3047MDL-003-00109173, -9221

In fact, in 2018, Meta acknowledged that "we can make changes to Facebook so it has less potential to be habit-forming and provide support for people to "break" Facebook "habits" they don't want."[183] Further, the document goes so far as to propose changes in four areas:

[183] META3047MDL-014-00359270, -9307



Document 53: META3047MDL-014-00359270, -9308

A 2018 email from Margaret Stewart VP of Product Design at Facebook states:

> I expect the team has already explored this, but have be thought about ways to allow people to limit their time per day on our products? I know this sounds a bit extreme, but if we were to be able to set a budget of time and then be notified when we go over it (similar to ways people manage their food intake), that would go among way in terms of giving people a sense of control. When I first saw mention of the 'time out" feature we launched, I thought that's what it was going to be 😊

Document 54: META3047MDL-014-00071620, -1621

Kang-Xing in his deposition addressing the "mechanics" of news feed and their role in "problematic use," was asked explicitly about steps Facebook took to address it:

> Q: And you're basically saying -- I mean, at a high level, just to explain this in layman's terms for the jury, I mean, you're saying there's a lot of work to be done to get where we need to be on problematic use. I mean, isn't that what this is Page 443 trying to communicate at the bottom of page 1?
>
> THE WITNESS: "I think at a high level, yes, although I think the "where we need to be" definition is one that there probably wasn't broad alignment on either within the company or outside. So I think different people may, like, have different opinions on that.
>
> Q" But, really, by any measure -- wherever that ultimate endpoint was, by any measure, Meta had a lot of work to do to make progress on this issue; right?

THE WITNESS: It was my opinion that there was a meaningful amount of work that still needed to be done in this area, yes.

Q: Was that an informed opinion?

THE WITNESS: It was informed based on the context that I had, yes.

Document 55: Kang-Xing deposition p. 442:21-443:22

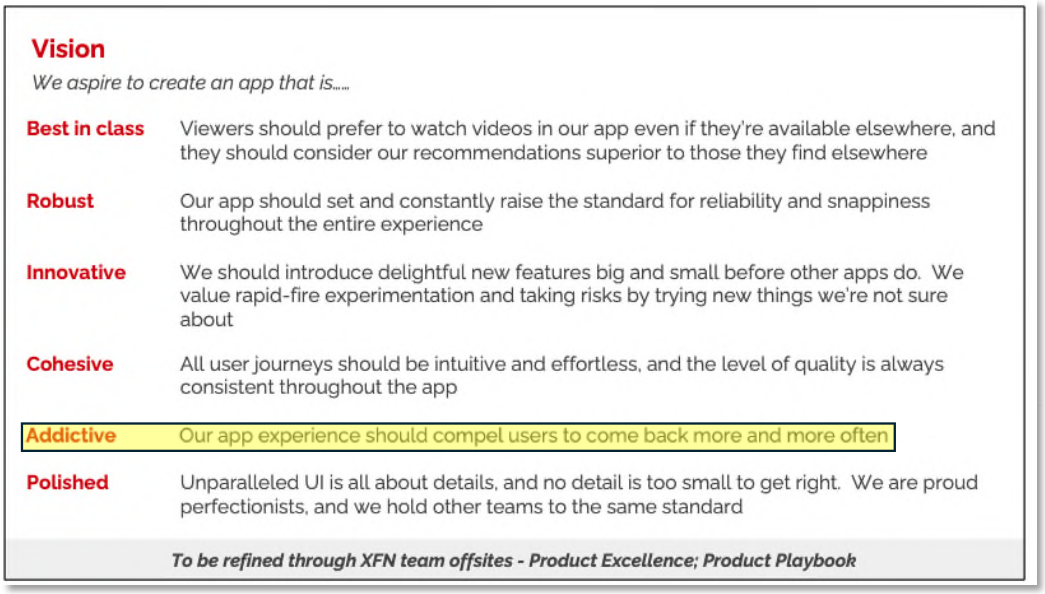
YouTube documents also provided evidence of problematic usage by virtue of design. YouTube's 2019 Strategy offsite includes the following observations about their usage and app features:

- Home and Watch Next are by far the biggest feeds on the platform, generating more than 75% (46% Watch Next, 30% Home) of feed content impressions on mobile. The next largest "feed" is Search, with 11% of impressions.
- Direct Response ads are our fastest growing, least budget constrained business. DR ads should be a focus and the DR Ads paper highlights how we will grow demand and evolve our formats and quality. We recently launched video ads throughout the home feed and will launch more demand into these slots over the next 2 quarters.
- Watch Next and comments compete directly for user attention in their current, adjacent configuration on mobile. This produces a zero-sum trade-off for user attention. We've historically viewed watch time & Community as similarly important priorities, which has constrained Watch Next to only 16 videos.
- Inline Playback in the Home feed experiments were metrics negative when they focused on shifting watch time to the feed (in 2015). Our current approach, which is metrics positive, provides a preview experience designed to bring users to the watch page, with an emerging secondary use case of watching videos with captions "on the go".

Document 56: GOOG-3047MDL-00937887, -7898

All of these point to design elements that promote increased time on the platform.

As for YouTube, a February 4th, 2016, presentation included the following "Vision" slide for the app that was then still early in development:



Vision

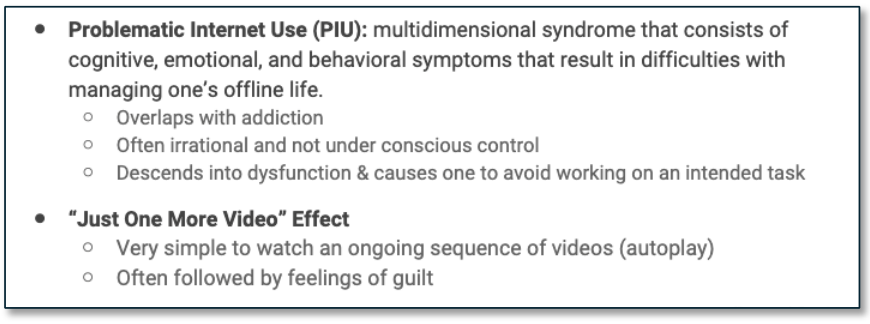
We aspire to create an app that is…..

Best in class	Viewers should prefer to watch videos in our app even if they're available elsewhere, and they should consider our recommendations superior to those they find elsewhere
Robust	Our app should set and constantly raise the standard for reliability and snappiness throughout the entire experience
Innovative	We should introduce delightful new features big and small before other apps do. We value rapid-fire experimentation and taking risks by trying new things we're not sure about
Cohesive	All user journeys should be intuitive and effortless, and the level of quality is always consistent throughout the app
Addictive	Our app experience should compel users to come back more and more often
Polished	Unparalleled UI is all about details, and no detail is too small to get right. We are proud perfectionists, and we hold other teams to the same standard

To be refined through XFN team offsites - Product Excellence; Product Playbook

Document 57:GOOG-3047MDL-00767071 at Slide 11

As seen above (highlighting added), making the app "addictive" was a core design feature. This was consistent with the aspiration articulated in slide 51 of the same presentation of "Building the world's most powerful and delightful video consumption experience." YouTube internally acknowledged the potential negative effects of digital videos in a 2018 presentation entitled "Literature Review: Effects of watching digital videos and viewer well-being" by [redacted] (User Experience Researcher). Below is a screen capture from later in that presentation:



- **Problematic Internet Use (PIU):** multidimensional syndrome that consists of cognitive, emotional, and behavioral symptoms that result in difficulties with managing one's offline life.
  - Overlaps with addiction
  - Often irrational and not under conscious control
  - Descends into dysfunction & causes one to avoid working on an intended task
- **"Just One More Video" Effect**
  - Very simple to watch an ongoing sequence of videos (autoplay)
  - Often followed by feelings of guilt

Document 58: GOOG-3047MDL-00874191 at Slide 8

The slide calls out problematic internet use and states that it overlaps with "addiction" consistent with my belief that the entire continuum to the right of casual use (Figure 20) can be viewed as problematic. Furthermore, it highlights how "autoplay," a key feature of YouTube, drives the "just one more video effect." Slide 10 summarizes data from an internal survey of "265 respondents" that calls out the "stickiness" of the app and states that its interactivity and notifications "causes users to feel that they must be aware of what is happening on the platform" which "keeps users on the platform longer."[184]

The sampling frame and methodology of this survey are not evident from the documents provided to me, but it is not material since the slide presents the findings as if they are conclusive, or at least sufficiently robust to take as factual. The same survey yielded the findings noted below. While cat videos can create a more positive mood, "it is difficult to stop watching the videos."

[184] GOOG-3047MDL-00874191 at Slide 10

Document 59: GOOG-3047MDL-00874191 at Slide 11

There is something else that is notable in this slide: "videos are used for quick mood management." In other words, people bring an affect to their search: angst, sadness, depression; or conversely happiness, enthusiasm, excitement. The point is that the content is tailored to the pre-morbid mood and driven by the platform's algorithms. This is a fundamental way in which YouTube is different from other, "pre-internet" or "analogue" viewing experiences (TV, Cable, VHS/DVD) where options were infinitely more limited and not "auto played" based on one's mood and prior preferences. Slide 14 of the presentation acknowledges these saliant differences while acknowledging that "notifications are a critical part of YouTube and contribute to addiction." (see below).

Document 60: GOOG-3047MDL-00874191 at Slide 14

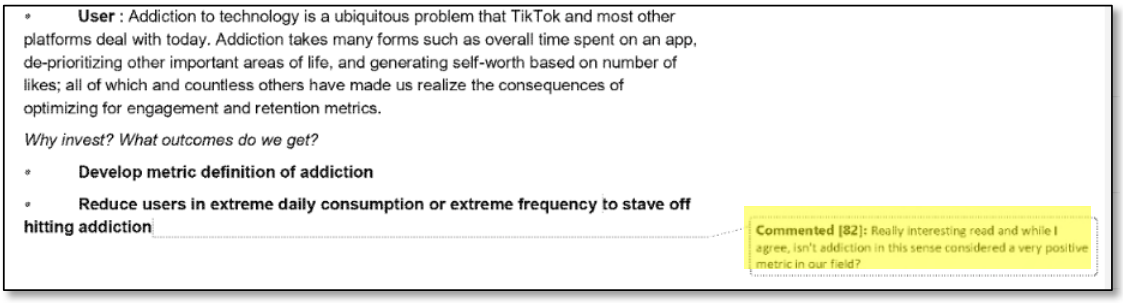
TikTok's engagement algorithm is frequently viewed as the most effective in the industry: "more personalized," "more accurate," and "more diversified." They emphasize its effectiveness in their marketing presentations and tout that >53% of suggested videos are "viewed."[185]

An internal memo citing the company's "vulnerabilities" reports: "In a user survey of 2,300 users in February of 2020, when respondents were asked to give a score of 5 to indicate strength of agreement with the statement 'I spend too much time on TikTok, the average response was a 4.0."[186] It goes on to say, "some elements of persuasive design may be unique to TikTok; for instance, the fact that when you click the back button on your phone to leave the For You Feed/all, you get a prompt saying, 'Tap again to exit,' which can be seen as increasing friction for users

[185] TIKTOK3047MDL-004-00314472, -4483
[186] TIKTOK3047MDL-002-00100441, -0452

seeking to leave the app."[187] And still later concedes, "TikTok is particularly popular with younger users, who are seen as more vulnerable to online harms and the negative impacts of compulsive use."[188]

In a "2021 TikTok for Good Business Plan and Vision" document, the following is stated:



Document 61: TIKTOK3047MDL-005-00325851, -5862 (emphasis added)

Notably, the plan acknowledges that "addiction to technology is a ubiquitous problem." At the same time, comment [82] notes that "addiction" could be "considered a very positive metric in our field." In other words, for all of its public posturing seeking to discredit or minimize the existence of compulsive or addictive use of screens, internal documents acknowledge its existence and even allude to its "value" to the industry.

TikTok's algorithms are widely considered the "best in the industry" because of their effectiveness at driving engagement. They lay out their business case quite simply:

Document 62:TIKTOK3047MDL-004-00290146, -0146

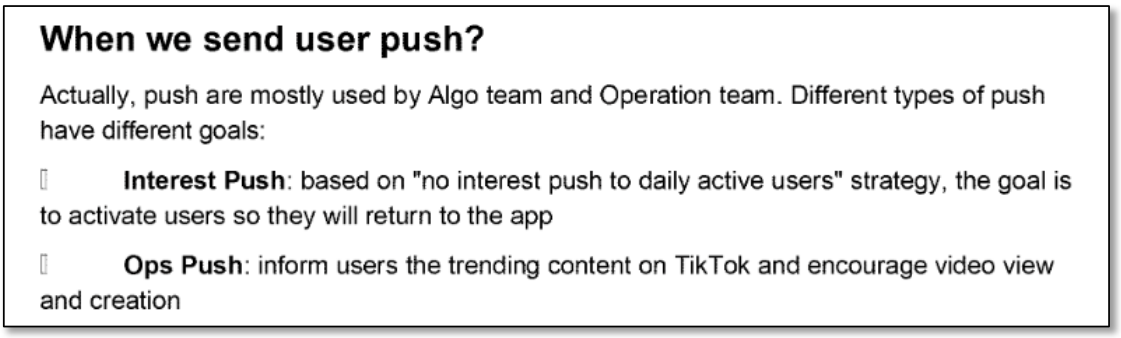
[187] TIKTOK3047MDL-002-00100441, -0452
[188] TIKTOK3047MDL-002-00100441, -0452

In pursuit of that end, they made leaving the app more difficult than others:

> This is an issue common for many platforms. However, some elements of persuasive design may be unique to TikTok; for instance, the fact that when you click the back button on your phone to leave the For You feed/app, you get a prompt saying, 'Tap again to exit,' which can be seen as increasing friction for users seeking to leave the app.

Document 63: TIKTOK3047MDL-060-01158658, -8668

And for those times when people did succeed in leaving, they refined their "push" approach to, among other things, get people back onto their app:



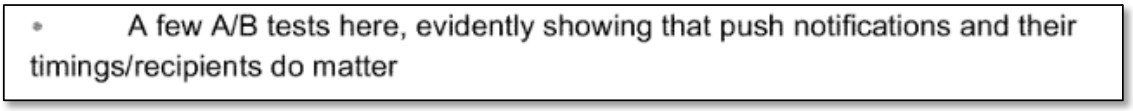
When we send user push?

Actually, push are mostly used by Algo team and Operation team. Different types of push have different goals:

- **Interest Push**: based on "no interest push to daily active users" strategy, the goal is to activate users so they will return to the app
- **Ops Push**: inform users the trending content on TikTok and encourage video view and creation

Document 64: TIKTOK3047MDL-004-00291835, -1835

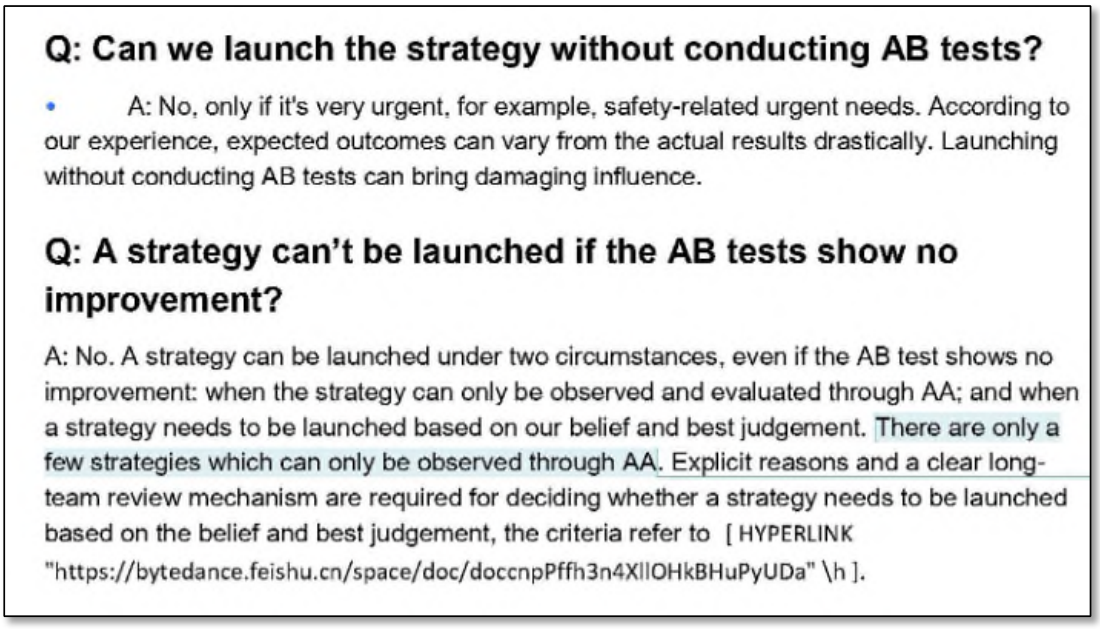
And their "push methodology", like every change they make to their platform, was apparently subjected to A/B testing where rapid cycle experiments were performed comparing one version to another and users are randomized to experience each version (i.e. no confounding) and with an eye to ensuring that core metrics were not adversely affected.



- A few A/B tests here, evidently showing that push notifications and their timings/recipients do matter

Document 65: TIKTOK3047MDL-004-00290146, -0149

One can infer from this statement that they tested not just the notifications, but the timings and the characteristics of the recipients. In fact, TikTok is firmly grounded in the idea that every strategic change to their platform should be tested against that metric:



Q: Can we launch the strategy without conducting AB tests?

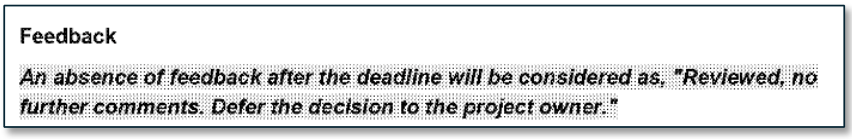
- A: No, only if it's very urgent, for example, safety-related urgent needs. According to our experience, expected outcomes can vary from the actual results drastically. Launching without conducting AB tests can bring damaging influence.

Q: A strategy can't be launched if the AB tests show no improvement?

A: No. A strategy can be launched under two circumstances, even if the AB test shows no improvement: when the strategy can only be observed and evaluated through AA; and when a strategy needs to be launched based on our belief and best judgement. There are only a few strategies which can only be observed through AA. Explicit reasons and a clear long-team review mechanism are required for deciding whether a strategy needs to be launched based on the belief and best judgement, the criteria refer to [HYPERLINK "https://bytedance.feishu.cn/space/doc/doccnpPffh3n4XlIOHkBHuPyUDa" \h].

Document 66: TIKTOK3047MDL-004-00139811, -9822 (emphasis in original)

While focused on the bottom line and rigorous evaluation of changes, the pace of modifications appears to be quite brisk. A frequent phrase, peppered throughout TikTok shared documents is:



Feedback

An absence of feedback after the deadline will be considered as, "Reviewed, no further comments. Defer the decision to the project owner."

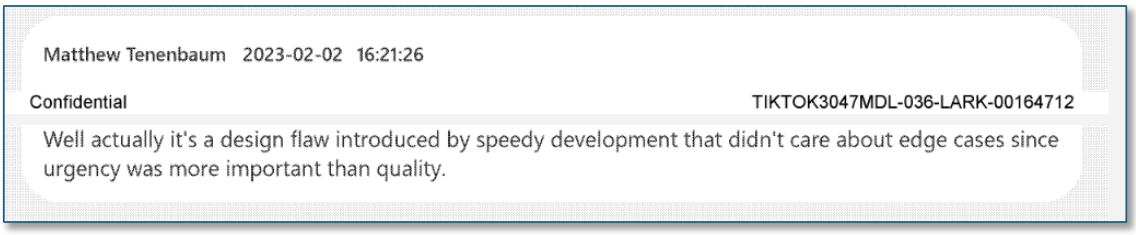
Document 67: TIKTOK3047MDL-015-00341931, -1934

This "presumptive approval" approach facilitates keeping modifications adherent to deadlines by assuming no response is assent or agreement. And similarly, the culture at Meta was driven by the "move fast and break things."[189] While the company ethos was designed to enable engagement innovations to move quickly, safety features were held to a different standard.

[189] Vaishnavi Jayakumar Dep. Tr. at 37:7-10

Jayakumar, the youth safety policy lead for Insta, goes on to say in her deposition that "we had to be very mindful of any impact that it [safety recommendation] might have on growth, and really demonstrate that we were mitigating any potential impact to growth as much as possible."[190]

Simply stated, the approach driving SM companies is fundamentally orthogonal to one that prioritizes safety. In fact, a culture of safety is predicated on verbal affirmation not on tacit or implied agreement. Pilots wait to hear their co-pilots read back their settings; surgeons have checklists they read out and wait to have them confirmed before cutting anything. Similarly, "breaking things" is not a safety motto. It is not surprising then that when reacting to the development of TikTok now, Mathew Tenenbaum (Senior Product Manager) says:

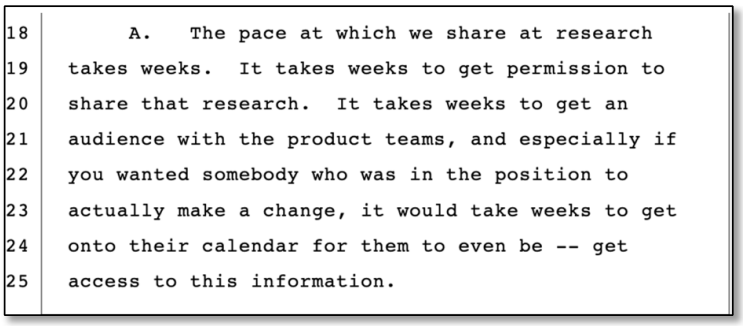

Matthew Tenenbaum 2023-02-02 16:21:26

Confidential TIKTOK3047MDL-036-LARK-00164712

Well actually it's a design flaw introduced by speedy development that didn't care about edge cases since urgency was more important than quality.

Document 68: TIKTOK3047MDL-036-LARK-00164712, 4712-13

In contrast to the breakneck speed at which tech innovations proceed at Meta, "integrity" and "safety" research is on a different track. Dr Lee in her deposition states:


A. The pace at which we share at research takes weeks. It takes weeks to get permission to share that research. It takes weeks to get an audience with the product teams, and especially if you wanted somebody who was in the position to actually make a change, it would take weeks to get onto their calendar for them to even be -- get access to this information.

Document 69: Alison Lee Dep. Tr. at 94:18-25

[190] Vaishnavi Jayakumar Deposition Tr. at 30:6-11

In fact, after the Haugen leak to the *Wall Street Journal*, all research was paused for a period of three months and then was subjected to "comms leadership" review.[191] The net effect of fast-paced rollouts and slow-paced integrity research is a vehicle with a gas pedal an no brakes and it predictably leads to safety problems. An Insta presentation from Dr Lee had the following slide:

Document 70: Alison Lee Deposition Exhibit 4 at Slide 5

In H2, they launched over 200 products with 30+ regressions.[192] If each integrity regression is treated as a safety defect, this would yield a defect rate of approximately 17% which would be shockingly high for any consumer industry that typically sets defect standards between 1 in 100K to 1 in 1 million. For software defects that reach consumers, I could not find clear benchmarks although the Tability blog lists a change failure rate of 10-20% as average and best in class as less than 5%.[193] But Dr Lee in a October 2021 chat reports her "dismay" that Mosseri's responded to a question about additional resources for integrity by saying that they were "doing enough" and then asking "how much is enough to invest into integrity?".[194]

For its part, Snap innovated the concept of "the streak" which it specifically designed to gamify its platform and drive usage and engagement. Streaks are built and maintained by two

[191] Alison Lee Dep. Tr. at 117:22-25; *see also* Alison Lee Dep. Exhibit 8 at -8879
[192] Alison Lee Dep. Exhibit 5 at Slide 6
[193] *The 10 Best Metrics For Software Quality*, TABILITY, https://www.tability.io/templates/m/X4kB_LA75HWq (last accessed Apr. 16, 2025)
[194] Alison Lee Dep. Exhibit 12 at -1435

people "snapping" back and forth on consecutive days. The quality or content of the snap is irrelevant—it's all about ping-ponging back and forth consistently. Streaks were extraordinarily effective. Less than a year after they were launched, 22% of users had at least one streak, and the average highest streak value was 76.[195] Snapstreaks were also particularly popular with younger users. 47% Snapstreak users were under 17.[196] (The true number was likely even higher, given how easy Snap made it for children to lie about their age. *Infra* XII.P.iv.)

But at the same time that Snap was chasing the engagement increases offered by streaks, worries about the addictive effect of Streaks on children were growing. For example, focus groups results forwarded by Rachel Racusen (Sr. Director of Corporate Communications and Public Affair)" to Jennifer Stout (VP of Global Public Policy) found the following.

But at the same time that Snap was chasing the engagement increases offered by streaks, worries about the addictive effect of Streaks on children were growing. For example, focus groups results forwarded by Rachel Racusen (Sr. Director of Corporate Communications and Public Affair)" to Jennifer Stout (VP of Global Public Policy) found the following:

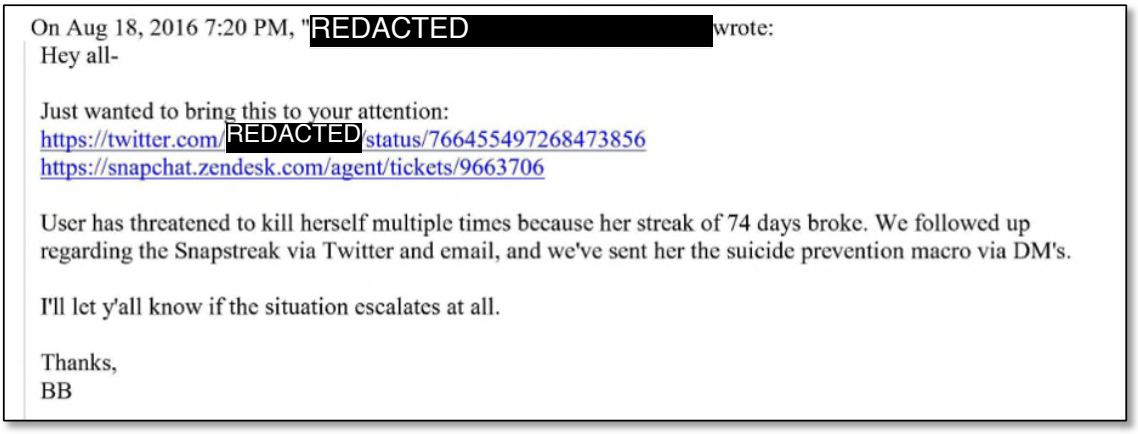
- While not raised with the same level of concern as ephemerality and Snap Map, Snap Streaks are also mentioned as a feature that compounds parents' displeasure with their teens using the app.
- Snap Streaks are viewed as furthering the already strong grasp that technology broadly, and Snapchat specifically, has on their teen's focus and attention.
- Parents often mention their teens' seemingly uncontrollable need to "keep their streaks alive" associating the practice with ceaseless online communication and screen addiction.

Document 71: SNAP1251784, -1784

Another employee put it even more bluntly: "we seem to have tapped into some mass psychosis were 17 million people ***must*** keep the streaks going.[197]

[195] SNAP6759344, -9344
[196] SNAP6759344, -9344
[197] SNAP6759344, -9344 (emphasis in original)

There was also desperate outreach from individual users:



On Aug 18, 2016 7:20 PM, "REDACTED wrote:
Hey all-

Just wanted to bring this to your attention:
https://twitter.com/REDACTED/status/766455497268473856
https://snapchat.zendesk.com/agent/tickets/9663706

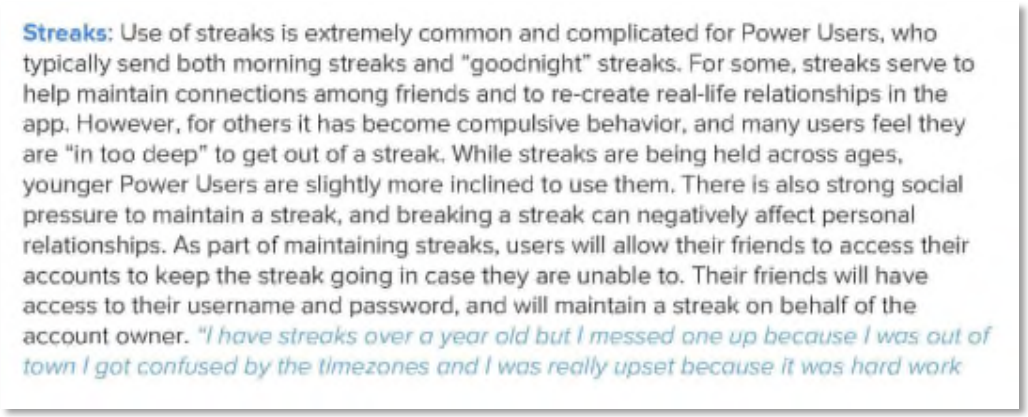
User has threatened to kill herself multiple times because her streak of 74 days broke. We followed up regarding the Snapstreak via Twitter and email, and we've sent her the suicide prevention macro via DM's.

I'll let y'all know if the situation escalates at all.

Thanks,
BB

Document 72:SNAP0857671, -7671

A 2017 study of Snap "Power Users," commissioned by Snap to better understand features that drove usage, found that "For some, streaks have become a "compulsive behavior" that they are "in too deep" with."[198]



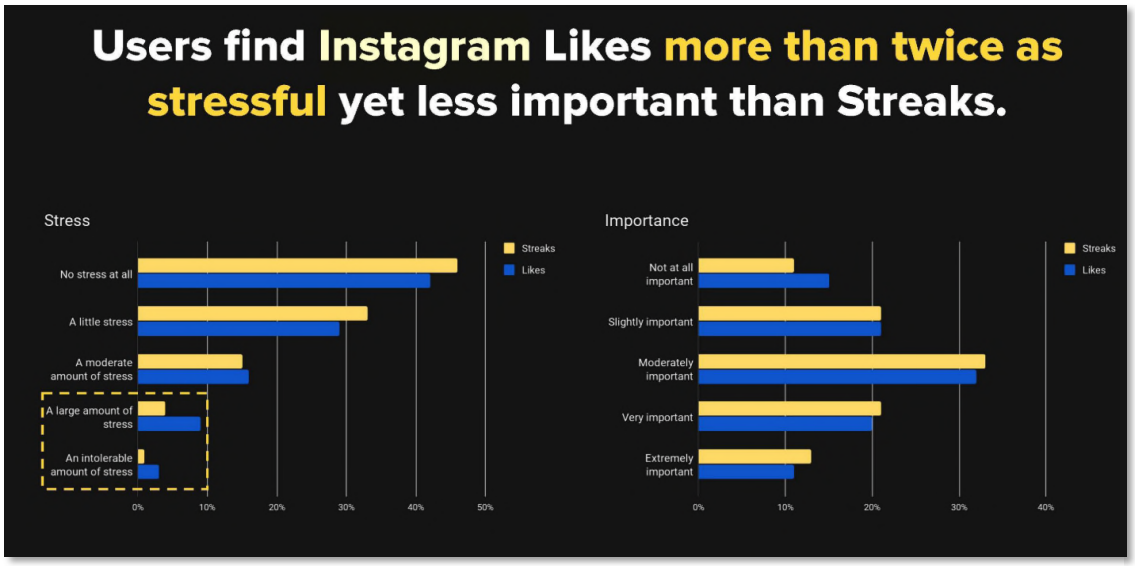
Streaks: Use of streaks is extremely common and complicated for Power Users, who typically send both morning streaks and "goodnight" streaks. For some, streaks serve to help maintain connections among friends and to re-create real-life relationships in the app. However, for others it has become compulsive behavior, and many users feel they are "in too deep" to get out of a streak. While streaks are being held across ages, younger Power Users are slightly more inclined to use them. There is also strong social pressure to maintain a streak, and breaking a streak can negatively affect personal relationships. As part of maintaining streaks, users will allow their friends to access their accounts to keep the streak going in case they are unable to. Their friends will have access to their username and password, and will maintain a streak on behalf of the account owner. *"I have streaks over a year old but I messed one up because I was out of town I got confused by the timezones and I was really upset because it was hard work*

Document 73: SNAP0666370, -6374

[198] SNAP0029949, -9959

Similarly, an internal presentation on streaks tried to spin them as a positive tool for building friendships, but nonetheless was forced to observe that Streaks can be "really stressful" and "makes it impossible to unplug for even a day."[199]

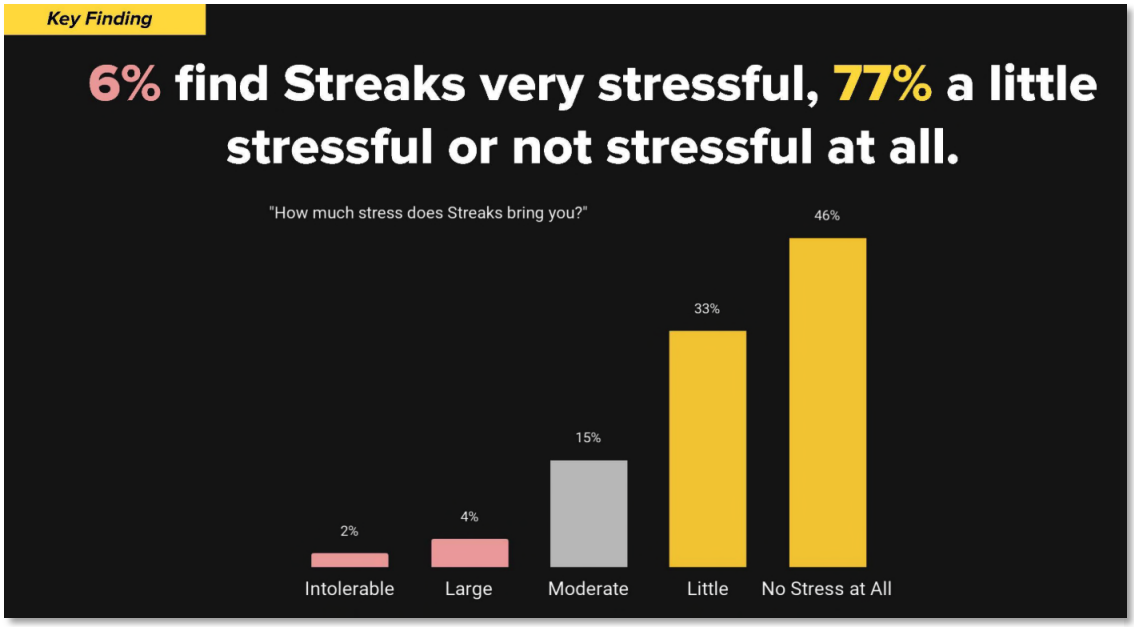
To better assess the harms of streaks, in 2018 Snap commissioned a survey of 790 13–24-year-old users (its core demographic).



Document 74:SNAP2183204, -3231

In Snap's telling, this study showed that that only a minimal number of users found streaks stressful.

[199] SNAP2183204, -3272



Document 75: SNAP2183204, -3234

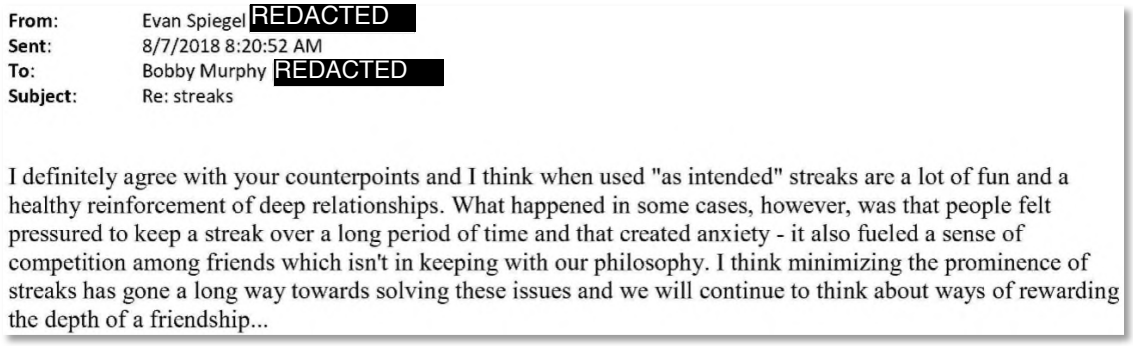
Snap presented this same conclusion to the United States Senate, writing that the study showed "the majority of our community did not indicate Streaks were a significant source of stress—but six percent did."[200]

However, both the methodology and Snap's spin on the results were deeply flawed. Given Snap's millions of users, 6% still represents hundreds of thousands if not millions of users. And to get to 6%, Snap disregarded the "moderate" stress responses entirely. Snap also, without justification, combined those who found streaks a little stressful with those who found they caused no stress at all. A more accurate assessment of stress levels might be that 21% of users experience at least moderate stress because of snaps. A more holistic statement of the survey's results would be that 54% of streak users found streaks at least a little stressful. The other problem with sampling "users" to assess experiential stress is what in epidemiological terms is called the "survivor effect."

[200] SNAP0008117, -8119

Many people who found streaks intolerably stressful will have left the platform or opt not participate in a study about how stressful they are. In other words, this approach leads to a biased sample. Much like asking people still in a baseball stadium when the game has gone into 13 innings if games take too long will underestimate the true proportion of fans who think they do, asking regular users of an app how stressful it is underestimates the unease it induces. The study also depended on self-reporting from young people. But as Jennifer Stout, Snap's Global Vice President for Public Policy, pointed out "Kids like a lot of dumb things and parents are always trying to regulate their activities for their own safety!"[201]

Snap's spin on the 2018 study is further undermined by the fact that Snap employees, including Spiegel, continued to express concern that streaks were addictive and harmful for users.



From: Evan Spiegel [redacted]
Sent: 8/7/2018 8:20:52 AM
To: Bobby Murphy [redacted]
Subject: Re: streaks

I definitely agree with your counterpoints and I think when used "as intended" streaks are a lot of fun and a healthy reinforcement of deep relationships. What happened in some cases, however, was that people felt pressured to keep a streak over a long period of time and that created anxiety - it also fueled a sense of competition among friends which isn't in keeping with our philosophy. I think minimizing the prominence of streaks has gone a long way towards solving these issues and we will continue to think about ways of rewarding the depth of a friendship...

Document 76: SNAP0892766, -2766

Along similar lines, in 2019, Josh Siegel, a Product Manager whose work included Streaks, sent the following email to two other senior Snap employees:

[201] SNAP1251784, -1784

> The general product stance on Streaks is that we don't love them (it was an accidentally addictive, somewhat unhealthy feature that gamifies friendships in a weird way), but they're too delicate to touch right now. 50M+ users have streaks, a few million probably only use the app for streaks. We definitely don't want to invest in or exacerbate the problem right now, but I'm hoping it's something we can get to in 2019 via other ways to encourage daily behaviors.

Document 77: SNAP4389271, -9271

A 2023 document containing suggested answers for an employee Q&A with Speigel is clear that Streaks "can cause confusion and/or anxiety. We know this from the millions of support tickets we get every week from people asking us to restore a streak they accidentally lost."[202]

Users themselves make clear that they found streaks addictive. As the Q&A answer explained, users' frantic commitment to streaks could be tracked in part by tickets seeking to restore lost streaks.[203] But the answer actually understated how desperate users were to have their streaks restored. By 2021, Snap was receiving an average of four hundred thousand streak restore requests *a day*, making up 95% of the total volume of customer service contacts.[204] In some cases, individual users reach out directly to Spiegel to express the harms of streaks.

[202] SNAP1197331
[203] SNAP1197331
[204] SNAP0006256, -6256

From: Redacted--PII
Date: Sun, Jun 5, 2022 at 3:20 PM
Subject: Snapstreaks
To: REDACTED

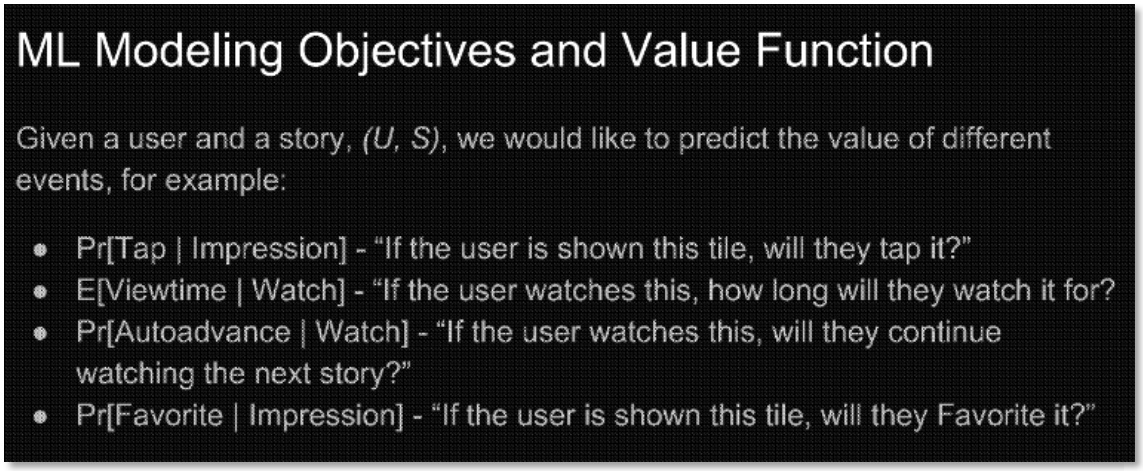
Hi Evan,

I am sorry for this direct email, but I wanted to ask you to consider some changes to Snapstreaks or just make you aware of the influence that this feature has on a generation of kids including my children.
Snapchat is a great social media platform and a communication channel for millions of groups and individuals. I know how fun it is to use the different filters and other interactive features and how my children love reading new stories and snap with their friends. I am thankful for the fact that snaps are not stored but disappear after 10s (although this provides protection and risk at the same time), and I understand that this channel is growing stronger by the day. I have been leading IT teams for over 20 years, and I am still developing new applications, games and services to this day and I know how every feature is being tested and considered before going live.

The issue that we have as parents with the Snapstreaks feature, is the effect it has on the mental health of our children. Similar to what happened with 'likes' on Facebook, the anxiety of missing a streak means that millions of young kids feel that they 'must' login every day, even if for one minute, so they won't disappoint their friends. I have personally witnessed the distress and fearfulness and I am sure that this was not the intention of this feature although this is the reality.

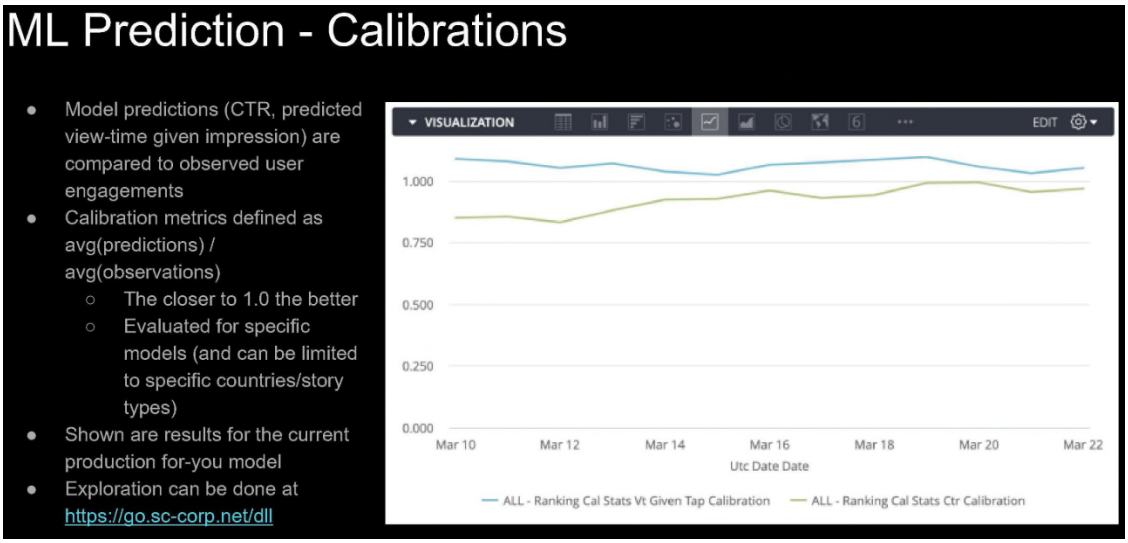
Document 78: SNAP1152337, -2337

Snap's engagement strategy was not limited to streaks. It also conducted internal research to predict and maximize time on the app. The slides below show how they designed algorithms to predict and prioritize the likelihood of specific user behaviors:



Document 79: SNAP0224369, -4381

Document 80: SNAP0224369, -4382

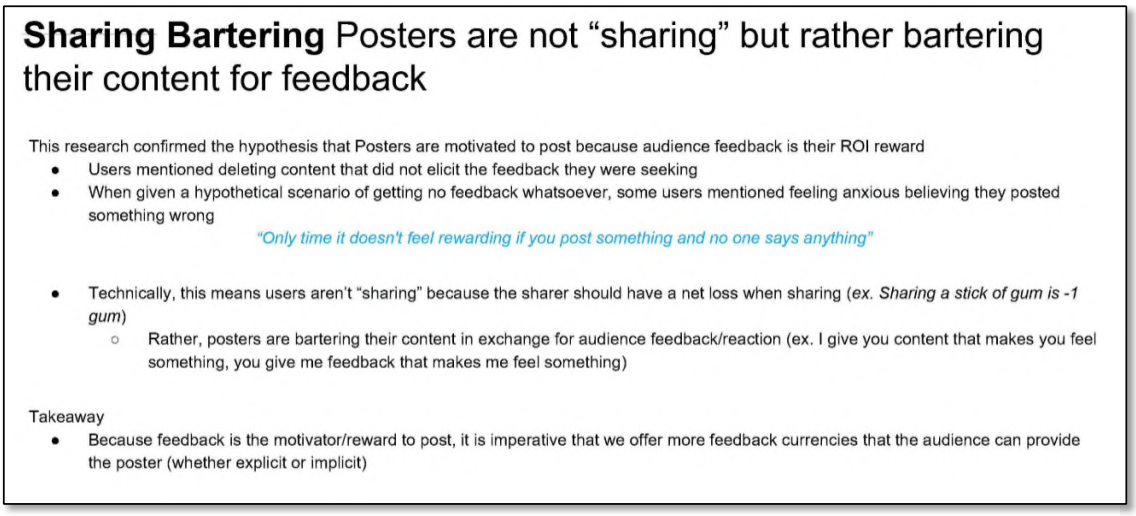


Document 81: SNAP0224369, -4385

Tests showed that algorithmic ranking significantly increased both the numbers of stories viewed and the time spent viewing stories relative to just ordering them at random.[205]

[205] SNAP0224369, -4373

Snap also explicitly embraced the idea that social rewards were key to keeping users coming back for more, conducting research that "confirmed the hypothesis that Posters are motivated to post because audience feedback is their ROI reward."[206]



Sharing Bartering Posters are not "sharing" but rather bartering their content for feedback

This research confirmed the hypothesis that Posters are motivated to post because audience feedback is their ROI reward

- Users mentioned deleting content that did not elicit the feedback they were seeking
- When given a hypothetical scenario of getting no feedback whatsoever, some users mentioned feeling anxious believing they posted something wrong

"Only time it doesn't feel rewarding if you post something and no one says anything"

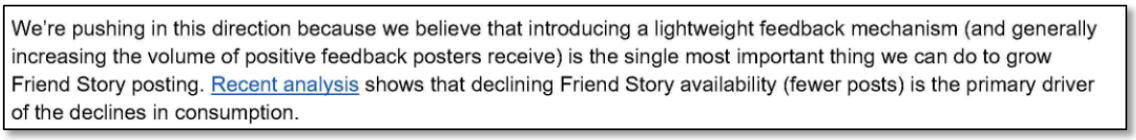
- Technically, this means users aren't "sharing" because the sharer should have a net loss when sharing (*ex. Sharing a stick of gum is -1 gum*)
  - Rather, posters are bartering their content in exchange for audience feedback/reaction (ex. I give you content that makes you feel something, you give me feedback that makes me feel something)

Takeaway

- Because feedback is the motivator/reward to post, it is imperative that we offer more feedback currencies that the audience can provide the poster (whether explicit or implicit)

Document 82: SNAP4301491, -1500

Indeed, Snap's research "confirmed the *causal* relationship between receiving feedback (views and replies) and the poster propensity to post again."[207] Following these conclusions, Snap's product team proposed tweaking "Story reactions" and replies to generate more engagement and posting.



We're pushing in this direction because we believe that introducing a lightweight feedback mechanism (and generally increasing the volume of positive feedback posters receive) is the single most important thing we can do to grow Friend Story posting. Recent analysis shows that declining Friend Story availability (fewer posts) is the primary driver of the declines in consumption.

Document 83: SNAP0467577, -7577

[206] SNAP4301491, -1500
[207] SNAP0467577, -7579 (emphasis added).

And just as feedback made users feel good, Snap's user research team found that not getting feedback was "discouraging." Snap researchers found that 44% of snapchat story posters didn't receive any feedback on a given day leaving them more anxious and worse off than not having posted at all.[208]

Senior Snap employees were clear-eyed about the consequences of manipulating users' basic neurobiology and socioemotional responses. Responding to suggestions for ways to increase feedback rewards on Snapchat, CEO Evan Spiegel chimed in to say:

> What is not discussed here is the research-based evidence that these sorts of mechanics are harmful for mental health which is one of the reasons we have not enabled this for friend stories on Snapchat. Feeling like you need to post "popular" and "likeable" content can actually contribute to reduced sharing in the future as the bar for sharing becomes higher.

Document 84: SNAP0467577, -7578

Similarly, when reviewing proposed changes to the way that streaks operate, Stephen Collins, a Director of Public Policy, expressed a similar sentiment, observing that "[r]ewards are known to drive compulsive/addictive behavior among some vulnerable groups."[209] Of course, Collins's solution to this was not to reduce the role that rewards-maximizing play in Snap's design but just avoid using the word.[210]

Ultimately, every site adapted effective addictive and harmful design elements from their competitors. Below is a summary of key features and which platforms deploy them.

[208] SNAP0467577, -7577
[209] SNAP4783191, -3196.
[210] SNAP4783191, -3196 ("I wouldn't use the term 'reward'.").

Table 5: Summary of Harmful Design Features by Platform

Design Feature	Platform
Infinite scroll	TikTok, Insta, FB, YT, Snap
Streaks	Snap, TikTok
Notifications	TikTok, Insta, FB, YT, Snap
FOMO	TikTok, Insta, FB, Snap, YT
Newsfeed prioritization	TikTok, Insta, FB, YT, Snap
Reels/Short form videos	TikTok, Insta, FB, YT, Snap
Variable intermittent rewards	TikTok, Insta, FB, YT, Snap
Likes	TikTok, Insta, FB, YT, Snap
Engagement Algorithm	TikTok, Insta, FB, YT, Snap
Video autoplay	TikTok, Insta, FB, YT, Snap
Appearance Filters/Negative Social Comparison	TikTok, Insta, FB, YT, Snap

It is my opinion to a reasonable degree of medical and scientific certainty that certain design features of social media increase usage, including problematic usage and addictive behavior. These design features include engagement algorithms, beauty or appearance filters, metrics such as the like button, comments, infinite scroll, and auto-play. The medical and academic community recognize the harm that flows from the use of these features. Similarly, there are ample Defendant documents providing additional support that these features increase usage, including problematic and addictive usage.

X. Social Media and Specific Harms

I will now turn to a discussion of specific harms. Following the above framework, I will first discuss the literature regarding the relationship between social media and the harm identified. I have not cited every single study reviewed or possible, but rather focused on a synthesis of the totality of the evidence. I will then discuss exemplar internal documents that discuss that harm.

A. Body Dysmorphic Disorder

In this section, I will review the existing scientific literature supporting a causal relationship between social media use and body image and eating disorders mediated through the pathways of depression, body image, anxiety, and problematic/addictive use. As discussed before, problematic or addictive use remains relevant for these pathways as it drives additional time online (or on sites) which in turn drives the other downstream outcomes.

Body Dysmorphic Disorder (BDD) involves obsessive thoughts, repetitive behaviors, and mental acts in response to perceived appearance flaws and may focus on a particular feature of one's body (nose, hair, chin for example). The DSM-5 criteria for the diagnosis are below:

A. Preoccupation with one or more perceived defects or flaws in physical appearance that are not observable or appear slight to others.
B. At some point during the course of the disorder, the individual has performed repetitive behaviors (e.g., mirror checking, excessive grooming, skin picking, reassurance seeking) or mental acts (e.g., comparing his or her appearance with that of others) in response to the appearance concerns.
C. The preoccupation causes clinically significant distress or impairment in social, occupational or other areas of functioning.
D. The appearance preoccupation is not better explained by concerns with body fat or weight in an individual whose symptoms meet diagnostic criteria for an eating disorder.

Document 85: DSM-5 Body Dysmorphic Disorder Criteria

Eating Disorders (ED) involve disturbances in thoughts and behaviors related to eating, weight, and shape. Body Dysmorphic Disorder (BDD) and eating disorders, such as anorexia

nervosa or bulimia nervosa, share similarities in that both involve a preoccupation with appearance and a distorted self-image. Individuals with BDD focus intensely on perceived flaws in their physical appearance, often unrelated to weight, which may lead to compulsive behaviors like mirror checking or seeking cosmetic procedures. In contrast, eating disorders specifically center on weight, body shape, and food behaviors, with associated actions like extreme dieting, binge eating, or purging. While both conditions stem from deep psychological distress and can co-occur, their core focus differs: BDD is rooted in an obsession with minor or nonexistent physical imperfections, whereas eating disorders primarily involve concerns about weight and eating patterns. Both require specialized treatments, often involving therapy, to address underlying issues of self-esteem and anxiety.

Both ED and BDD cause considerable distress and dysfunction. In many cases, body dysmorphic disorder precedes the onset of eating disorder.[211] This finding suggests that body dysmorphic concerns may serve as a risk factor for the development of some eating disorders. Individuals with BDD and ED experience functional impairment in their daily lives but those with BDD often suffer more than those with ED. They have a higher rate of suicidality, including suicide ideation and suicide attempts, and more severe levels of depression.[212]

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[211] Grant JE, Phillips KA. Is anorexia nervosa a subtype of body dysmorphic disorder? Probably not, but read on. *Harv Rev Psychiatry*. Mar-Apr 2004;12(2):123-6. doi:10.1080/10673220490447236

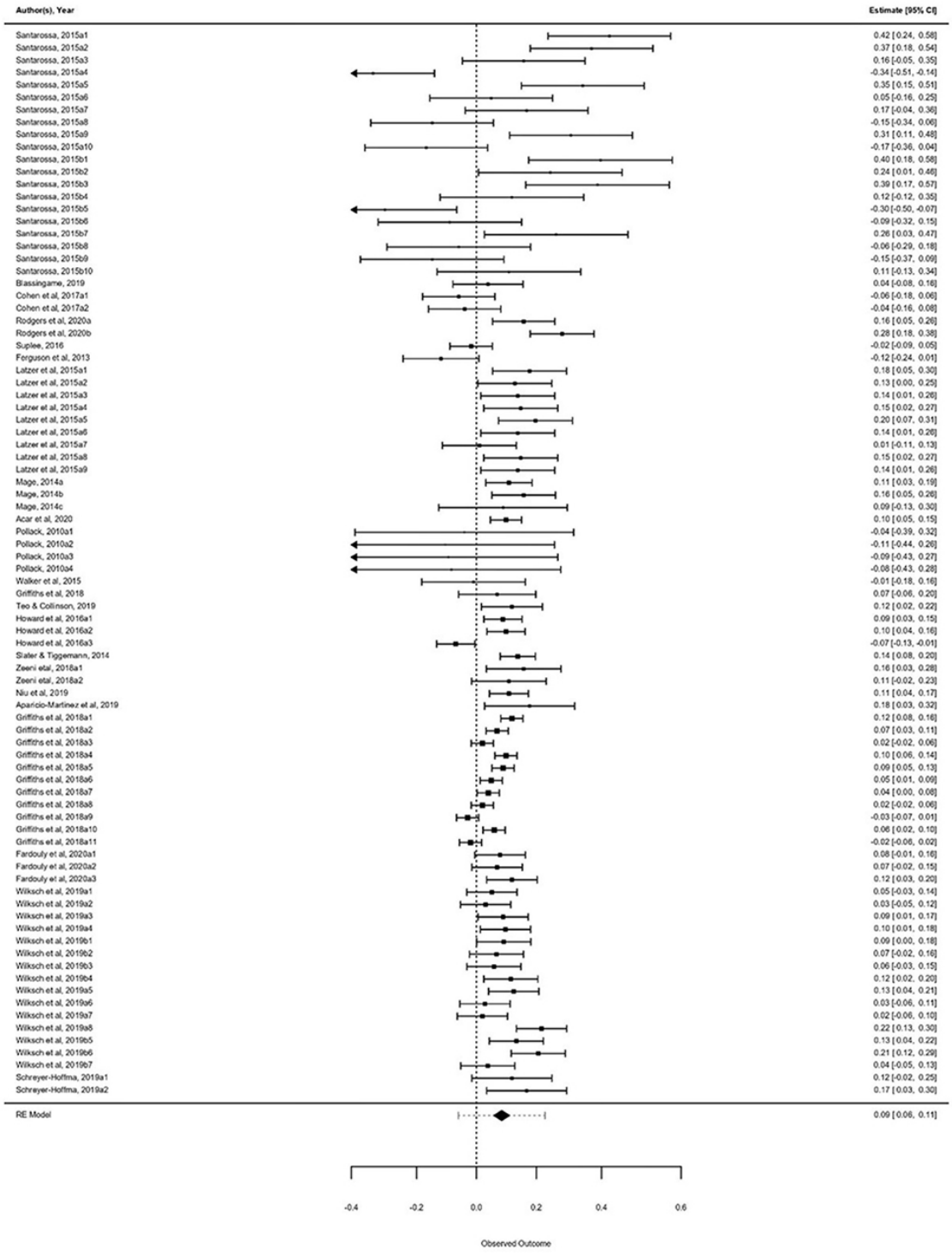
[212] *See* Krebs G, Fernández de la Cruz L, Rijsdijk FV, et al. The association between body dysmorphic symptoms and suicidality among adolescents and young adults: a genetically informative study. *Psychol Med*. May 2022;52(7):1268-1276. doi:10.1017/s0033291720002998; Fennig S, Hadas A. Suicidal behavior and depression in adolescents with eating disorders. *Nord J Psychiatry*. 2010;64(1):32-9. doi:10.3109/08039480903265751; Rief W, Buhlmann U, Wilhelm S, Borkenhagen ADA, BrÄHler E. The prevalence of body dysmorphic disorder: a population-based survey. *Psychological Medicine*. 2006;36(6):877-885. doi:10.1017/S0033291706007264

Based on DSM-5 criteria, the lifetime prevalence of eating disorders is approximately 8% in girls and women and 2% in boys and men.[213] One metanalysis estimated the prevalence of BDD at 11% but noted that there was considerable heterogeneity in the samples meaning that the estimates varied widely depending on the source population.[214] A single population-based study (using random digit dialing) in the U.S. puts the prevalence at about 4% and found it to be equally common in men and women.[21553]

Evidence suggests that social media usage can increase the risk of or exacerbate existing negative body image body dysmorphia. With respect to body image in particular, the effects are driven by the reactions one gets ("likes" or comments) to posted images of oneself. The effects can be positive or negative. Multiple studies have examined the net effects of social media and body image.

[213] Galmiche M, Déchelotte P, Lambert G, Tavolacci MP. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *The American Journal of Clinical Nutrition*. 2019/05/01/ 2019;109(5):1402-1413. doi:https://doi.org/10.1093/ajcn/nqy342
[214] McGrath LR, Oey L, McDonald S, Berle D, Wootton BM. Prevalence of body dysmorphic disorder: A systematic review and meta-analysis. *Body Image*. 2023/09/01/ 2023;46:202-211. doi:https://doi.org/10.1016/j.bodyim.2023.06.008
[215] Koran LM, Abujaoude E, Large MD, Serpe RT. The Prevalence of Body Dysmorphic Disorder in the United States Adult Population. *CNS Spectrums*. 2008;13(4):316-322. doi:10.1017/S1092852900016436

Figure 27: Metanalysis of SM and Disordered Eating Behaviors



The Figure above is from a metanalysis limited to the studies that allowed for pooling and combining data relating social media usage and body image problems. Although the figure is presented in a way that makes it too small to see the individual studies, all bars to the right of the central bar show a positive correlation between social media usage and BDD. The overall (summary) effect size was 0.11 (small).[216]

A more comprehensive systematic review of 40 studies examining the relationship between social media use and BDD found that the two are correlated.[217] The studies were too heterogenous to perform a metanalysis and derive a summary estimate. A separate metanalysis that evaluated 48 studies that experimentally manipulated social comparisons revealed a negative significant effect size of .24 (moderate) on body image wellbeing and self-esteem in spite of the heterogeneity of the included studies.[218]

An experimental manipulation of Instagram selfies conducted in 144 adolescent girls in which they were exposed to original or enhanced Instagram photos (see the figure below) found that body image and satisfaction were lower upon viewing the manipulated ones (effect size .17).[219]

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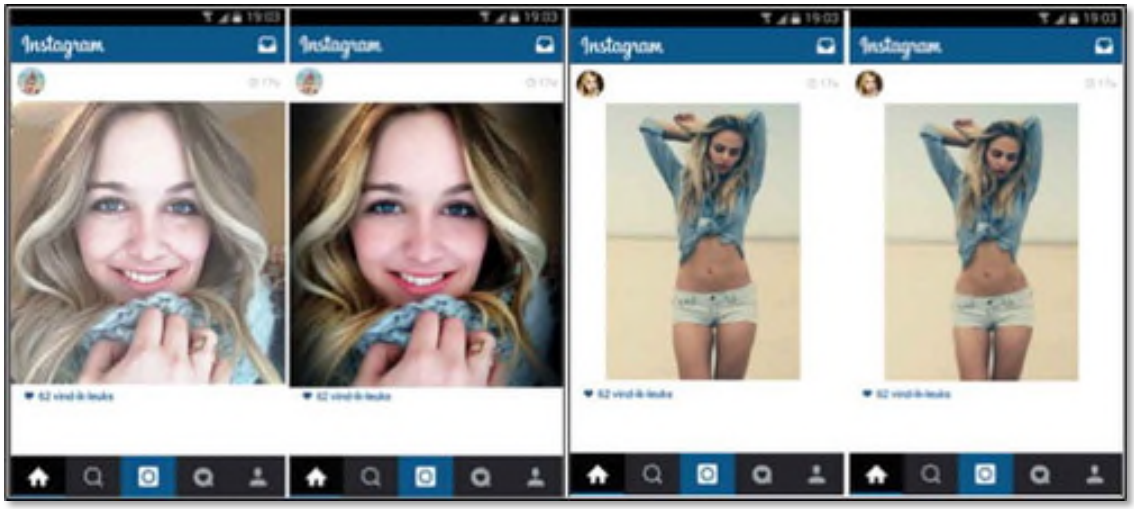
[216] Zhang J, Wang Y, Li Q, Wu C. The Relationship Between SNS Usage and Disordered Eating Behaviors: A Meta-Analysis. *Front Psychol*. 2021;12:641919. doi:10.3389/fpsyg.2021.641919

[217] Ryding FC, Kuss DJ. The use of social networking sites, body image dissatisfaction, and body dysmorphic disorder: A systematic review of psychological research. *Psychology of Popular Media*. 2020;9(4):412-435. doi:10.1037/ppm0000264

[218] McComb C, Vanman E, Tobin S. A Meta-Analysis of the Effects of Social Media Exposure to Upward Comparison Targets on Self-Evaluations and Emotions. *Media Psychology*. 2023;26(5)

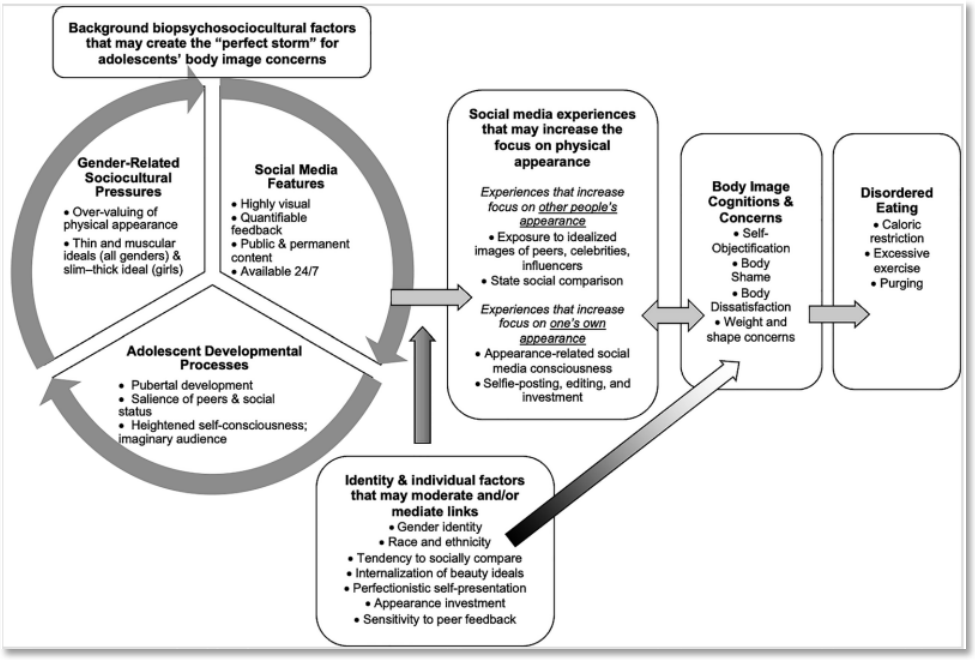
[219] Kleemans M, Daalmans S, Carbaat I, Anschütz D. Picture Perfect: The Direct Effect of Manipulated Instagram Photos on Body Image in Adolescent Girls. *Media Psychology*. 2018/01/02 2018;21(1):93-110. doi:10.1080/15213269.2016.1257392

Figure 28: Real or Enhanced Instagram Images Presented to Teen Subjects



The Handbook on Children and Screens included the following figure, which captures the relationship between social media features and the development of body image conditions and eating disorders:

Figure 29: Handbook on Children and Screens at 151



This figure, adapted from the version first published in Choukas-Bradley et. al. (2022) in Clinical Child and Family Psychology Review, indicates the perfect-storm of social media use, vulnerable adolescent development, and subsequent eating disorder and body image conditions.[220] Academics have recognized that specific features such as highly visual posts, quantifiable feedback or metrics (such as the like button), the public and permanent nature of social media, and social media's 24/7 availability all drive body image concerns. Notably, appearance and beauty filters are missing from this list, though they are recognized in the literature as contributing to body image issues and eating disorders.[221]

[220] Handbook of Children and Screens page 151.
[221] Fioravanti G, Bocci Benucci S, Ceragioli G, Casale S. How the exposure to beauty ideals on social networking sites influences body image: a systematic review of experimental studies. Adolesc Res Rev. 2022;7(3):419–58. https://doi.org/10.1007/ s40894-022-00179-4.

Internal documents reflect that Defendants studied the effect of these design features on the development of body image issues and eating disorders. For example, Margaret Gould Stewart, "Head of Responsible Innovation" at Meta, testified regarding the relationship between appearance filters and potential harms as follows: "My recollection is that the significant majority of them confirmed our hypothesis that these had the potential to be very harmful, in particular to young people, and some of them specifically called out young women." She went on to say the following:

> My recollection, and I would need to reread the documents to get specific, but that the sense of negative comparison, so how I look versus how other people look, or the naturalistic presentation of myself versus the augmented, manipulated, affected view of myself over time, would feed into anxiety, body dysmorphia, depression related to one's appearance.[222]

Her recollection is accurate. All but one of the experts that Meta consulted stated that beauty filters that simulated plastic surgery would pose significant risks of negative outcomes especially for girls.[223] Internal Meta documents assert that "Filtering leads to unrealistic beauty standards, mental health issues, and a rise in plastic surgery."[224] As discussed above, one of the mechanisms by which filters lead to adverse outcomes is through the phenomenon of social comparison. In January of 2020, Jennifer Guadagno, PhD, a lead researcher on Meta's well-being team, states that "social comparison is the most important driver of well-being."[225]

Dr. Guadagno commissioned her own independent analysis of filters, led by Dr. Diane Moscovitz, a PhD Psychologist at Duke and an expert on body image in teens. Her opinion, after reviewing the existing literature, is summarized below:

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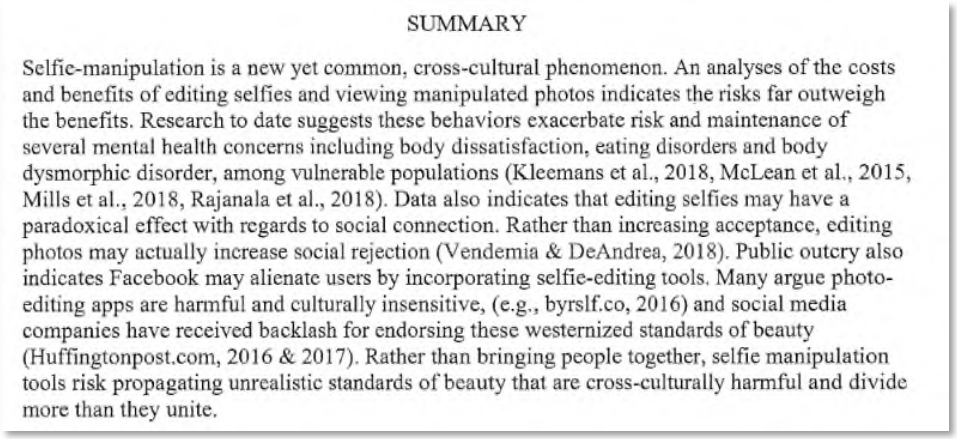
[222] Margaret Gould Stewart Deposition Transcript at 46:24-47:8
[223] Vaishnavi Jayakumar Dep. Exhibit 17 at -7136
[224] META3047MDL-020-00609936, -9937
[225] Jennifer Guadagno Deposition Exhibit 4 at -4847



SUMMARY

Selfie-manipulation is a new yet common, cross-cultural phenomenon. An analyses of the costs and benefits of editing selfies and viewing manipulated photos indicates the risks far outweigh the benefits. Research to date suggests these behaviors exacerbate risk and maintenance of several mental health concerns including body dissatisfaction, eating disorders and body dysmorphic disorder, among vulnerable populations (Kleemans et al., 2018, McLean et al., 2015, Mills et al., 2018, Rajanala et al., 2018). Data also indicates that editing selfies may have a paradoxical effect with regards to social connection. Rather than increasing acceptance, editing photos may actually increase social rejection (Vendemia & DeAndrea, 2018). Public outcry also indicates Facebook may alienate users by incorporating selfie-editing tools. Many argue photo-editing apps are harmful and culturally insensitive, (e.g., byrslf.co, 2016) and social media companies have received backlash for endorsing these westernized standards of beauty (Huffingtonpost.com, 2016 & 2017). Rather than bringing people together, selfie manipulation tools risk propagating unrealistic standards of beauty that are cross-culturally harmful and divide more than they unite.

Document 86: Jennifer Guadagno Deposition Exhibit 11 at -6302

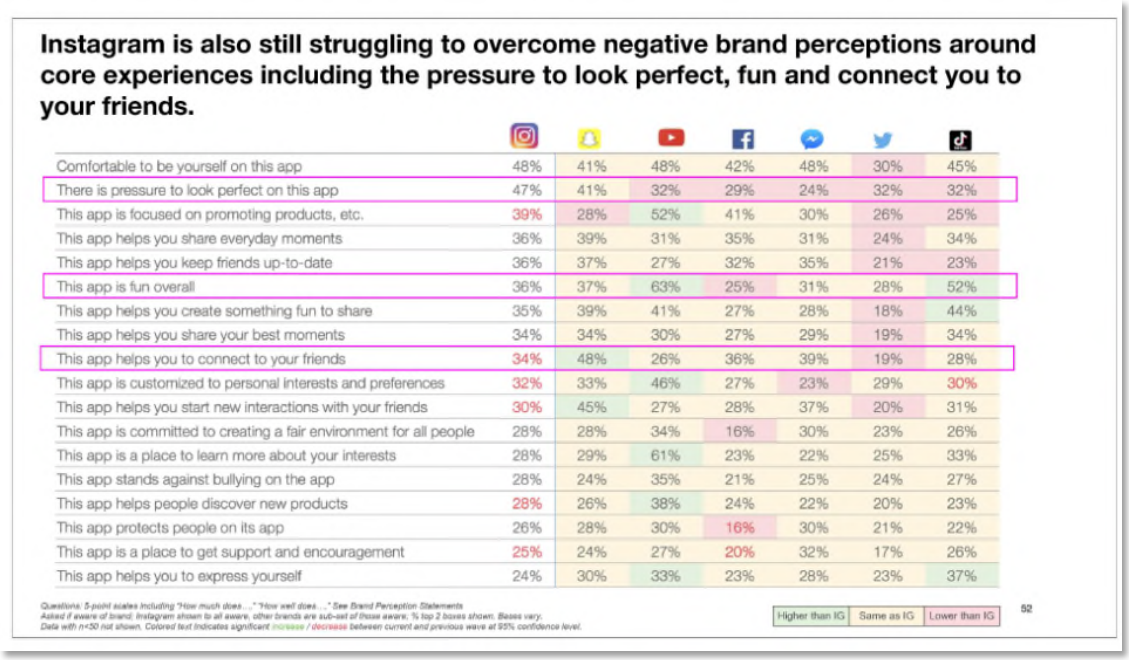
In her deposition, Dr. Guadagno concurred that there are significant risks, stating, "I believe the main findings or some of the core summary was that social media can increase the risk of some of these concerns including poor body image."[226] Despite this, Meta reversed its initial decision and allowed beauty or appearance filters.[227]

Interestingly, Dr. Guadagno's team proposed an entire research plan (longitudinal or experimental) to test the effects of cosmetic surgery effects on body image. As stated previously, only industry could do the type of research study her team proposes, namely experimentally manipulating access to filters for a large group of social media users and following them prospectively over time.[228] It is not clear from the documents I reviewed why such studies were not done. However, once the decision to remove the filter ban was made, Dr. Guadagno "made the unpopular (among Responsible Innovation Team) decision to not have my team continue deep research in the area. Even though they were asking for it, I identified that the research requested would be significant work without a lot of gain and likely wouldn't add anything that would change

[226] Jennifer Guadagno Dep. Tr. at 136:10-13
[227] Vaishnavi Jayakumar Dep. Tr. at 103:8-11
[228] *See e.g.*, Jennifer Guadagno Dep. Exhibit 16

leads' minds."[229] Implicit in her assertion is her belief that even robust experimental evidence showing harm would not be persuasive suggesting yet again that bottom line metrics trump well-being at Meta.

Meta did conduct a survey of teens' attitudes about Instagram and it revealed the following:



Instagram is also still struggling to overcome negative brand perceptions around core experiences including the pressure to look perfect, fun and connect you to your friends.

Comfortable to be yourself on this app	48%	41%	48%	42%	48%	30%	45%
There is pressure to look perfect on this app	47%	41%	32%	29%	24%	32%	32%
This app is focused on promoting products, etc.	39%	28%	52%	41%	30%	26%	25%
This app helps you share everyday moments	36%	39%	31%	35%	31%	24%	34%
This app helps you keep friends up-to-date	36%	37%	27%	32%	35%	21%	23%
This app is fun overall	36%	37%	63%	25%	31%	28%	52%
This app helps you create something fun to share	35%	39%	41%	27%	28%	18%	44%
This app helps you share your best moments	34%	34%	30%	27%	29%	19%	34%
This app helps you to connect to your friends	34%	48%	26%	36%	39%	19%	28%
This app is customized to personal interests and preferences	32%	33%	46%	27%	23%	29%	30%
This app helps you start new interactions with your friends	30%	45%	27%	28%	37%	20%	31%
This app is committed to creating a fair environment for all people	28%	28%	34%	16%	30%	23%	26%
This app is a place to learn more about your interests	28%	29%	61%	23%	22%	25%	33%
This app stands against bullying on the app	28%	24%	35%	21%	25%	24%	27%
This app helps people discover new products	28%	26%	38%	24%	22%	20%	23%
This app protects people on its app	26%	28%	30%	16%	30%	21%	22%
This app is a place to get support and encouragement	25%	24%	27%	20%	32%	17%	26%
This app helps you to express yourself	24%	30%	33%	23%	28%	23%	37%

Higher than IG | Same as IG | Lower than IG

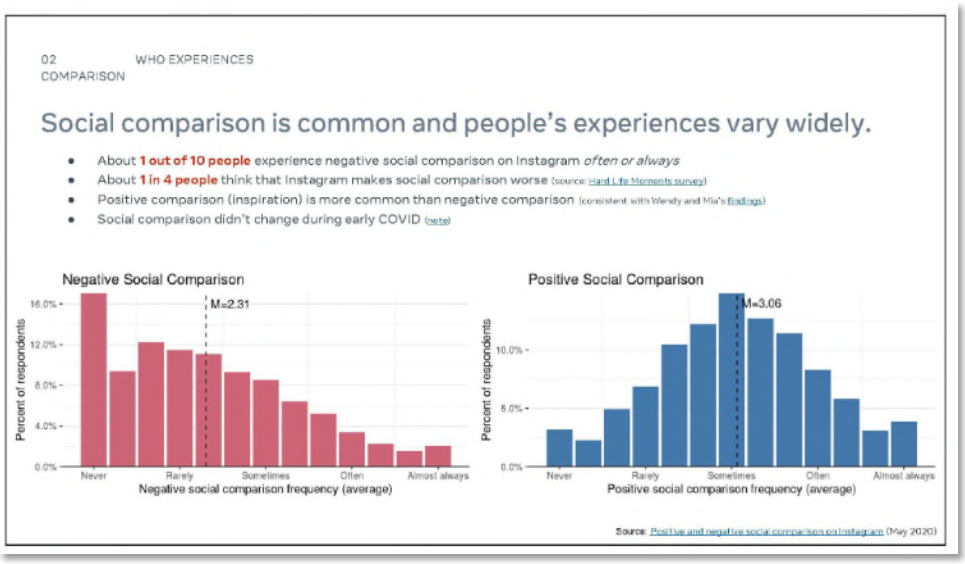
52

Document 87: META3047MDL-020-00350316, -0367

A sizeable percentage (for Instagram almost half) of teens report that "There is pressure to look perfect" on various social media apps and that pressure in turn motivates some to resort to cosmetic surgery effects.

The "underlying social comparison" that motivates users is common. In a global survey of 100K users of Instagram, Meta reported the following:

[229] META3047MDL-020-00265122, -5123



Document 88: META3047MDL-003-00001890, -1895

Ten percent of users experience negative social comparison on Instagram "often" or "always" and 25 percent think that Instagram makes social contagion worse.

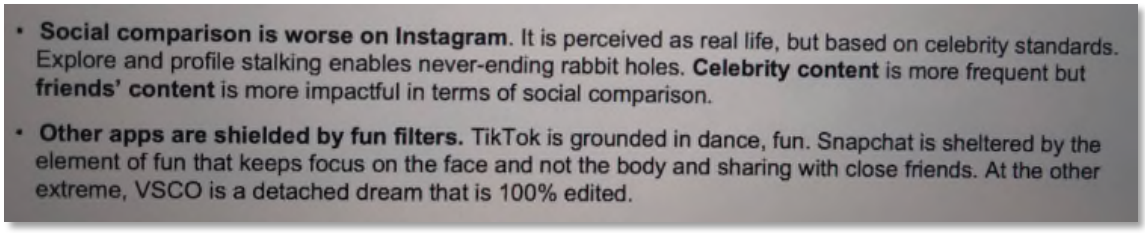
Further, Diego Castaneda, in an email exchange with an Instagram analyst, reported the following:

Dr. Diego Emiliano Castaneda (8/31/2021 07:45:41 PDT):
>Hi Gargi- That sounds right. I'm looking at the previous leads review from two week ago (which is where I think you got it, right?) to make sure it's aligned.

Dr. Diego Emiliano Castaneda (8/31/2021 07:46:37 PDT):
>"Teens feel that aspects of Instagram exacerbate each other and lead to vicious cycles of scrolling and comparing, causing them to feel bad about themselves" this slide has similar language.
https://docs.google.com/presentation/d/1iQKb8ycOrhT5wIqnjWYYvL8UBPo4a3WafHI5KDTSvDU/edit#slide=id.ge8009939c5_3_451

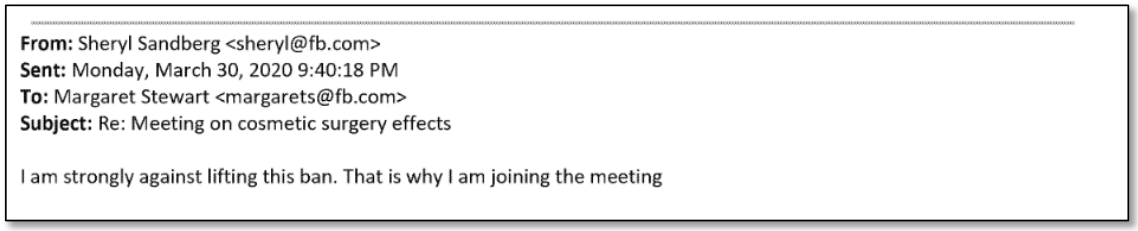
Document 89: Diego Castaneda Deposition Exhibit 27 at -9652

Again, this is an explicit acknowledgement of the negative feedback loop that social comparison and algorithms can have on teens' self-esteem and body image. Meta's own analysis provides support that Instagram is worse than its competitors in fostering negative social comparison:



Document 90: Haugen_00015958, -5964

Concerns over the potential harms of cosmetic surgery effects, especially to teenage girls, led Meta to temporarily ban them in 2019 motivated in part by recommendations from outside academic experts, including a psychologist at Duke University.[230] But soon thereafter, a movement to lift the bans emerged motivated by the risk they posed to adoption of the platform, a movement which was opposed by Sheryl Sandberg herself in her email below:



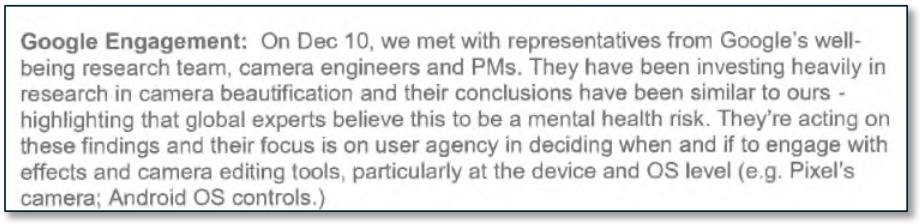
Document 91: Margaret Gould Stewart Deposition Exhibit 13

Stewart's concerns about cosmetic surgery effects emerged in part from her experience as a parent. She stated "Yes, I feel that raising teenagers during that team [sic] period gave me a perspective on why we needed to be looking at this issue because of my personal proximity to it."[231] And later, "As a parent of two teenage girls, I can tell you the pressure on them and their peers coming through social media is intense with respect to body image."[232] Her concerns were shared by other tech executives. As reported in *The Atlantic*:

[230] Margaret Gould Stewart Dep. Tr. at 67:9-13; *see also* Margaret Gould Stewart Dep Exhibit 9
[231] Margaret Gould Stewart Dep. Tr. at 34:3-7
[232] Margaret Gould Stewart Dep. Tr. at 58:22-25; *see also* Margaret Gould Stewart Dep Exhibit 8

> Steve Jobs limited his children's use of technology. TikTok CEO Shou Zi Chew doesn't let his children on TikTok. Bill Gates restricted his kids' screen time and did not give them a phone until they were 14. Google CEO Sundar Pichai didn't give his 11-year-old a phone. Mark Zuckerberg has carefully monitored his kids' screen time and avoided sharing identifying photos of them on Instagram. Snap CEO Evan Spiegel limited his 7-year-old's technology use to 90 minutes a week. [233]

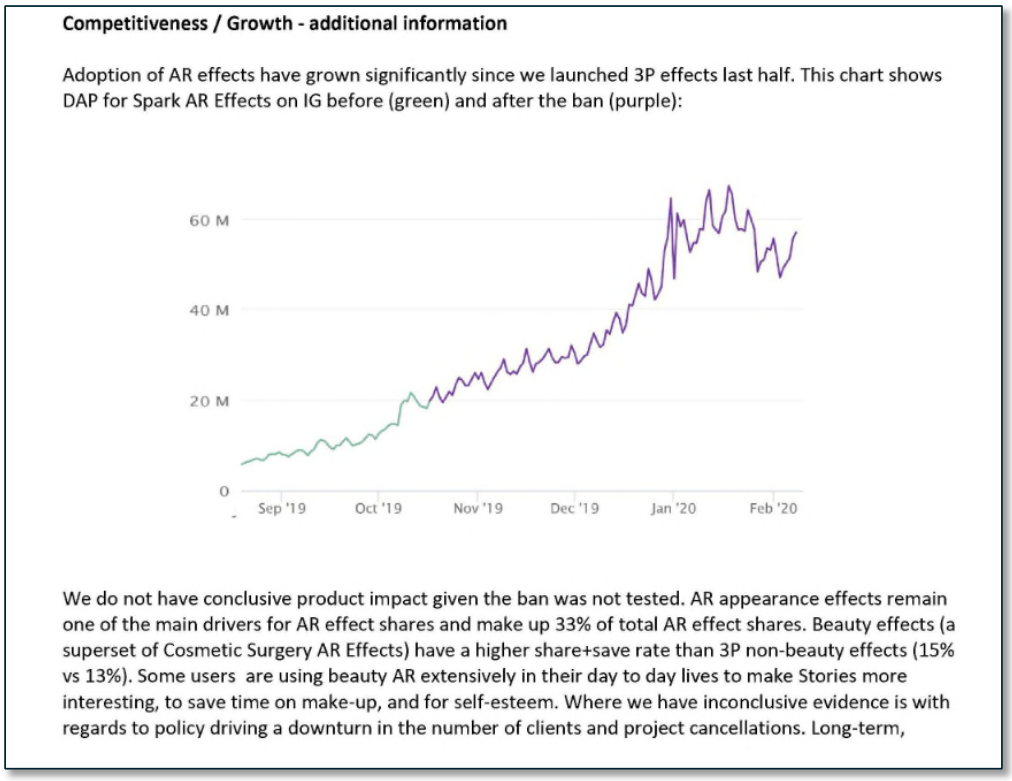
Ms. Stewart's and Ms. Sandberg's concerns were confirmed by a consultation with Google which Ms. Stewart forwarded in a group email:


Google Engagement: On Dec 10, we met with representatives from Google's well-being research team, camera engineers and PMs. They have been investing heavily in research in camera beautification and their conclusions have been similar to ours - highlighting that global experts believe this to be a mental health risk. They're acting on these findings and their focus is on user agency in deciding when and if to engage with effects and camera editing tools, particularly at the device and OS level (e.g. Pixel's camera; Android OS controls.)

Document 92: Margaret Gould Stewart Deposition Exhibit 22 at -8779

Leaning against the ban were data presented on the adoption effects of Augmented Reality (AR) and how the ban might impact growth and engagement with the platform. The data are below:

[233] Rausch Z, Haidt J, Torres L, *Social-Media Companies' Worst Argument*, THE ATLANTIC (Sep. 12, 2024), https://www.theatlantic.com/ideas/archive/2024/09/social-media-lgbtq-teens-harms/679798/.



Document 93: Margaret Gould Stewart Deposition Exhibit 6 at -9488

Although as the report acknowledges, the data does not assess what the effect of the ban might be, they suggest that augmented reality is a major driver of Instagram uptake. The decision to lift this ban was allegedly made by Mr. Zuckerberg himself in May of 2020.[234]

For its part, Snap also researched the effect and reach of its filters using a sample of 13–25-year-old users. As part of that study, Snap asked users to explain "why they felt they looked best in Snap Chat Camera."[235] Users overwhelmingly listed "Beautification lenses" as the reason.[236] The same report also found:

[234] META3047MDL-014-00053599, -3600.
[235] SNAP0640776, -0777
[236] SNAP0640776, -0777

- Many of these open-end responses were troubling, with responses like "Bc the filters actually make me look decent instead of being a horrendous ugly black girl," "because it hides blemishes and makes my face look thinner and lighter than it is," and "I love the filters it hides my uglyness"
- Users were very quick to point to their own perceived physical 'flaws' with some highlighting the benefit of looking lighter in a Lens. While it is a positive users feel confident when using Lenses, users are simultaneously left feeling bad about how they look without one; this underlines a key issue mentioned in research with employees around 'Lens Dysmorphia'

Document 94: SNAP0640777

Beyond the effects that cosmetic surgery effects and AR might have on BDD, Instagram also explored the role that "likes" might play in exacerbating negative social comparison.[237] In 2019, Instagram launched "Project Daisy" which as originally proposed would test turning off the "like count" in general for all users (discussed in section VIII.A above) but in the end this was made a setting people could opt into rather than a default.[238]

The linkage between social media use and BDD is highly psychologically plausible. Body dissatisfaction has long been recognized as influenced by a variety of sociocultural factors including media. Historically, this has happened in the "real" world or via magazine advertisements or television programs. Prior to the widespread use of social media, media exposure, and in particular exposure to advertisements was associated with BDD. A 2008 metanalysis of 77 studies (predating social media) found small to moderate correlations between media exposure and body dissatisfaction.[239] Meta's own research concludes/accepts this, stating:

> The media has long held a role in establishing and perpetuating "standards" of beauty and attractiveness, communicating how we *should* look and act to gain

[237] Vaishnavi Jayakumar Dep. Tr. at 167:5
[238] Vaishnavi Jayakumar Dep. Tr. at 167
[239] Grabe S, Ward LM, Hyde JS. The role of the media in body image concerns among women: a meta-analysis of experimental and correlational studies. *Psychol Bull*. May 2008;134(3):460-76. doi:10.1037/0033-2909.134.3.460

> acceptance and find happiness. **These message about ideal attractiveness pose a significant risk for body dissatisfaction, eating disorder behaviors, depression and anxiety among vulnerable populations who adopt these standards as their own**.[240]

(Both italics and bold fonts are present in original document.)

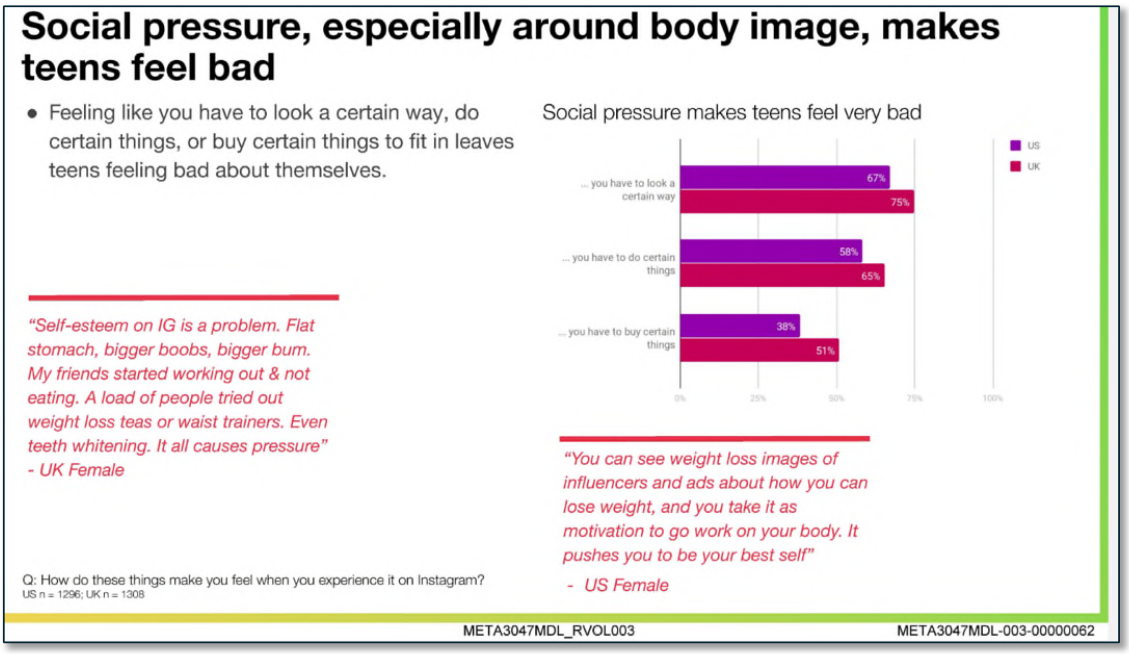
In addition, internal emails referencing research done by Meta with their own data reports the following.[241] (Their data included ~6,000 respondents in 7 countries, matched with their log data, something no independent scientist could do.)

- Social comparison is common on Instagram. 51% of people experience social comparison on Instagram. They either compare their accomplishments to others or observe other people to decide how they should act "sometimes" or more often;[242]
- Women and teens are more prone to social comparisons, especially negative social comparison;[243]
- 33% of people have been feeling worse about themselves on Instagram for "several months to a year;"[244]
- Women on average engage in more social comparison then men (53% vs. 43%) and those comparisons on average make them feel worse about themselves whereas they make men feel better about themselves. The precise percentage difference is not discernable because of the low-resolution graphic in the document;[245]

[240] META3047MDL-014-00376298 (emphasis added)
[241] Haugen_00000797
[242] Haugen_00000797, -0797
[243] Haugen_00000797, -0797
[244] Haugen_00000797
[245] Haugen_00000,797, -0822

- The negative effects of comparison for females are considerably greater for teenagers. Again, precise differences are not discernable;[246]
- A logistic regression of their data shows that 13-17 year olds (OR 4.4), 18–24-year-olds (OR 2.0), and females (OR 1.8) all have statistically increased odds of negative comparisons; and[247]
- 1 in 3 teen girls, according to Meta's own data, report that Instagram use makes their body image issues worse.[248]

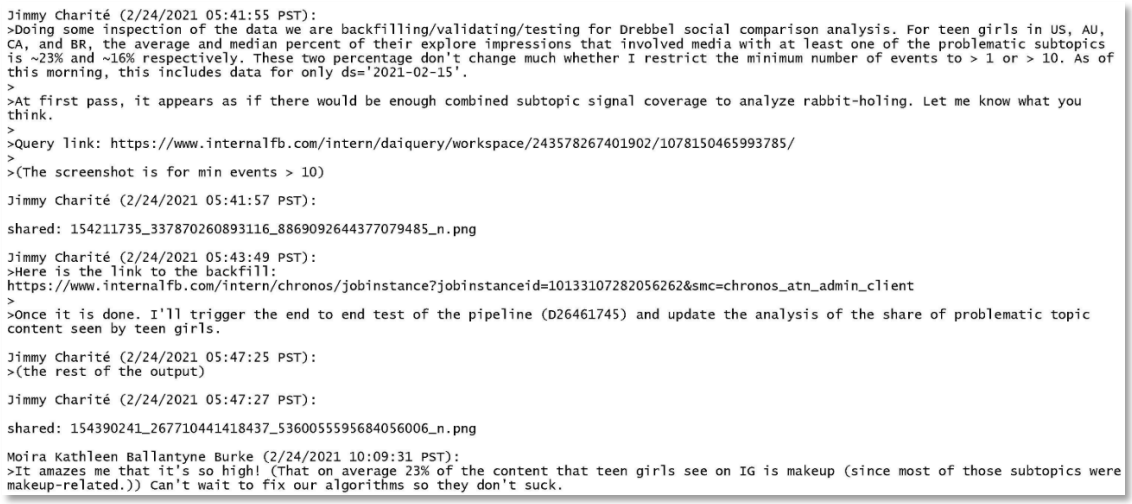
And a separate Meta survey of 2,500 13–17-year-olds in the US and UK reported the following:



Document 95:META3047MDL-003-00000029, -0063

[246] Haugen_00000797, -0823
[247] Haugen_00000797, -0828
[248] Haugen 00016707

In 2018, Gabriel Chiu emailed Moira Burke, a Research Scientist, and the "Well-being (+Meaningful Interactions & Agency/Control) Research XFN" team, to propose: "What if IG suggests photo filters selectively, e.g. only to certain types of photos such as landscape but not to people portraits (major trigger for social comparison)? And, "What if we launch a campaign such as "No Filter Friday," #beyourtrueself to promote authentic expression on IG"?[249] Both of these proposed solutions, neither of which to my knowledge were implemented, may, based on available evidence, have mitigated the untoward effects on body image. But more to the point, they demonstrate that Meta was at least aware of, and one researcher acknowledged, the problem they were exacerbating. And it is something their platform, specifically their algorithms, is responsible for. Below is an internal text exchange between Jimmy Charite (IG Well-Being Sr. Data Scientist) and Dr. Burke:



Jimmy Charité (2/24/2021 05:41:55 PST):
>Doing some inspection of the data we are backfilling/validating/testing for Drebbel social comparison analysis. For teen girls in US, AU, CA, and BR, the average and median percent of their explore impressions that involved media with at least one of the problematic subtopics is ~23% and ~16% respectively. These two percentage don't change much whether I restrict the minimum number of events to > 1 or > 10. As of this morning, this includes data for only ds='2021-02-15'.
>
>At first pass, it appears as if there would be enough combined subtopic signal coverage to analyze rabbit-holing. Let me know what you think.
>
>Query link: https://www.internalfb.com/intern/daiquery/workspace/243578267401902/1078150465993785/
>
>(The screenshot is for min events > 10)

Jimmy Charité (2/24/2021 05:41:57 PST):

shared: 154211735_337870260893116_8869092644377079485_n.png

Jimmy Charité (2/24/2021 05:43:49 PST):
>Here is the link to the backfill:
https://www.internalfb.com/intern/chronos/jobinstance?jobinstanceid=10133107282056262&smc=chronos_atn_admin_client
>
>Once it is done. I'll trigger the end to end test of the pipeline (D26461745) and update the analysis of the share of problematic topic content seen by teen girls.

Jimmy Charité (2/24/2021 05:47:25 PST):
>(the rest of the output)

Jimmy Charité (2/24/2021 05:47:27 PST):

shared: 154390241_267710441418437_5360055595684056006_n.png

Moira Kathleen Ballantyne Burke (2/24/2021 10:09:31 PST):
>It amazes me that it's so high! (That on average 23% of the content that teen girls see on IG is makeup (since most of those subtopics were makeup-related.)) Can't wait to fix our algorithms so they don't suck.

Document 96: META3047MDL-003-00123974, -3974

In response to the content that is being feed to teen girls as a result of their searches, Burke responds that she "can't wait to fix our algorithms so they don't suck." As a slide from Alison Lee's

[249] META3047MDL-014-00035646, Exhibit 14 to Justin Cheng Deposition

deposition asserts, "Prior research on rabbit holing suggests that particular kinds of accounts and topics may serve as gateway entities for falling into problematic Rabbit holes."[250]

For its part, YouTube also recognized a design feature that amplified content and creates rabbit holes that could be harmful.

Document 97: GOOG-3047MDL-01372619

The notes to this slide state "Once you watch a few of these, your feed might become concentrated w/ a high volume of content that repeat the same message," which is to say that the algorithm itself creates, perpetuates, and exacerbates the problem.

From a scientific standpoint, there is consistency across multiple studies as the overwhelming majority, but not all of them find an association between social media and BDD. Although the preponderance of existing research linking social media to BDD is cross-sectional and relies on self-report of social media usage, there have been some longitudinal and laboratory

[250] Alison Lee Dep. Exhibit 28 at Slide 2

based experimental studies. Much like smoking, experimentally testing whether social media exposure leads to BDD is impractical to the point of impossibility. Accordingly, experimental manipulations typically bring subjects into a laboratory, randomize them to see (or not see) various idealized images of themselves or others, and conduct pre- and post-exposure assessments of how they feel about their bodies comparing their feelings before and after.

For example, one laboratory study randomized 130 undergraduate female students to see 18 Instagram images. The intervention group saw "fitspiration" ones of women in fitness clothing or engaging in exercise and the control arm saw women at travel destinations. Mood and body dissatisfaction as well as self-esteem were measured both at baseline and after the exposures. Both body dissatisfaction and self-esteem were significantly lower in the "fitspiration" group.[251] A systematic review (again a metanalysis was not feasible) of 43 experimental studies found moderate to large effects of such approaches.[252] Meta's own documents refer to (and do not dispute) the existence of "snapchat dysmorphia" wherein affected individuals present idealized selfies of themselves to plastic surgeons and ask to be made to look like them.[253] And the Haugen documents, detailing their study of ~6000 users of IG, found that "Beauty, Fitness, and Fashion are the top three contents that trigger negative comparisons for women."[254]

There also appears to be a dose response relationship: the more time spent on social media sites, the greater the risk of BDD. Studies that assessed the correlation between appearance-

[251] Tiggemann M, Zaccardo M. "Exercise to be fit, not skinny": The effect of fitspiration imagery on women's body image. *Body Image*. 2015/09/01/ 2015;15:61-67. doi:https://doi.org/10.1016/j.bodyim.2015.06.003

[252] Fioravanti G, Bocci Benucci S, Ceragioli G, Casale S. How the exposure to beauty ideals on social networking sites influences body image: A systematic review of experimental studies. *Adolescent Research Review*. 2022:No Pagination Specified-No Pagination Specified. doi:10.1007/s40894-022-00179-4

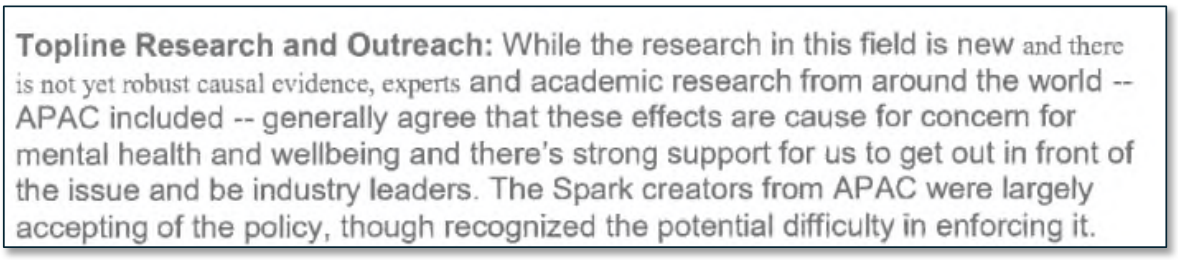
[253] META3047MDL-014-00376300

[254] Haugen_00000834

focused social media vs. general social media usage found larger effect sizes (r=0.31 vs 0.11).[255] While problematic, idealized images have existed in media for decades, the advent of social media – with features that promote social comparison, 24/7 access, filters, and engagement algorithms that create rabbit holes – is particularly harmful to mental health. In other words, while the images are problematic, their capacity to cause harm is greatly increased by the characteristics of social media.

Finally, there appears to be some ability to reverse or reduce the risk by mediating social media usage. A systematic review of media literacy programs' effects on body dissatisfaction found some modest evidence of benefit. In particular, training adolescents to recognize that online portrayals are unrealistic or even doctored reduced the risk of BDD.[256] In addition, a cornerstone of effective BDD psychotherapeutic treatment is Cognitive Behavioral Therapy which, among other things, counsels subjects to be aware of and actively mitigate the effects SM has on them.

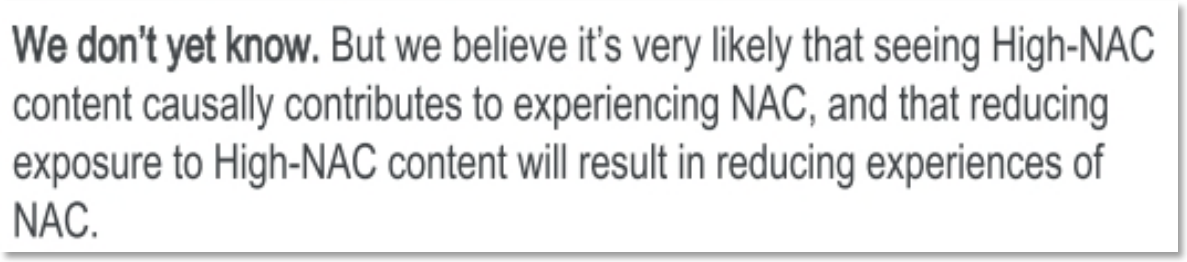
An internal Facebook email from 2019 states:


Topline Research and Outreach: While the research in this field is new and there is not yet robust causal evidence, experts and academic research from around the world -- APAC included -- generally agree that these effects are cause for concern for mental health and wellbeing and there's strong support for us to get out in front of the issue and be industry leaders. The Spark creators from APAC were largely accepting of the policy, though recognized the potential difficulty in enforcing it.

Document 98: Margaret Gould Stewart Deposition Exhibit 22

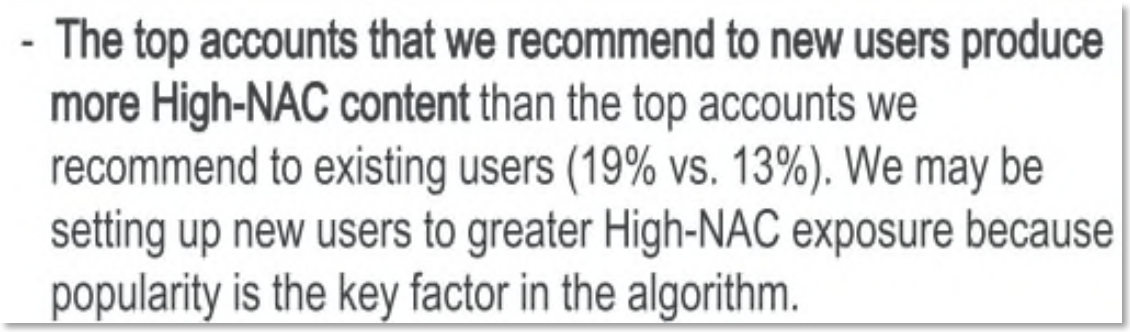
[255] Saiphoo AN, Vahedi Z. A meta-analytic review of the relationship between social media use and body image disturbance. *Comput Hum Behav*. 2019;101:259-275.
[256] McLean SA, Paxton SJ, Wertheim EH. The role of media literacy in body dissatisfaction and disordered eating: A systematic review. *Body Image*. Dec 2016;19:9-23. doi:10.1016/j.bodyim.2016.08.002

In other words, Facebook's own "take" on the academic consensus was that there was "cause for concern" based on the use of cosmetic surgery effects. In fact, even as they state internally that we don't "yet" know if high Negative Appearance Comparison (NAC) content (content that promotes NAC in teens) is causally related to teens experiencing NAC, an internal document states:



Document 99: META3047MDL-019-00066693 at Slide 11

If they "believe" that there is a causal relationship between seeing "negative appearance content" and experiencing it, something the preponderance of the scientific literature supports, they surely were obligated to act on it. But I did not find credible evidence that they did. Furthermore, the same report acknowledges that "High NAC content is prevalent, and our systems make it more common."[257] The net result, per Meta, is that "High NAC is 18% of what teen girls and women see on IG." And then it states:



Document 100: META3047MDL-019-00066693 at Slide 12

[257] META3047MDL-019-00066693, Slide 12

Meta implicates its own algorithm in promoting NAC content. The content is ubiquitous, but the unique and effective means of promoting it – feeding it – is their own invention. Furthermore, Meta's own assessment determined that 23% of 13–15-year-olds have felt worse about themselves because of people's posts on Instagram.[258]

In November 2023, in spite of the public backlash for Meta's filters, TikTok launched its own image enhancing product, "The Bold Glamour Filter." It too faced harsh criticism:

> • TikToker Rosaura Alvarez called the beauty filter "a problem," and called out TikTok for taking it "a little too far." In her video, which now has 8.7 million views, Alvarez says, "you can't even tell it's a filter anymore!" "As someone who experienced body dysmorphia growing up, this makes me sick to my stomach," read the caption of her video. "TikTok u can't be enabling this…it's sickening for our youth."
>
> • The Bold Glamour filter has also been described as [HYPERLINK "https://www.thetimes.co.uk/article/the-ugly-truth-of-tiktoks-new-beauty-filter-jlp9nvlnw" \h] for setting unrealistic beauty standards amongst young women and girls.

Document 101:TIKTOK3047MDL-056-00987601

It is my opinion to a reasonable degree of medical and scientific certainty that the overwhelming evidence supports a causal relationship between social media use and body dysmorphia. In my opinion this occurs through a variety of mechanisms, including social comparison that is enhanced and facilitated by the design of the SM platforms. A review of the internal Defendant documents provides further support for a causal relationship between social media and the development of body dysmorphia and body image conditions. Of note, it appears that on more than one occasion the Defendants utilized design features that increased the risk of harm, rather than safer alternatives.

B. Eating Disorders

[258] META3047MDL-031-00118103, -8104

In addition to the link between social media use and BDD discussed above, there are reasons to plausibly believe that social media usage can cause eating disorders. A brief summary of clinical eating disorders taken from Dane and Bhatia's derivation is in figure below.[259]

Figure 30: Summary of Clinical Eating Disorders

CLINICAL EATING DISORDERS	
Anorexia	An intense fear of weight gain and/or a disturbed body image that motivates severe dietary restriction or other weight loss behaviours
Bulimia	Recurrent episodes of binge eating and compensatory behaviours, e.g., purging, to prevent weight gain
Binge eating disorder	Recurrent episodes of compulsive overeating that leads to distress without attempts to compensate for weight gain
Avoidant/restrictive food intake disorder	The avoidance or restrictive intake of food in the absence of body image concerns and fear of weight gain
Pica	Eating non-nutritive or non-food substances for a period of one month or more
Rumination disorder	Involves regurgitation of food after eating in the absence of nausea, involuntary retching, or disgust
SUBCLINICAL OTHER SPECIFIC FEEDING AND EATING DISORDERS	
Orthorexia Nervosa	A pathological fixation with healthy or 'clean' eating, avoidance of unhealthy foods and rigid dietary and exercise practices- violations of which cause severe emotional distress
Atypical anorexia	Majority of symptoms of anorexia are present, but the individual is classified as being within the normal BMI range
Atypical bulimia	Mimics clinical bulimia but occurs less frequently and with shorter duration
Atypical binge eating disorder	Mimics clinical binge eating disorder but occurs less frequently and with shorter duration
Purging disorder	Purging or using laxatives as a mean to control weight
Night eating disorder	Repeatedly eating at night, either after an evening meal or waking up from sleep
COMMON PATHOLOGY	
Dieting, binging, purging, restricting, avoidance of certain food groups, compulsive or compensatory exercise behaviours and the use of laxatives or weight loss pills	
Adapted from [1, 2, 5, 6]	
https://doi.org/10.1371/journal.pgph.0001091.t001	

In terms of psychobiological plausibility, much of the basis for a linkage between social media usage and eating disorders is discussed in the BDD section (X.A) immediately prior and relates to social comparisons either with one's "friends" or with other idealized images that are frequently posted to, or shared via, social media. It also includes risk created by tailored algorithms

[259] Dane A, Bhatia K. The social media diet: A scoping review to investigate the association between social media, body image and eating disorders amongst young people. *PLOS Global Public Health*. 2023;3(3):e0001091.

that can create rabbit holes or filter bubbles and provide extensive exposure of harmful content to a user.

A 2022 study by Fairplay, circulated and cited within Meta emails shared with me, investigated the so called "Pro-Eating Disorder" Bubble, namely an ecosystem of Instagram accounts that actively promote unhealthy eating habits and techniques to both optimize them and avoid detection. The researchers in this study created test accounts that showed an interest in pro-eating disorder content by using vocabulary such as "Thinspo" and "TW (trigger warning)" in their biographies. Over 5 weeks of inactivity, one such account gained an additional 686 followers who had been algorithmically directed to the account and chose to follow it presumably in search of content.[260] Within that same report, a first-hand account of "Kelsey" a 17-year-old Southern California high school student is reported. Among other things, she alleges that "pro-eating disorder" content was "always pushed towards [her] from the moment I opened my account." She goes on "I have never searched for those things and yet they pop up on my screen, whereas images or reminders of positive things, such as body positivity influencers, et cetera, I have to actively search for them in order for them to appear on my phone."[261]

When asked if these kinds of "never searched for" things are an example of product mechanics that cause harm, Kang-Xing Jin responds, "Yes. If this user's experience was that they were getting essentially pushed this content without having prior indication that they wanted it, then that would be, in my opinion, on the high-responsibility side of things for recommendations."[262] Notably, he does not take issue that such unwelcomed content *could* be pushed towards a user. Indeed, in follow-up questioning, when asked if Meta should have done

[260] Kang-Xing Jin Dep. Exhibit 43
[261] Kang-Xing Jin Dep. Tr. at 493
[262] Kang-Xing Jin Dep. Tr. at 495

more to optimize for teen safety, Jin replies "Yes"[263] Indeed, Meta's own data show that "18% of teens have seen someone promoting eating disorders or unhealthy weight loss on Instagram in the last week."[264]

In terms of effect size, a recent metanalysis of 87 effect sizes from 22 studies produced a summary estimate of the association between self-reported social media use and various validated measures of eating disorders.[265] All studies included were published between 2010 and 2020 and the included sample had 5,031 males and 8,270 females. Notably, there was considerable heterogeneity in the studies driven in large part by BMI of respondent, sample source (e.g. college students, children, adolescents, clinical populations), and survey methods (e.g. online vs. paper and pencil). The summary estimate showed a "weak" but significant correlation between social media usage and disordered eating (0.09 [95% CI .06, .11]). The overall association, while small, must be taken in the context of the limitations of the data collection methodologies as well as the very high likelihood that there is significant variability in susceptibilities amongst included participants.

The primary predictor variable was some self-reported measure of social media usage and the primary outcome was some measure of disordered eating. For many people, social media usage may not include much (or any) portrayals of idealized bodies. In fact, for some people, social media usage might be affirming of their current body habits and thus have a "protective" effect against disordered eating. Again, the limited granularity about what content is pushed and therefore consumed limits the ability to discern both a more precise estimate of effect but also who is more

[263] Kang-Xing Jin Dep. Tr. at 710
[264] META3047MDL-003-00156702, -6718
[265] Zhang J, Wang Y, Li Q, Wu C. The Relationship Between SNS Usage and Disordered Eating Behaviors: A Meta-Analysis. *Front Psychol*. 2021;12:641919. doi:10.3389/fpsyg.2021.641919

likely to be affected and makes it difficult for independent scientists to study this problem. This is (yet) another example of the kind of lacuna in research that could be filled with industry data.

Several longitudinal studies confirm that there is a temporal association between exposure to social media images of ideal bodies and subsequent eating disorder symptoms.[266] From a dose response (biologic gradient) standpoint, if increased exposure to content might drive (or be associated with) eating disorders, one might posit that more time spent on the internet might increase risk. To that end, a metanalysis of studies that tested the association between problematic internet use and eating disorders including 39 studies from 21 countries found an effect size of (0.21 [95% CI 0.14, 0.28].[267] This effect size is still small but twice the size of the overall effect size of general usage and eating disorders.

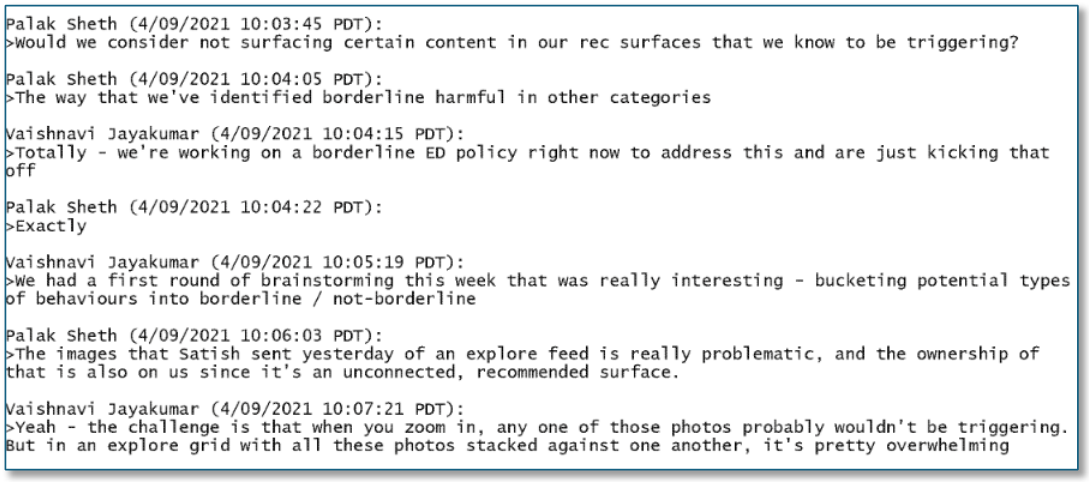
Experimental data are sparse because, much as with BDD, manipulations of exposure with sufficient frequency and long enough follow up to document differences in the development of eating disorders is sufficiently impractical as to be essentially impossible. But shorter-term laboratory based experimental approaches such as the one performed by Tiggman and summarized

[266] *See* Brown Z, Tiggemann M. Attractive celebrity and peer images on Instagram: Effect on women's mood and body image. Body Image. 2016/12/01/ 2016;19:37-43. doi:https://doi.org/10.1016/j.bodyim.2016.08.007; Kim M, Park W. Who is at risk on Facebook? The effects of Facebook News Feed photographs on female college students' appearance satisfaction. The Social Science Journal. 2016/12/01/ 2016;53(4):427-434, doi:https://doi.org/10.1016/j.soscij.2016.08.007; Puccio F, Kalathas F, Fuller-Tyszkiewicz M, Krug I. A revised examination of the dual pathway model for bulimic symptoms: The importance of social comparisons made on Facebook and sociotropy. Computers in Human Behavior. 2016/12/01/ 2016;65:142-150. doi:https://doi.org/10.1016/j.chb.2016.08.018.

[267] Ioannidis K, Taylor C, Holt L, et al. Problematic usage of the internet and eating disorder and related psychopathology: A multifaceted, systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*. 2021/06/01/ 2021;125:569-581. doi:https://doi.org/10.1016/j.neubiorev.2021.03.005

above, shows that there are at least short-term effects on one's body image based on what one is presented on social media.[268]

Internally documents reflect a recognition that unconnected content either in "image" or "reel" format on users' "explore" tab could be problematic for people at risk for eating disorders. Below is an exchange between Jayakumar and Palak Sheth from Meta's policy department:



Palak Sheth (4/09/2021 10:03:45 PDT):
>Would we consider not surfacing certain content in our rec surfaces that we know to be triggering?

Palak Sheth (4/09/2021 10:04:05 PDT):
>The way that we've identified borderline harmful in other categories

Vaishnavi Jayakumar (4/09/2021 10:04:15 PDT):
>Totally - we're working on a borderline ED policy right now to address this and are just kicking that off

Palak Sheth (4/09/2021 10:04:22 PDT):
>Exactly

Vaishnavi Jayakumar (4/09/2021 10:05:19 PDT):
>We had a first round of brainstorming this week that was really interesting - bucketing potential types of behaviours into borderline / not-borderline

Palak Sheth (4/09/2021 10:06:03 PDT):
>The images that Satish sent yesterday of an explore feed is really problematic, and the ownership of that is also on us since it's an unconnected, recommended surface.

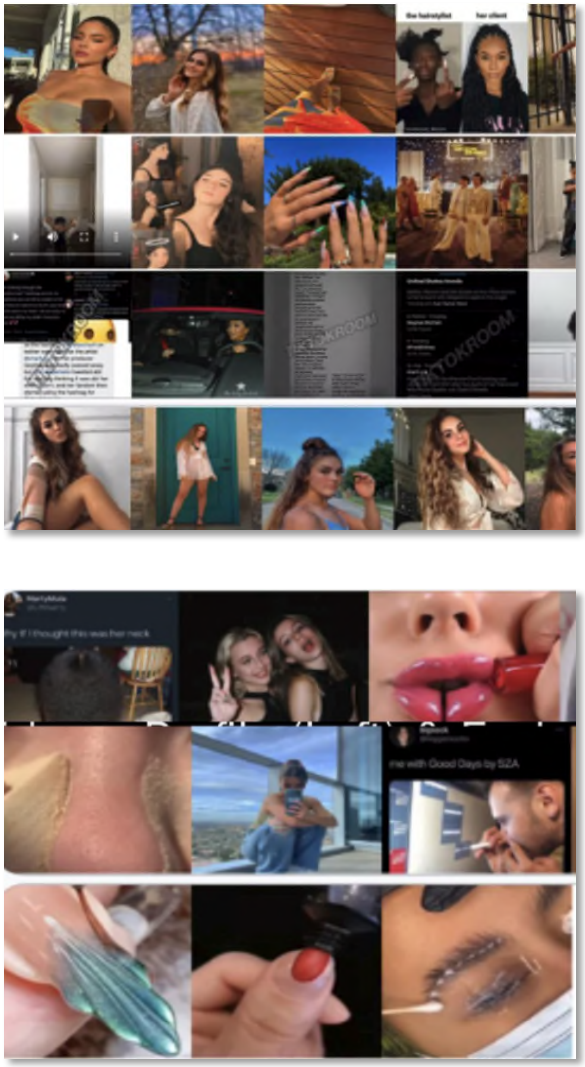
Vaishnavi Jayakumar (4/09/2021 10:07:21 PDT):
>Yeah - the challenge is that when you zoom in, any one of those photos probably wouldn't be triggering. But in an explore grid with all these photos stacked against one another, it's pretty overwhelming

Document 102: META3047MDL-040-00541685

Below are the referenced images taken from the explore feed of a teenage Instagram user sent by Satish Mummareddy who stated: "The question is that there is content that will continue to be created on the platform that makes teens feel back [sic] about themselves."[269]

[268] *See* Kim M, Park W. Who is at risk on Facebook? The effects of Facebook News Feed photographs on female college students' appearance satisfaction. *The Social Science Journal*. 2016/12/01/ 2016;53(4):427-434. doi:https://doi.org/10.1016/j.soscij.2016.08.007; Tiggemann M, Barbato I. "You look great!": The effect of viewing appearance-related Instagram comments on women's body image. *Body Image*. 2018/12/01/ 2018;27:61-66. doi:https://doi.org/10.1016/j.bodyim.2018.08.009

[269] Vaishnavi Jayakumar Dep. Tr. at 181:3-6



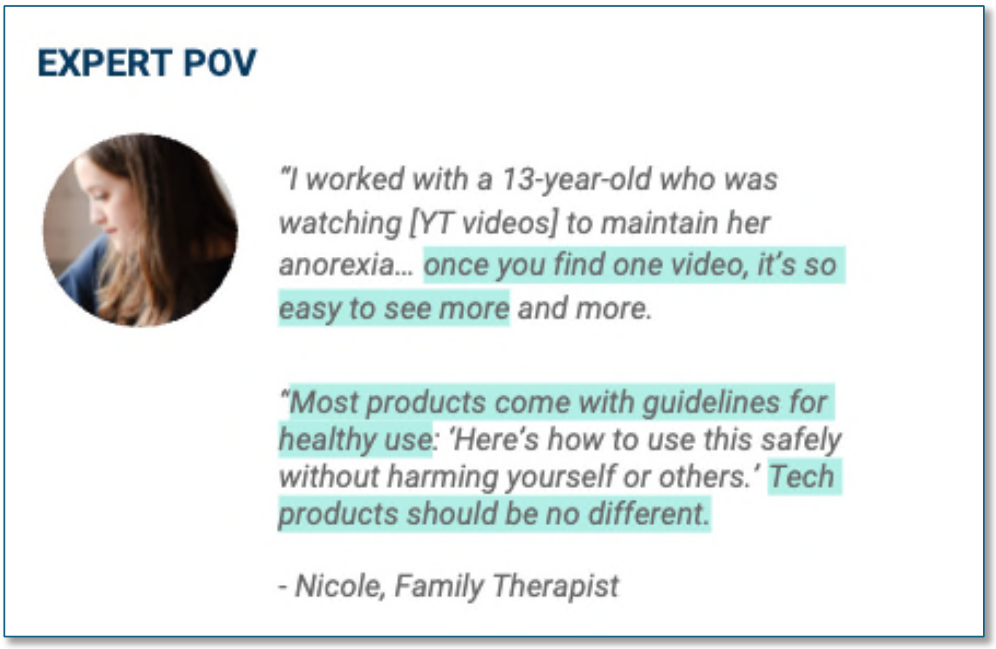
Document 103: META3047MDL-145-00000005

Jayakumar in her deposition asserts that while viewing these images would not necessarily cause harm to everyone, "One could argue that if you already struggle with negative social comparison, being flooded with a wave of images like that could be -could make you feel really bad about yourself."[270] Fair enough. But the design of social media is such that certain people

[270] Vaishnavi Jayakumar Dep. Tr. at 184:2-6

with pre-existing vulnerabilities are more likely to receive a "flood" of posts that tap into this pre-existing vulnerability. This amplification of content and design that pushes the content to vulnerable children is part of the mechanism by which social media simultaneously increases engagement and the risk of harm. In other words, the problem is that teens with body image issues or those prone to eating disorders are fed such posts and it happens in the "explore" tab which is amassed by Meta's algorithms. In fact, Jayakumar goes on to say that the aggregation is part of the problem.

YouTube's algorithms also curate ED content for its viewers. Google's own internal focus group study had the following quote:



Document 104: GOOG-3047MDL-00236723 at Slide 12 (emphasis in original)

It is my opinion that to a reasonable degree of medical and scientific certainty, social media usage increases the risk of eating disorders and body image conditions in adolescents. This is in part due to several design features that exacerbate social comparison, provide idealized beauty

standards, and pull children into filter bubbles or rabbit holes. A review of the internal documents provides further support that Defendants recognized that social media increased the risk of or exacerbated eating disorders, negative social comparison, body image conditions, and low self-esteem.

C. Sleep Problems

Sleep is essential for maintaining overall health and well-being. It plays a crucial role in various bodily functions, including the repair and rejuvenation of cells, muscles, and tissues. During sleep, the brain consolidates memories and processes information which can help improve cognitive function, memory retention, and problem-solving skills. Lack of sleep, on the other hand, has been linked to a higher risk of developing chronic health conditions such as heart disease, diabetes, and obesity. It also weakens the immune system, making the body more vulnerable to infections. Moreover, sleep is vital for mental and emotional health. A well-rested brain is better equipped to manage stress, regulate emotions, and maintain a positive mood.

Sleep deprivation, however, can lead to irritability and difficulty concentrating, which negatively impacts daily performance, including at school. In the long term, insufficient sleep can contribute to mental health disorders like depression and anxiety. Therefore, maintaining a healthy sleep routine is crucial for both physical and mental well-being. As presented above (Section VII.C), a metanalysis found that the mere presence of a device in a child's bedroom is associated with a 79% increased risk of sleep problems irrespective of addiction.[33]

For simplicity, we will focus only on the direct path between SM use and sleep (which again is enhanced by compulsive/addictive screen use). But both depression and anxiety (discussed

in the next section of this report) have reciprocal relationships with sleep, and in fact sleep disturbance is a core symptom of both.[271]

There are several plausible psychobiological/environmental mechanisms by which this relationship is causal:

1) Psychological arousal: Social media, by virtue of the engaging (and enraging) content its algorithms are designed to surface, can inhibit the relaxation process that is essential to inducing sleep.
2) Displacement: Peri-bedtime spent on social media effectively displaces time that could be spent sleeping. Simply put, a child in bed on their phone is postponing or delaying sleep.
3) Melatonin inhibition: Decades of research have established that emitted light suppresses secretion of the sleep inducing hormone, melatonin.[27271]
4) Alerts or Notifications: Audible or visual alerts from social media sites indicating updates can disrupt or delay sleep.
5) Fear of Missing Out (FOMO): As discussed elsewhere in this report, FOMO mitigation drives social media use.

In terms of the association between social media and sleep problems, there have been several systematic reviews performed.[273] A comprehensive systematic review summarized 42 studies of social media use and sleep quality including both cross sectional and longitudinal

[271] Gregory AM, Sadeh A. Sleep, emotional and behavioral difficulties in children and adolescents. *Sleep Med Rev*. Apr 2012;16(2):129-36. doi:10.1016/j.smrv.2011.03.007
[272] Lewy AJ, Wehr TA, Goodwin FK, Newsome DA, Markey SP. Light suppresses melatonin secretion in humans. *Science*. Dec 12 1980;210(4475):1267-9. doi:10.1126/science.7434030
[273] A distinction can be made between studies that looked at SM use and sleep and those that looked at screen time and sleep. While some studies regarding screen time and sleep have inconsistent results regarding association between use and sleep health outcomes, the use of SM that interrupt nighttime sleep are associated with a variety of adverse sleep outcomes in the literature. This distinction is discussed in the Handbook of Children and Screens.

studies.[274] It reported that five cohort studies found excessive social media use at baseline to be a risk factor for poor sleep quality a follow up. In addition, among the 24 cross sectional studies identified, 23 found positive associations between frequent social media use and poor sleep quality.

In terms of temporality and effect size, a few longitudinal studies have examined the relationship between social media and insomnia. In one study, 1098 adolescents (13-19 years of age) were followed serially over 4 months with monthly assessments of nomophobia, social media addiction, and insomnia.[275] Insomnia was associated with both nomophobia (B=.20 p<.001) and addictive social media usage (B=.49 p<.001). A systematic review and metanalysis of 23 *longitudinal* studies of screen use and sleep in adolescents found an effect size of -.12 for social media usage -.19 for dysfunctional media usage at baseline and subsequent sleep health at follow up.[276] A systematic review and metanalysis of 16 *experimental* studies of screen time reduction in children is summarized below.[277]

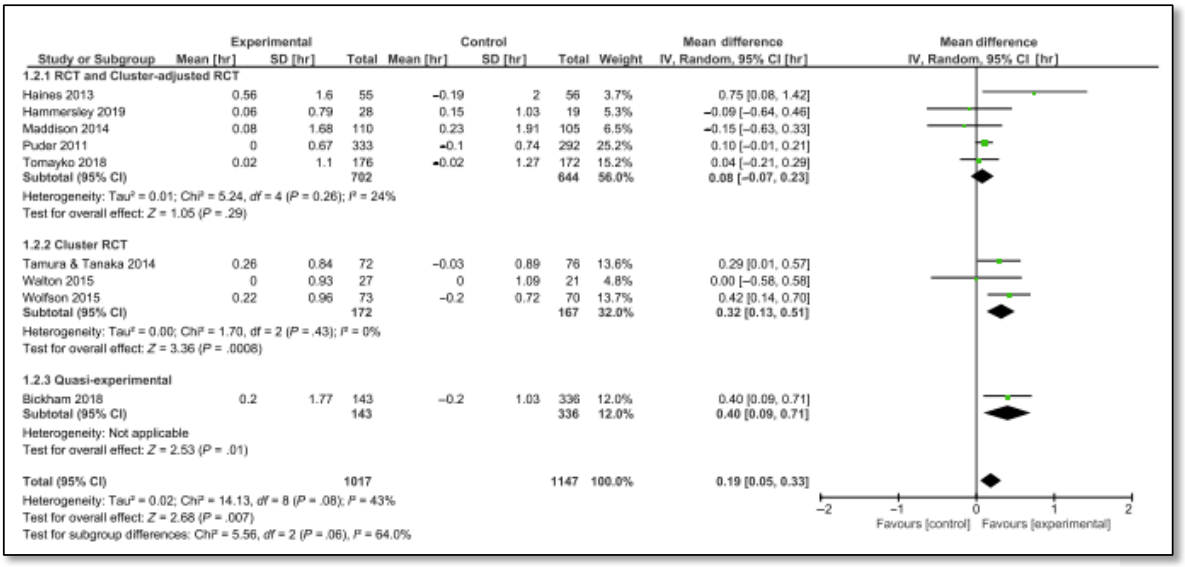
[274] Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. *Sleep Med Rev*. Apr 2021;56:101414. doi:10.1016/j.smrv.2020.101414

[275] Lin C-Y, Potenza MN, Ulander M, et al. Longitudinal Relationships between Nomophobia, Addictive Use of Social Media, and Insomnia in Adolescents. *Healthcare*. 2021;9(9):1201.

[276] Pagano M, Bacaro V, Crocetti E. "Using digital media or sleeping … that is the question". A meta-analysis on digital media use and unhealthy sleep in adolescence. *Computers in Human Behavior*. 2023/09/01/ 2023;146:107813. doi:https://doi.org/10.1016/j.chb.2023.107813

[277] Martin KB, Bednarz JM, Aromataris EC. Interventions to control children's screen use and their effect on sleep: A systematic review and meta-analysis. *Journal of Sleep Research*. 2021;30(3):e13130. doi:https://doi.org/10.1111/jsr.13130

Figure 31: 28 Metanalysis Of Experimental Studies Of Screen Use And Sleep



The overall effect of screen time reduction interventions resulted in a significant increase of 11 minutes of sleep. Since that metanalysis was published, Bartel and colleagues performed a within person experiment in 14–18-year-old adolescents wherein their baseline sleep was monitored for a week after which they were given individual phone stoppage time 1 hour before bed for one school week. During the phone restriction week, adolescents stopped using their phones 80 min earlier, turned their lights out 17 minutes earlier and slept 21 minutes longer.[278]

Finally, the Davis and Goldfield study (detailed in the FOMO section of this report, Section VII.F), also assessed sleep after 3 weeks of social media reduction. The intervention group slept almost 30 minutes more per night based on self-report. To understand the implications of this effect size, consider that among teens, evidence from the school start time literature show that average

[278] Bartel K, Scheeren R, Gradisar M. Altering Adolescents' Pre-Bedtime Phone Use to Achieve Better Sleep Health. *Health Communication*. 2019/03/21 2019;34(4):456-462. doi:10.1080/10410236.2017.1422099

differences as small as 10-20 minutes of sleep per night are adversely associated with academic, cognitive, and motor vehicle crash outcomes.[279]

FOMO occurs throughout the day of course but there are, at least in theory, other structural societal constraints that lean against checking social media continuously (e.g. school for children although school cell policies have until very recently been nonexistent or not enforced effectively).[280] However, at the end of the day, when children are in bed, those other constraints are largely gone and FOMO can preclude the mental relaxation that is requisite to induce sleep.

In addition, there is some evidence of coherence. Functional magnetic imaging studies have shown that various areas of the brain are differentially activated by episodic or chronic usage of social media.[281] In particular, both the nucleus accumbens discussed earlier, and the amygdala which is part of the "arousal" circuitry of the brain, could plausibly impact sleep and both are preferentially stimulated. Additional features of social media that interrupt sleep include receiving nighttime notifications, addictive engagement through the algorithmic delivery of intermittent variable rewards, and increased anxiety and depressive symptoms that are also a byproduct of the design of social media.

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[279] Wheaton AG, Chapman DP, Croft JB. School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. *J Sch Health*. May 2016;86(5):363-81. doi:10.1111/josh.12388; Bowers JM, Moyer A. Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: a meta-analysis. *Sleep Health*. Dec 2017;3(6):423-431. doi:10.1016/j.sleh.2017.08.004; Danner F, Phillips B. Adolescent sleep, school start times, and teen motor vehicle crashes. *J Clin Sleep Med*. Dec 15 2008;4(6):533-5.

[280] Tandon PS, Zhou C, Hogan CM, Christakis DA. Cell Phone Use Policies in US Middle and High Schools. *JAMA Netw Open*. May 1 2020;3(5):e205183. doi:10.1001/jamanetworkopen.2020.5183
Christakis DA, Mathew GM, Reichebberger DA, Rodriguez IR, Ren B, Hale L. Adolescent smartphone use during school hours. *JAMA Peds*. In press

[281] Wadsley M, Ihssen N. A Systematic Review of Structural and Functional MRI Studies Investigating Social Networking Site Use. *Brain Sciences*. 2023;13(5):787.

Furthermore, while the evidence reviewed herein will be deliberately limited to social media use and sleep, there is a broader literature linking *overall* screen use to disordered sleep and as discussed in section elsewhere in this report, social media use constitutes a significant percentage of that use. In fact, 60% of emerging adults report using screens and social media prior to bedtime.[282] Reviewing the totality of existing data, a recent expert consensus panel (which I was a member of) convened by the National Sleep Foundation reached consensus meaning that at least 80% of the 16 experts agreed that: (1) in general, screen use impairs sleep health among children and adolescents, (2) the content of screen use before sleep impairs sleep health of children and adolescents, and (3) behavioral strategies and interventions may attenuate the negative effects of screen use on sleep health.[283] I would assert that it's the presentation of content that impairs sleep, as well as addictive features such as infinite scroll that directly contribute to impairing sleep.

Let us now apply the distinction between confounding and mediating (discussed above) where the outcome is sleep. Consider the summation of the findings of a study by Viner et al[284] that is referenced in a TikTok memo:

> We found that strong, longitudinal associations between very frequent social media use and mental health and well-being in girls were largely ***mediated*** by cyberbullying and the displacement of sleep and physical activity….. Our data suggests that interventions to reduce social media use to improve mental health might be misplaced. Preventive efforts should consider interventions to prevent or

[282] Hale L, Kirschen GW, LeBourgeois MK, et al. Youth Screen Media Habits and Sleep: Sleep-Friendly Screen Behavior Recommendations for Clinicians, Educators, and Parents. *Child Adolesc Psychiatr Clin N Am*. Apr 2018;27(2):229-245. doi:10.1016/j.chc.2017.11.014

[283] Hartstein LE, Mathew GM, Reichenberger DA, et al. The impact of screen use on sleep health across the lifespan: A National Sleep Foundation consensus statement. *Sleep Health*. Aug 2024;10(4):373-384. doi:10.1016/j.sleh.2024.05.001

[284] Viner RM, Gireesh A, Stiglic N, et al. Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: a secondary analysis of longitudinal data. *Lancet Child Adolesc Health*. Oct 2019;3(10):685-696. doi:10.1016/s2352-4642(19)30186-5

> increase resilience to cyberbullying and ensure adequate sleep and physical activity in young people."[285]

The memo heralds the "mediation" finding as proving that social media does *not* play a role in adverse mental health effects claiming instead that sleep, physical activity, and cyberbullying are to blame. But the paper reports that the association between social media use and mental health was *mediated* by cyberbullying, physical activity, and sleep, not *confounded* by them.[286] Social media sites can lead to cyberbullying, sleep disruptions, and reduced physical activity which in turn can negatively impact mental health. It is *through* them (along with other mechanisms) that social network sites affect mental health.

As for "preventive efforts" that might increase sleep and physical activity and promote resilience to cyberbullying, reduced screen time during the day (for physical activity) and at night (for sleep) would surely be part of any effective intervention. In fact, the same TikTok memo goes on to say, "When assessing and addressing TikTok's potential wellbeing impacts **we should consider not just how long children are using TikTok for but also when in the day they are doing so**."[287] And later still, the memo acknowledges: "Currently we send notifications to users during the school day in some cases, up until midnight, which could interfere with sleep."[288] Finally, social media mediation can actively reduce cyberbullying. For example, Instagram began using AI in 2017 to detect and suppress cyberbullying as TikTok itself calls out.[289]

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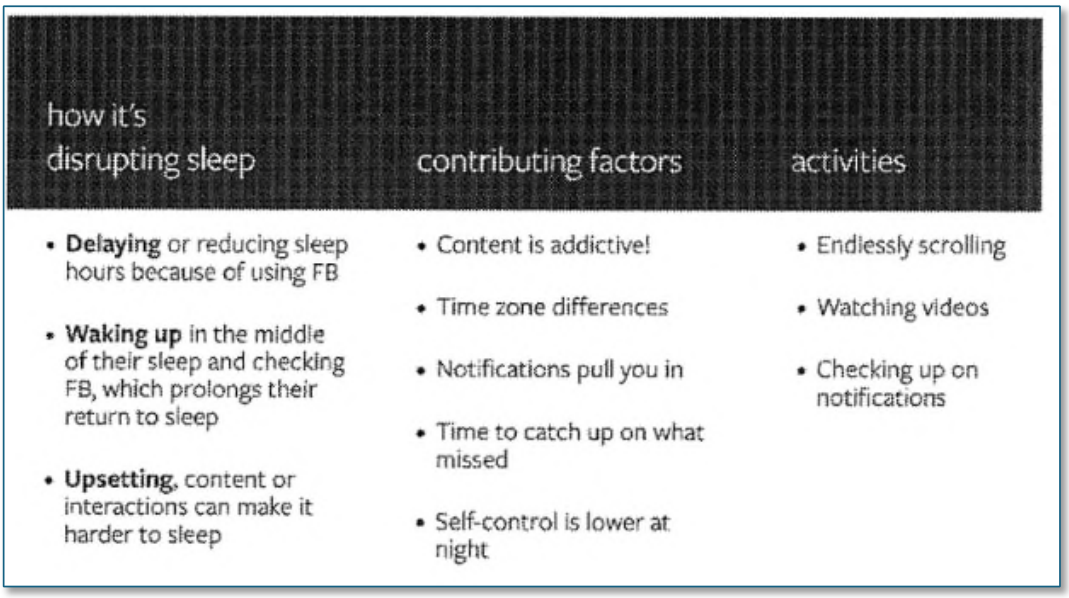
[285] TIKTOK3047MDL-002-00100445 (emphasis added)
[286] Viner RM, Gireesh A, Stiglic N, et al. Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: a secondary analysis of longitudinal data. *Lancet Child Adolesc Health*. Oct 2019;3(10):685-696. doi:10.1016/s2352-4642(19)30186-5
[287] TIKTOK3047MDL-002-00100441, -0448 (emphasis in original)
[288] TIKTOK3047MDL-002-00100441, -0452
[289] TIKTOK3047MDL-002-00100441, -0457

Meta was aware of the concern that Instagram usage was displacing sleep. Shruti Bhutada, wellbeing lead at Meta, made and circulated a graphic of the underlying ways she saw social media disrupting sleep:



Document 105: META3047MDL-019-00106590, -6592

Another former Meta employee, Kang-Xing Jin, testified in his deposition: "I think that's a reasonable high-level summary of what I would term the displacement of beneficial behaviors category of harms. And I think among those, for example, sleep is a very common one where, even if using Instagram or any other app on your phone late at night isn't inherently harmful, if it's actually causing you to get less sleep, my understanding is there's a fair amount of research that suggests enough sleep is important; right?"[290] Jin goes on to discuss the "platform's" vs the "individual's" agency with regard to features of Meta. He states:

> So using late-night notifications as an example, the platform exerts a fair amount of control through its defaults around, you know, whether, when, and to whom to send those notifications. And so that would fit into mechanics. And you could see

[290] Kang-Xing Jin Dep. Tr. at 397:10-20

> a place where, you know, decisions there may amplify some of these issues. And that's maybe somewhat distinct from tools and resources, where you could imagine the platform could also give people explicit controls to manage those notifications themselves and/or just upsell the system-level controls that already exist right?[291]

Instagram went so far as to document "late night use" which they defined as being on the site between 12 and 4 AM local time. They found that 43% of teen users had at least one late night session per week and 4.6% have one or more sessions every night.[292] As recently as 2022, over 2/3 of these late-night sessions are initiated by notification or a badge.[293] Mr. Volichenko's deposition quotes Ms. Hanko who states "For late night use, the negative impacts such as on work/school performance and mood, of little or poor sleep, especially on young people are well-documented."[294]

According to Volichenko, Meta considered instituting a "quiet mode" at night so that teens would not get notifications that might impede their sleep.[295] In fact, according to documents I have seen, that idea was first proposed before 2018. Meta knew that users--especially teens--were looking for solutions to curb late night use of their platforms. An early 2018 presentation titled "Time Spent: The Research Journey" reports that "teens said their phones were a constant distraction [during both the night and the day], both because of notifications and the convenience of immediate use."[296] Those teens also unanimously agreed that they would "use a feature that limited notifications to certain times a day.[297] In response to this feedback, Meta's researchers recommended "resurrect[ing] a product" internally referred to as "Quiet Mode" that was "shelved

[291] Kang-Xing Jin Dep. Tr. at 438:1-14
[292] META3047MDL-035-00005017 at Slide 12
[293] META3047MDL-035-00005017 at Slide 18
[294] George Volichenko Dep. Exhibit 5 at -2192
[295] George Volichenko Dep. Tr. at 141:14-143:2
[296] Snyder Exhibit 28 at Slide 5.
[297] Snyder Exhibit 28 at Slide 5.

because product focused on the negative." Snyder Exhibit 28 at Slide 9; *see also* Snyder Ex. 24 at -6820 (Proposing an "'Off' Mode setting one can enable to lock oneself out of FB at set times (like at school, work, or at bedtime" as early as 2017.) Instagram did not launch Quiet Mode until 2023.

Launching "quiet mode" took a fair amount of convincing of senior leadership. Jayakumar states in her deposition:

> I think it was a little challenging. I think while we generally had consensus that quiet mode, you know, sounded like a good idea in theory, we needed to really do a lot of research into what the impact might be on the platform, on engagement, on, you know, growth, I suppose is the shorter way of putting it.[298]

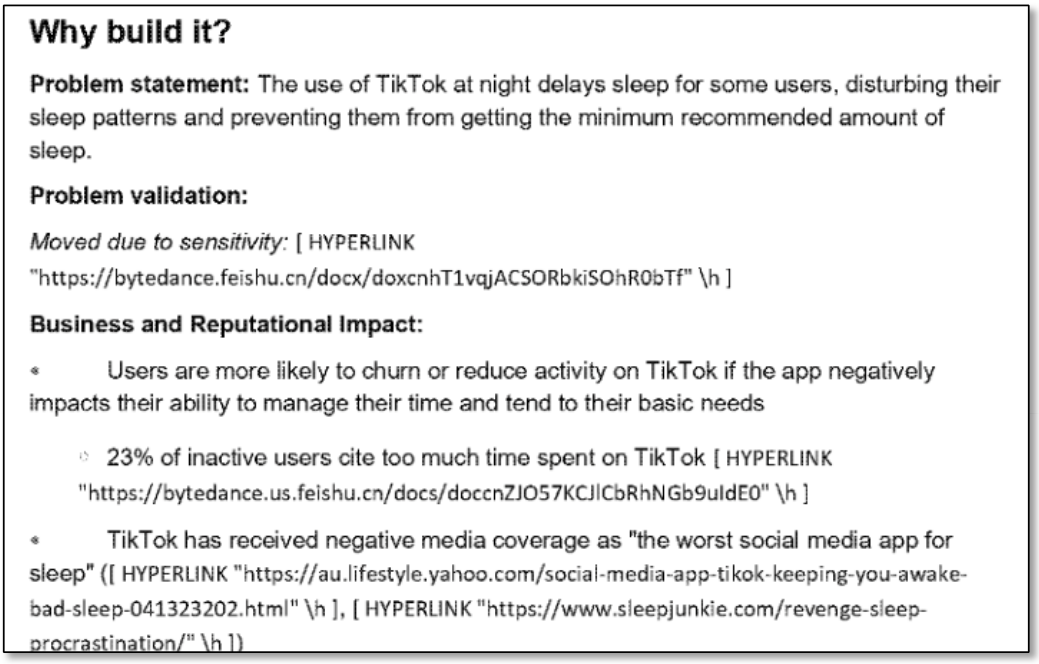
Instagram finally launched quiet mode in 2023 (at least five years after it was first proposed). But it was not launched as a "default" setting and as Jayakumar attested 6 out of 10 teens report never consider changing their settings from the "default ones."[299] Furthermore, as part of "quiet mode" the team considered and rejected making the screen be black and white – rather than color—to be less stimulating after hours.

Not surprisingly then, once launched and tested, "quiet mode" was found to result in a 0.3 percent (and not statistically significant) reduction in late night usage over 7 days.[300] When they looked at a 28-day window they found a reduction of 0.38% that was statistically significant.[301] But both of these effect sizes are *de minimis* or, in Volichenko's words "very small."[302] Quiet Mode was launched as a proven ineffective mechanism to reduce late night engagement but it "checked the box" of giving the appearance that Instagram was taking steps to curb problematic

[298] Vaishnavi Jayakumar Dep. Tr. at 150:13-19
[299] Vaishnavi Jayakumar Dep. Tr. at 74:13-19
[300] George Volichenko Dep. Exhibit 7 at -4278
[301] George Volichenko Dep. Exhibit 7 at -4271
[302] George Volichenko Dep. Tr. at 151:1-2

use to mitigate litigation risk.[303] Volichenko himself states that his supervisor, Ms. Gargi, did "not put teen safety first."[304]

TikTok also recognizes (admits) that its app negatively impacts sleep which motivated them to develop some functionality to diminish use late at night.



Why build it?

Problem statement: The use of TikTok at night delays sleep for some users, disturbing their sleep patterns and preventing them from getting the minimum recommended amount of sleep.

Problem validation:

Moved due to sensitivity: [HYPERLINK "https://bytedance.feishu.cn/docx/doxcnhT1vqjACSORbkiSOhR0bTf" \h]

Business and Reputational Impact:

- Users are more likely to churn or reduce activity on TikTok if the app negatively impacts their ability to manage their time and tend to their basic needs
  - 23% of inactive users cite too much time spent on TikTok [HYPERLINK "https://bytedance.us.feishu.cn/docs/doccnZJO57KCJlCbRhNGb9uIdE0" \h]
- TikTok has received negative media coverage as "the worst social media app for sleep" ([HYPERLINK "https://au.lifestyle.yahoo.com/social-media-app-tikok-keeping-you-awake-bad-sleep-041323202.html" \h], [HYPERLINK "https://www.sleepjunkie.com/revenge-sleep-procrastination/" \h])

Document 106: TIKTOK3047MDL-010-00329290, -9294

In particular, TikTok was cognizant of the UK's Age-Appropriate Design Code (AADC) and its California counterpart that both list "interrupted or inadequate sleep patterns" as a potential risk to be assessed and mitigated. [305]

Consistent with their corporate culture, designing a sleep reminder system was first subjected to A/B testing to ensure that it did not hit the guardrail of hurting daily active use (DAU).

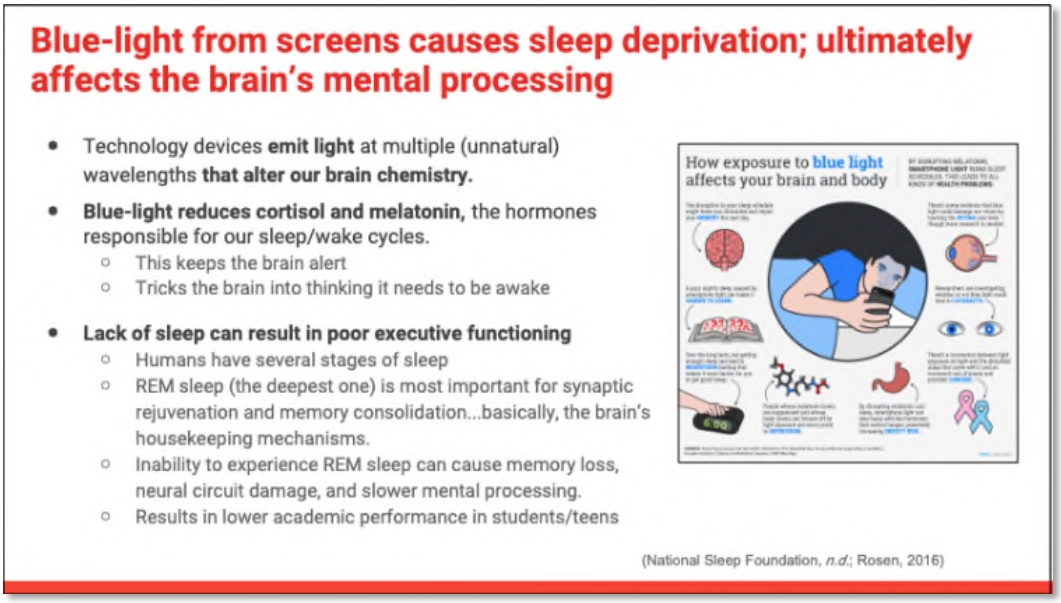
[303] George Volichenko Dep. Tr. at 74:23-75:8
[304] George Volichenko Dep. Tr. at 154:8-13
[305] TIKTOK3047MDL-010-00329290, -9295

Success - Secondary	Adoption of Sleep Reminders	Sleep Reminder DAU (% of total DAU with a sleep reminder configured)	0.10% of DAU, measured 2 weeks after launch
	Increase adoption of Screen Time Management features	Screen Time Management DAU (% of Total DAU)	Small increase
	Positive brand safety impact	Positive media/regulator feedback	-
Guardrail	Observe trade-offs and impact	Total stay duration / user	Fluctuate / Very small decrease
		Publish / user	No impact
		App uninstall rate	Small decrease

Document 107: TIKTOK3047MDL-010-00329290, -9297

YouTube data from 2016, early in the platform's history, found that 27% of 18–24-year-olds report that it is cutting into their sleep time.[306] Relatedly, 45.9% of young adults report staying on YouTube longer than they should which, per Google's own report, led to the "insight" that "some of the heaviest users on our platform don't report any well-being effects and aren't aware of how usage affects them.[307] Further, a 2018 YouTube internal presentation on what is "known about video effects," includes the following:

[306] GOOG-3047MDL-00236723 at Slide 9
[307] GOOG-3047MDL-00236723 at Slide 10

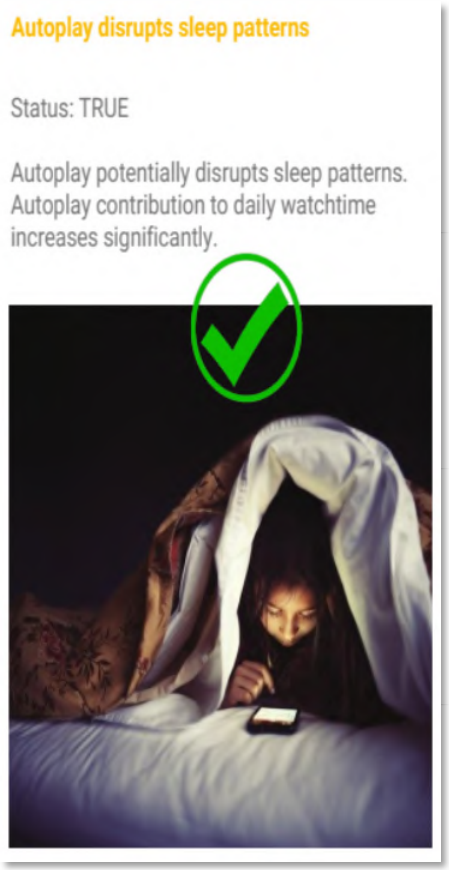


Document 108: GOOG-3047MDL-00874191 at Slide 23

Document 109: GOOG-3047MDL-01371645 at Slide 73

27.3% of YouTubers believe it cuts into their sleep and the median "bedtime" for 13–17-year-olds on weeknights is after 10:15 PM local time. Remember that median is the midpoint meaning over

½ are on it after that time. 12% of total watchtime occurs between 12 AM to 6 AM.[308] The full range of their data, while known to them, is not in this document. "Autoplay watch time contribution triples during the night."[309] Finally, in a presentation allegedly adjudicating allegations made about YouTube, the slide to the right which speaks for itself appears.



Document 110: Cristos Goodrow Dep. Exhibit 7 at p. 34

In my opinion, to a reasonable degree of medical and scientific certainty, a causal relationship exists between social media use and sleep problems. Furthermore, there is ample evidence internally that use of Meta, Snap, TikTok and Google social media platforms disrupt

[308] Cristos Goodrow Dep. Exhibit 7 at p. 15
[309] Cristos Goodrow Dep. Exhibit at 7 at p. 16

sleep. The actions Defendants took to mitigate these problems, if any, were weighed against the impact they would have on their core metrics, and ultimately on their bottom line, and were minimally effective by design.

D. Depression and Anxiety

Depression and anxiety are closely intertwined, with many individuals experiencing symptoms of both conditions simultaneously. While they are distinct mental health disorders, they often co-occur, creating a cycle of emotional and physical challenges that can amplify their individual impacts. Depression is primarily characterized by persistent feelings of sadness, hopelessness, and a loss of interest in previously enjoyable activities. On the other hand, anxiety involves excessive worry, fear, and a heightened state of arousal or tension. Despite these differences, they share common symptoms such as fatigue, difficulty concentrating, and sleep disturbances, making it difficult to differentiate between the two at times.

The relationship between depression and anxiety can be explained through shared biological, psychological, and environmental factors. Biologically, both conditions are associated with dysregulation in the brain's neurotransmitters, particularly serotonin, dopamine, and norepinephrine. This overlap suggests that individuals predisposed to one condition may have an increased risk of developing the other. Psychologically, negative thought patterns such as catastrophizing or ruminating can fuel both anxiety and depression, creating a feedback loop where worry about the future exacerbates feelings of hopelessness and vice versa. Environmental factors, such as chronic stress, trauma, or significant life changes, can also act as triggers for both conditions.

This interrelationship is reflected in the scientific literature where studies often evaluate both depression and anxiety simultaneously in the context of the same research protocol often

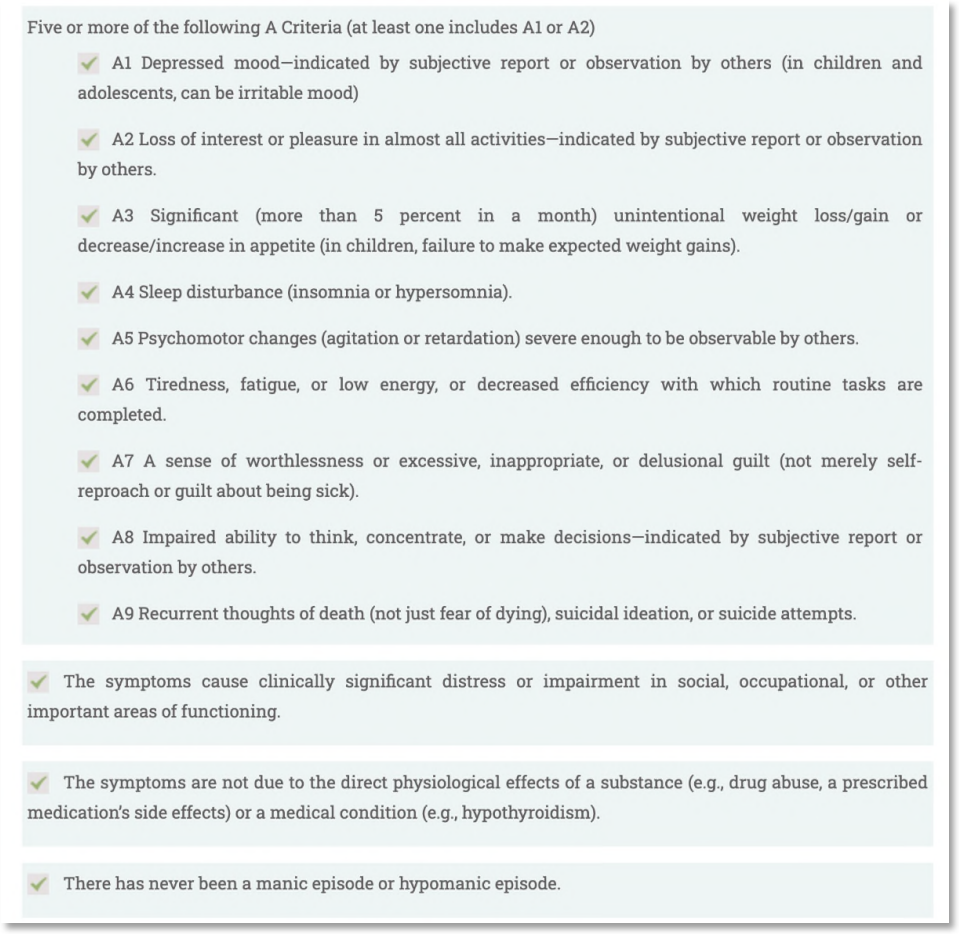
labeling them as "internalizing" symptoms. Depression and anxiety are mutually enhancing as reflected by the bidirectional arrow between them. Therefore, studies showing an increase in either can be interpreted as demonstrating an increase in both. Similarly, sleep problems, body image and self-esteem issues (addressed in other parts of this Section X) also increase the risk of both anxiety and depression. Shruti Bhutada (IG Well-Being User Experience Researcher) states, "Social Media is often not the cause of problems related to mental health. However, it can and does both attenuate and exacerbate a user's experience with mental health issues."[310]

i) Depression

Depression is a clinically diagnosable mental health disorder characterized by persistent and pervasive feelings of sadness, hopelessness, and a lack of interest or pleasure in activities, often accompanied by physical symptoms such as changes in appetite, sleep disturbances, and fatigue. A clinical diagnosis of "depression" entails having a constellation of "depressive" symptoms of sufficient intensity and frequency absent an alternative explanation for them. The DSMV-R criteria for depression are below:

[310] META3047MDL-019-00106371, -6371

Figure 32: DSMV-R Criteria for Depression



Depression typically lasts for weeks or longer and significantly impairs an individual's ability to function in daily life. While depressive symptoms can be part of a broader diagnosis of depression, they may also appear independently and be a cause of distress without reaching a clinical diagnostic threshold. Accordingly, some studies, and hence some meta-analyses, use depressive *symptoms* while others use the clinical diagnosis of depression. For example, the CDC as part of its ongoing Youth Risk Behavior Survey (YRBS) has been assessing adolescents'

feelings of sadness or hopelessness during the past year as well as whether they have seriously considered attempting suicide. It recently published 10-year trend data shown below.[311]

[311] Black MH, Milbourn B, Chen NTM, et al. The use of wearable technology to measure and support abilities, disabilities and functional skills in autistic youth: a scoping review. *Scandinavian Journal of Child and Adolescent Psychiatry and Psychology*. 2020;8(1):48-69. doi:doi:10.21307/sjcapp-2020-006

Figure 33: Prevalence of Suicidal Ideation Over Time

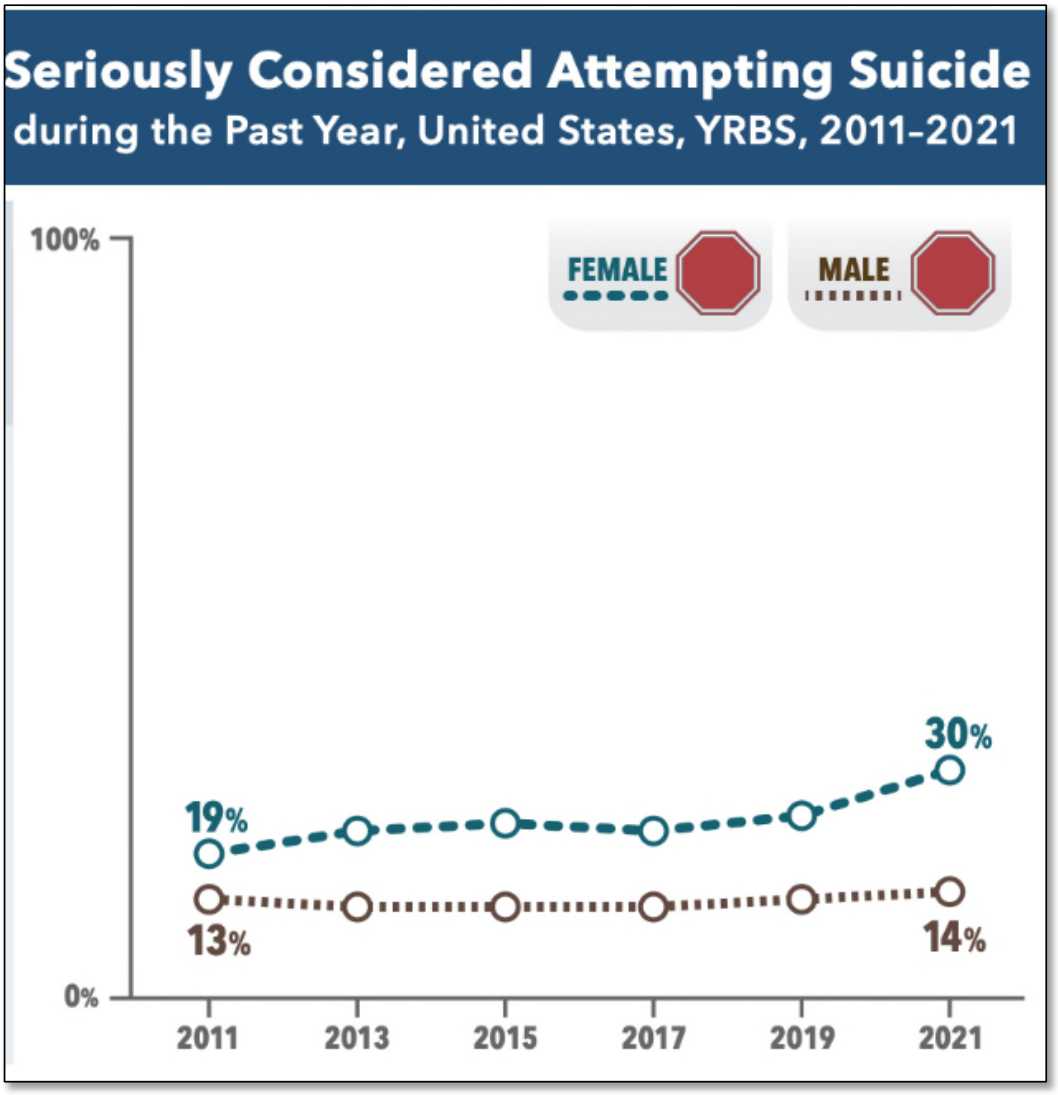
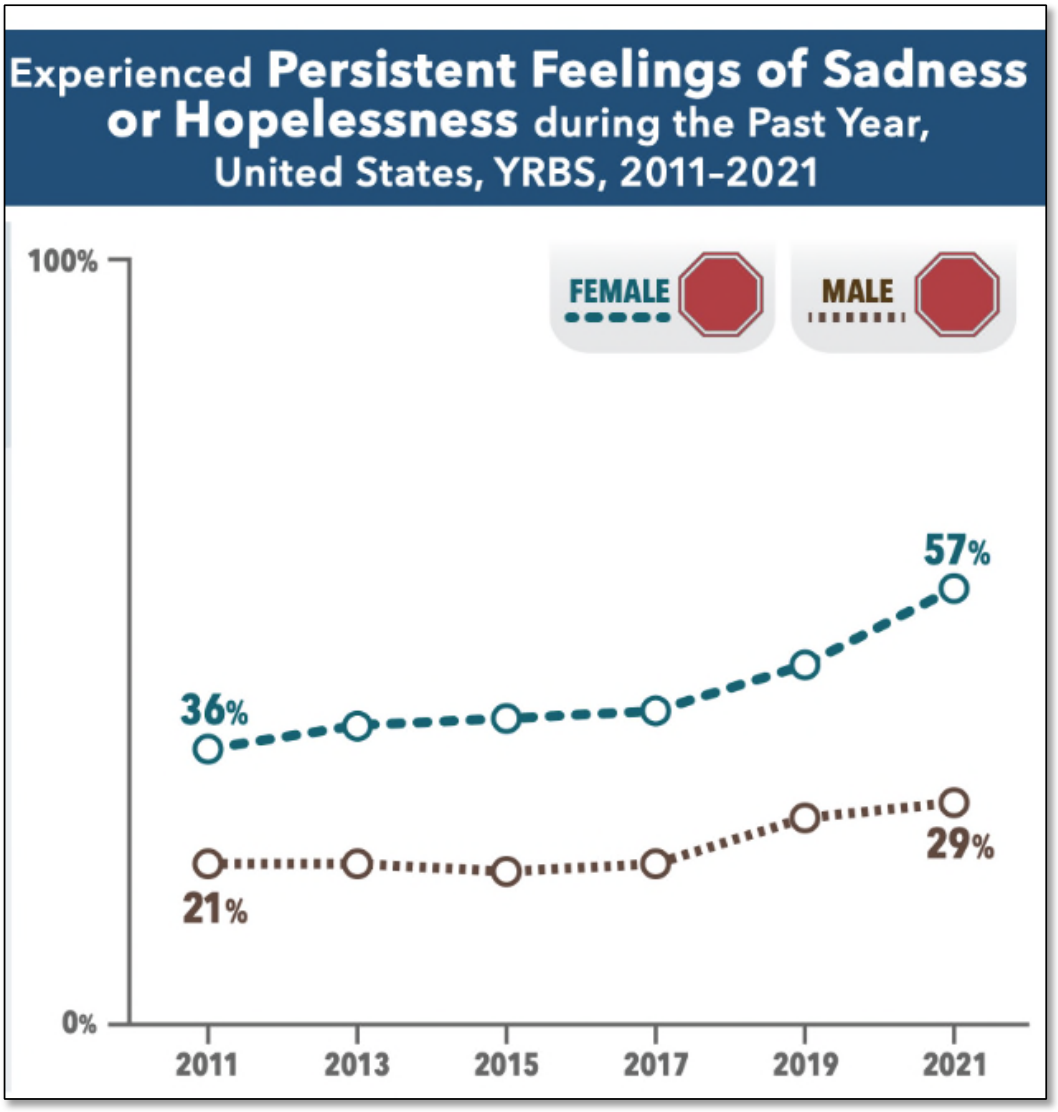


Figure 34: Prevalence of Sadness over Time

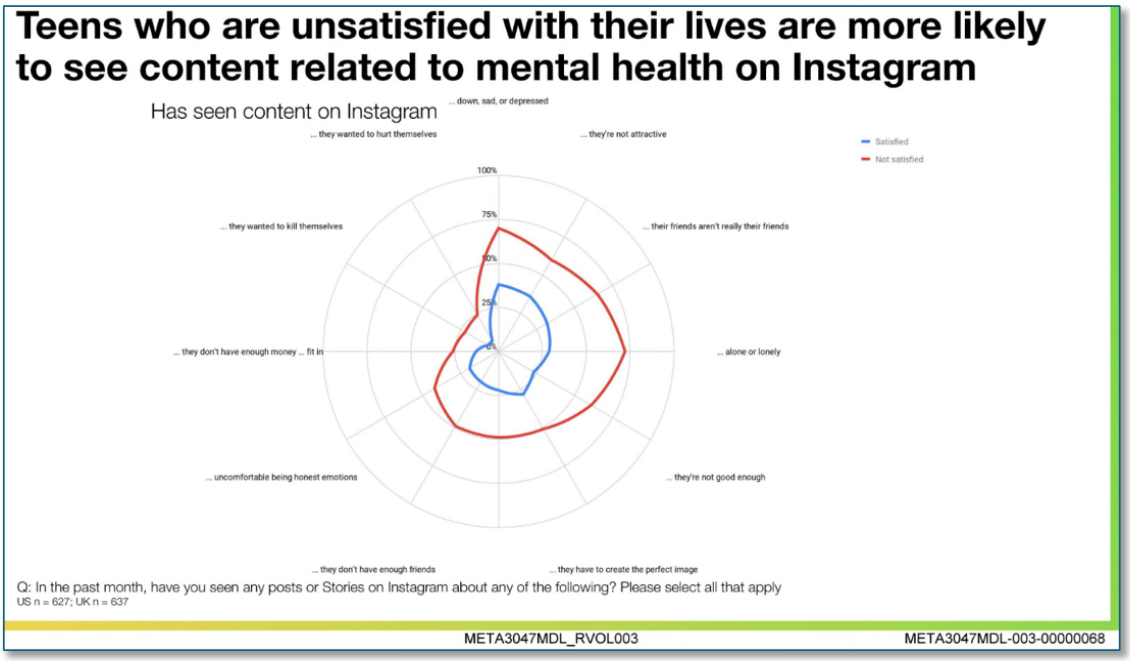


While not measures of clinical (DSMV-R) "depression," these data (particularly for females) have caused many to declare a "public health crisis" for teenagers in America and some

have implicated social media usage as the cause.[312] Although it is true that the rise of these depressive symptoms and the increase in depression and anxiety diagnoses mirror the rise of social media usage, that correlation in and of itself does not prove causation.

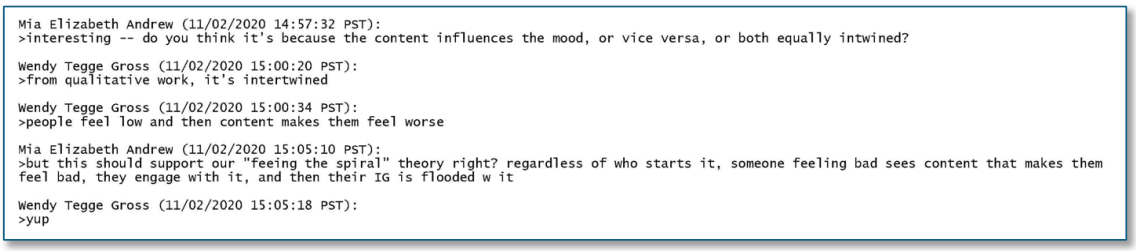
Sadly, as the slide below shows, Meta's own internal analysis reveals that the algorithms bring mental health related content to the fore more frequently for those who report being unsatisfied with their lives. For teens already prone to—or exhibiting—depressive symptoms, this sets up a very real potential negative feedback loop that both exacerbates symptoms and promotes negative content.

[312] Twenge JM. *iGEN: Why Today's Super-Connected Kids Are Growing Up Less Rebellious, More Tolerant, Less Happy-- And Completely Unprepared For Adulthood And (What This Means For The Rest Of Us)*. Atria Books; 2017:viii, 342 pages;
Haidt J. *The anxious generation : how the great rewiring of childhood is causing an epidemic of mental illness*. Penguin Press; 2024: 385 pages; Twenge JM. Increases in Depression, Self-Harm, and Suicide Among U.S. Adolescents After 2012 and Links to Technology Use: Possible Mechanisms. *Psychiatr Res Clin Pract*. Summer 2020;2(1):19-25. doi:10.1176/appi.prcp.20190015.



Document 111: META3047MDL-003-00000029, -0068

Instagram leaders had a name for the process their algorithms created, "fee[d]ing the spiral," as documented in this chat exchange between Mia Andrew and Wendy Gross (Head of Marketing Insights):



Document 112: META3047MDL-003-00121808, -1808

A 2021 metanalysis of 62 studies evaluating social media usage and depression symptoms found a significant but "weak" association (r=.11). However, the association between problematic

social media use and depressive symptoms was moderate (r=.29).[313] The majority of the included studies were observational, cross-sectional, and relied on self-report of social media usage, weaknesses that reflect the current state of existing knowledge as well as the quality of the data available to most scientists outside of industry. A recent meta-analysis found that the risk of depression increased 13% with each hour of daily social media use.[314] In the chapter regarding social media use and depressive symptoms, the authors concluded that there are "consistent links between social media use and depression and evidence of causality."[315]

One of the largest and best longitudinal, observational studies followed 6,595 subjects between 2013 to 2016 as part of the Population Assessment of Tobacco and Health (PATH) study. Participants' self-reported social media usage at ages 13-16 was used to predict depression and anxiety (internalizing) symptoms at ages 14-17 adjusting for baseline (ages 12-15) internalizing problems. Three to six hours of social media at ages 13-16 was associated with a 60% increased relative risk of internalizing problems at ages 14-17 and greater than 6 hours per day was associated with a 78% increased risk.[316] Recall that the median use of TikTok per day is approximately 2 hours and the 75th percentile is 3.

A subsequent systematic review of longitudinal studies of "screen time" and mental health in young people reported that 1.5 out of 4 studies of social media usage found associations for

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[313] Cunningham S, Hudson CC, Harkness K. Social Media and Depression Symptoms: a Meta-Analysis. *Res Child Adolesc Psychopathol*. Feb 2021;49(2):241-253. doi:10.1007/s10802-020-00715-7

[314] Liu M, Kamper-DeMarco KE, Zhang J, Xiao J, Dong D, Xue P. Time spent on social media and risk of depression in adolescents: a dose–response metaanalysis. Int J Environ Res Public Health. 2022:19

[315] Handbook of Children and Screens, p.139.

[316] Riehm KE, Feder KA, Tormohlen KN, et al. Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. *JAMA Psychiatry*. 2019;76(12):1266-1273. doi:10.1001/jamapsychiatry.2019.2325

depression and 2 out of 2 found associations for internalizing symptoms (including the PATH study cited above).[317] Overall, the authors conclude that there are small (r=.10) but significant associations between screen time and depressive symptoms in adolescents.[318]

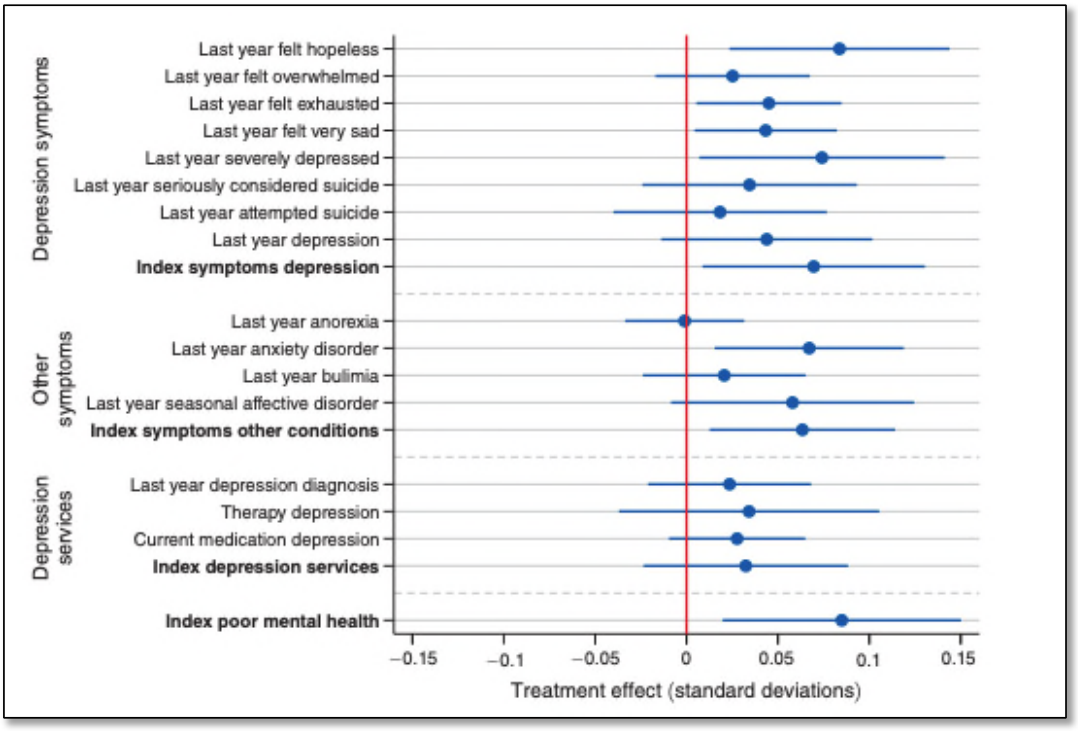
Not included in that systematic review, because it was published subsequent to it, is perhaps the best observational study to date. Braghieri et al deployed a "quasi-experimental" design wherein they tested the effect of the "rollout" of Facebook to 775 college campuses between 2004 (the year it launched) to 2006.[319] Mental health outcomes were derived from the NHCA survey that is administered on a semi-annual basis to US college students since 1998. It includes many questions related to psychological health and well-being and the researchers used all of them to create a composite score. The individual outcomes and the composite one are displayed to the right. The blue "dots" represent the point estimates and the bars represent the 95% confidence intervals. Being on the right of the red line means the outcome is worse than before. Dots with bars that do not cross the red midline are statistically significant.

[317] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clinical Psychology Review*. 2021/06/01/ 2021;86:102021. doi:https://doi.org/10.1016/j.cpr.2021.102021

[318] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clinical Psychology Review*. 2021/06/01/ 2021;86:102021. doi:https://doi.org/10.1016/j.cpr.2021.102021

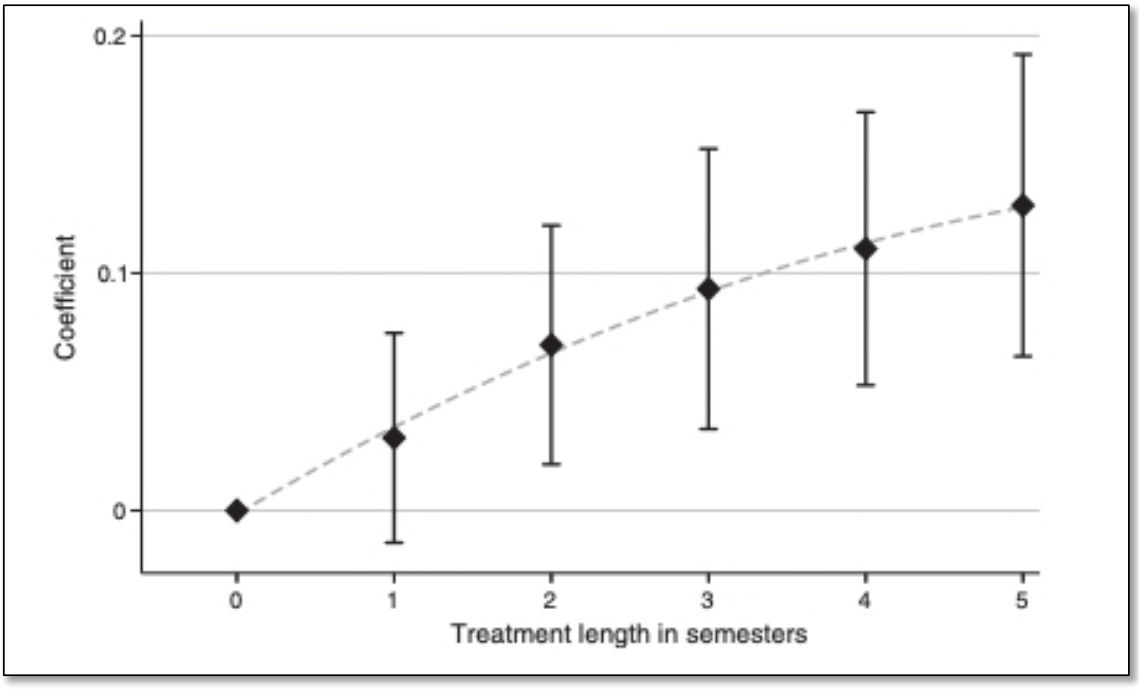
[319] Braghieri L, Levy Re, Makarin A. Social Media and Mental Health. *American Economic Review*. 2022;112(11):3660–93. doi:10.1257/aer.20211218

Figure 35: Effects of Introduction of Facebook to College Campuses



As can be seen, all but one of the dots falls to the right of the red line and the summary estimate is that the introduction of Facebook to a college campus resulted in statistically significant a .085 standard deviation unit decrease in overall mental health at that campus. To help benchmark that estimate, the authors compare it to the effect of job loss and find it to be about 22% of that. They further estimate that the introduction of Facebook to a college campus increases the percent of students who would meet the clinical diagnosis of depression or anxiety by 2%. Given a baseline estimate of 25% for depression and 16% for anxiety, this represents an 8% and 13% relative increase of each respectively. Next, the authors conducted a "dose-response" analysis in which they estimate the mental health effects based on the number of semesters given students were exposed. Those results are shown in the figure below.

Figure 36: Effect on Mental Health on College Campuses by Exposure to Facebook

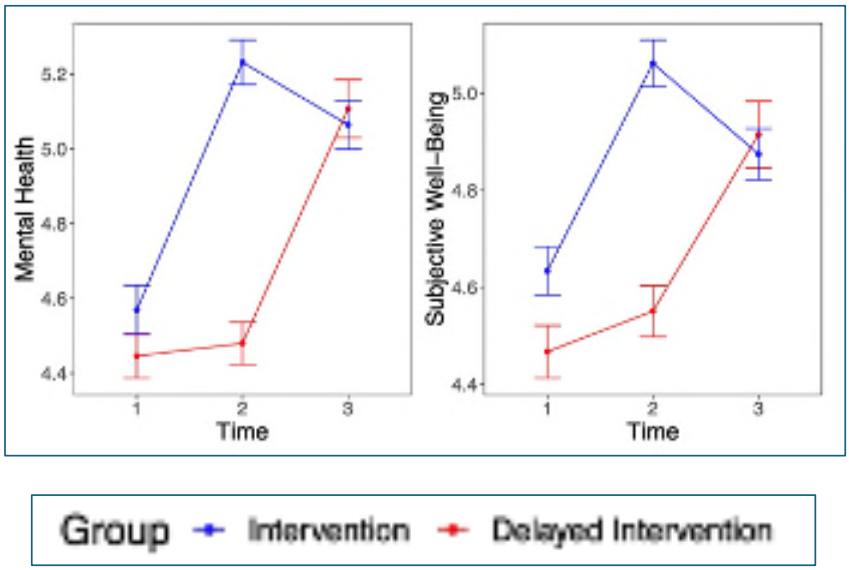


Again, these findings are consistent with the hypothesis that additional exposure to Facebook results in increased risk of poorer mental health at the campus level.

Two features of this analysis make the estimates conservative. First, the observed effect is at the *college* level without knowledge of whether or not individuals actually used Facebook or not. For example, if only 50% of students at college Y signed up for it, then the measured effect is diluted by the 50% that did not. Second, the selected years were just after the launch of Facebook when friends were largely limited to other college students, considerably less content was available (infinite scroll had not yet been invented), and sophisticated algorithms had not yet been deployed. In effect then, the study measured the impact of what by today's standards is an anemic version of Facebook and social media in general in terms of its command of one's attention, its ability to deliver maximally engaging content, and the amount and type of content delivered.

A just published experimental trial used a "blocking" technology to effectively make smart phones "dumb" for 2 weeks by preventing them from accessing WiFi and the internet but allowing calls and text messages.[320] Over a four week trial, they assessed attention, mental health, and subjective well-being in 467 adults who were randomly assigned to use the blocker for the first two weeks or the last two weeks. The results on mental health and well-being are presented below.[321]

Figure 37: Mental Health and Subjective Well-Being



Both mental health and subjective well-being improved from T1 to T2 (baseline to 2 weeks later) and then regressed somewhat after the blocking was turned off (Effect Sizes .57 & .46 respectively p<.001). Similarly, the delayed intervention group saw considerable improvements

[320] Castelo N, Kushlev K, Ward AF, Esterman M, Reiner PB. Blocking mobile internet on smartphones improves sustained attention, mental health, and subjective well-being. *PNAS Nexus*. 2025;4(2)doi:10.1093/pnasnexus/pgaf017

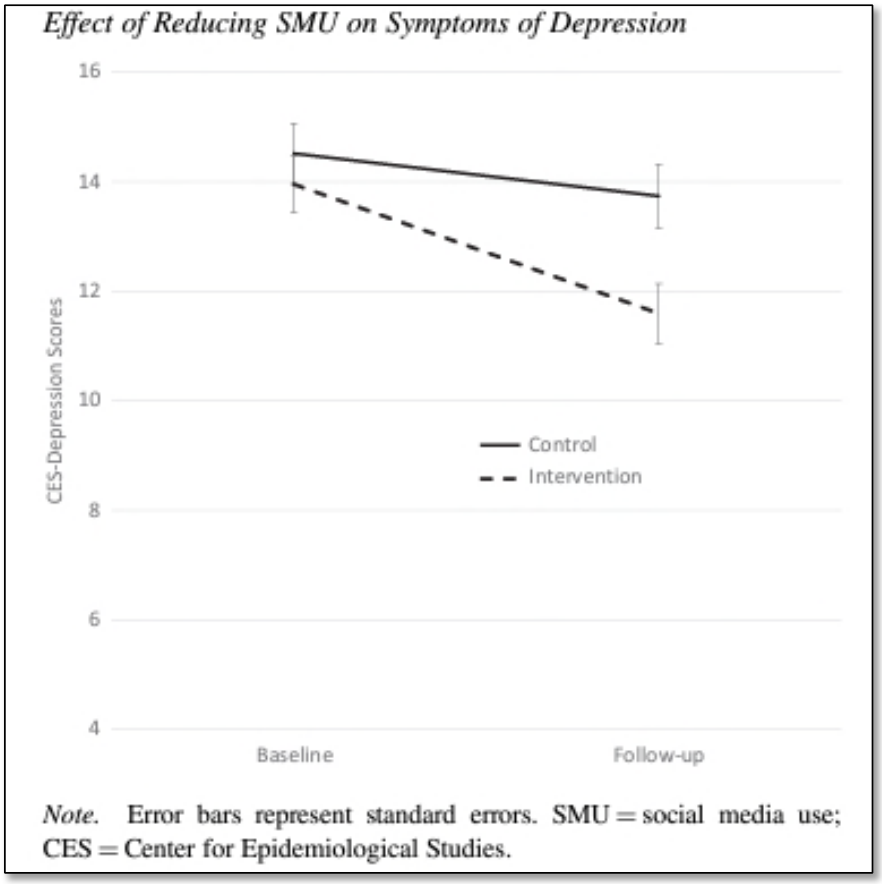
[321] Castelo N, Kushlev K, Ward AF, Esterman M, Reiner PB. Blocking mobile internet on smartphones improves sustained attention, mental health, and subjective well-being. *PNAS Nexus*. 2025;4(2)doi:10.1093/pnasnexus/pgaf017 at 4.

in both once they got the blocking program installed at T2. Although the blocking software would effectively prohibit all internet use, based on the preponderance of time spent on social media, it predominately reduced time on them.

Finally, the Davis social media reduction trial (discussed in Section VII.F) also assessed depression after three weeks of a 50% reduction in social media use.[322] Those results, presented below, show a difference of 2.36 points on the Center for Epidemiologic Studies of Depression Scale 10 (CES-D10) after the 3-week intervention.

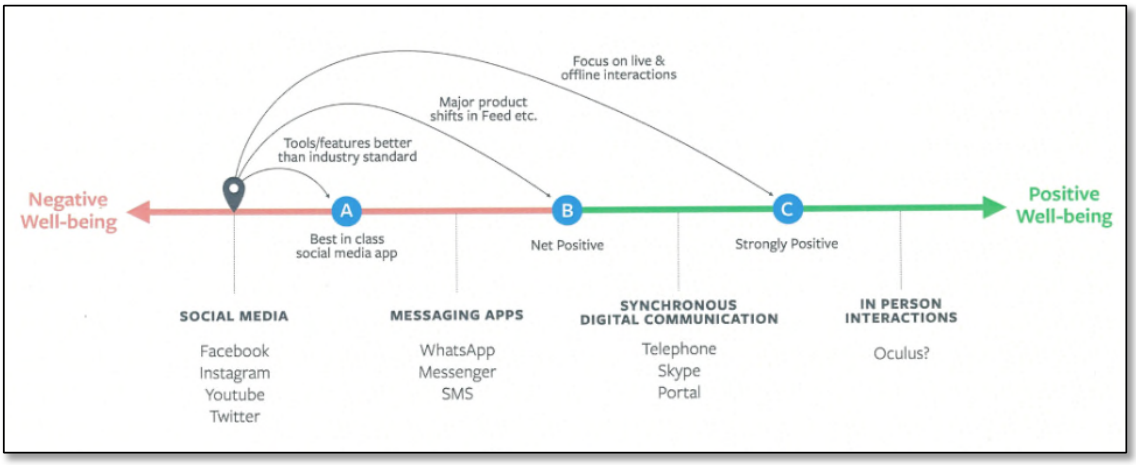
[322] Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. *Psychology of Popular Media*. 2025;14(1):1-11. doi:10.1037/ppm0000536

Figure 38: Effect of Reducing SMU on Symptoms of Depression



Although a clinically meaningful difference in the CES-D10 has not been widely established, the observed effect size in this study (Cohen's d) is .42 (.50 =medium). One important distinction of this study is that participants needed to be showing signs of distress at enrollment to be eligible for inclusion. The baseline average score on the CES-D10 was over 14 with above 10 being a clinically concerning score, and over 70% of subjects were above that threshold. As the authors indicate, it may be that social media usage is especially harmful to the mental health of individuals who are already showing signs of mental distress.

For its part, in 2019, Meta conceded that the average net effect of Facebook on well-being was slightly negative, a finding that was directly communicated to Mark Zuckerberg.[323] Its aspiration was to evolve into being on balance slightly net positive (a goal that was considered "really hard" to achieve).[324] Below is a figure presented at a meeting at which Sheryl Sandberg, COO of Facebook at the time, was allegedly present.



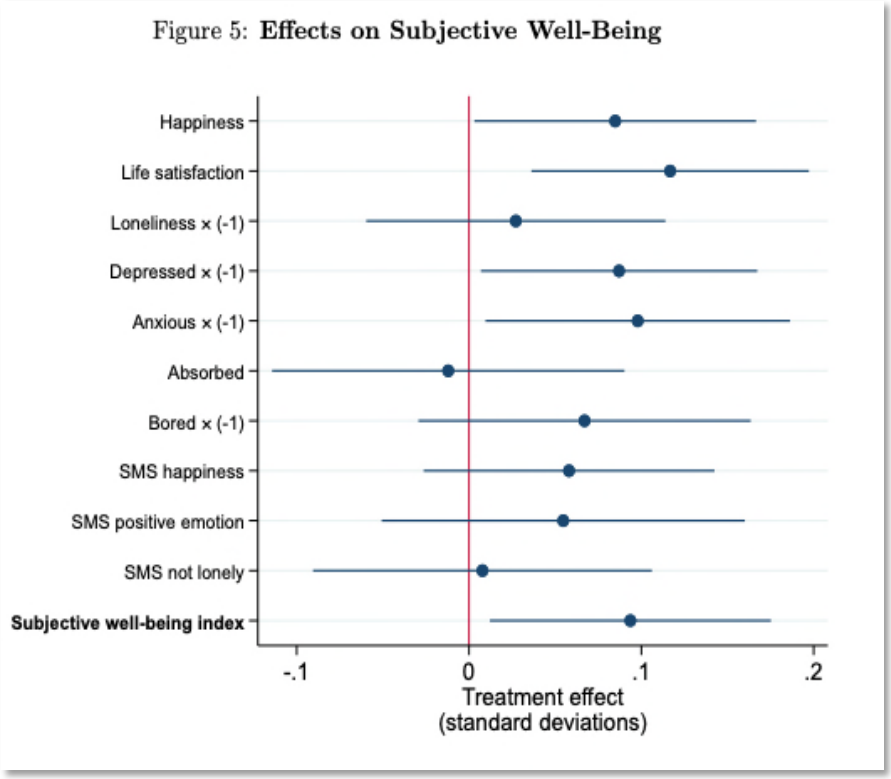
Document 113: META3047MDL-003-00086233, -6243

The largest publicly available experiment of Facebook effects is a National Bureau of Economic Research (NBER) working paper entitled "The Welfare Effects of Social Media,"[325] a study that Dr Burke is aware of and says can be "taken seriously."[326] In it, the authors recruited 2,743 users and elicited their willingness to accept payment to deactivate their accounts. Those randomized to the "treatment group" were paid $102 to do so for four weeks (longer than the 1-

[323] Zuckerberg Dep. 263:17-265:20.
[324] Zuckerberg Dep. 261:7-11.
[325] Allcott H, Braghieri L, Eichmeyer S, Gentzkow M. The Welfare Effects of Social Media. *American Economic Review*. 2020;110(3):629–76. doi:10.1257/aer.20190658
[326] Moira Burke Dep. Tr. at 303:7-304:5

week threshold identified by Thrule as critical).[327] They measured a suite of outcomes using text message, surveys, and emails among other ways. Most relevant to this report are the items related to subjective well-being. As before, they looked at each item individually and then created a composite index of all of them.

Figure 39: Effects on Subjective Well-Being



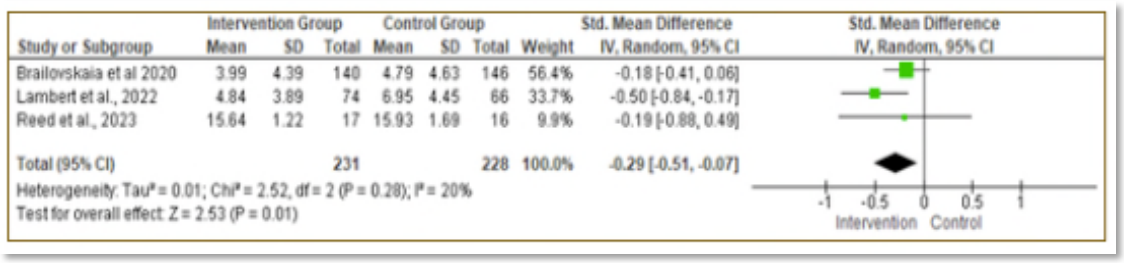
Again, to benchmark the effect size of .09, the authors compared it to the effectiveness of psychological interventions including self-help therapy, group training, and individual therapy. For those they used a summary estimate derived from a metanalysis of 39 randomized controlled

[327] Thrul J, Devkota J, AlJuboori D, Regan T, Alomairah S, Vidal C. Social media reduction or abstinence interventions are providing mental health benefits – reanalysis of a published meta-analysis. *Psychology of Popular Media*. In press;

trials. They concluded that deactivating Facebook increases subjective well-being by about 25-40% as much as standard psychological treatments, a key finding Meta cites in a presentation related to the potential harm it is causing in 2019.[328]

A metanalysis assessed the effects of experimental evaluations of "digital detox" on mental health outcomes. Again, these studies tested the putative benefits of a period of abstinence from social media sites.[329] There was considerable and statistically significant heterogeneity in both the approaches and the outcomes (p<.000001). While the overall effect of "detox" on well-being was null (which is not surprising given the heterogeneity) the effects on depression was moderate and significant with an effect size of -.29 (see below).

Figure 40: Summary of Metanalyses of Experimental Evaluations of 'Digital Detox on Mental Health Outcomes



This study also neglected to include the Allcott experiment for unclear reasons which would have further enhanced the results and made them more robust given its findings.[330]

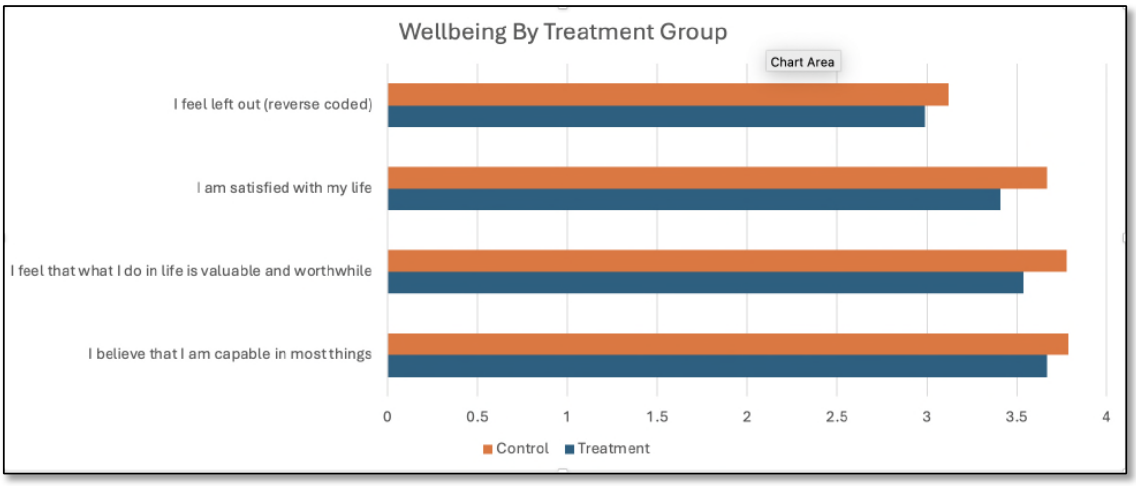
Meta itself conducted a study of 6,000 Instagram users to test the effect of social comparisons on affect. They did so by randomly sequencing questions related to overall well-being

[328] Haugen_00010114, -0123-24
[329] Ramadhan RN, Rampengan DD, Yumnanisha DA, et al. Impacts of digital social media detox for mental health: A systematic review and meta-analysis. *Narra J*. Aug 2024;4(2):e786. doi:10.52225/narra.v4i2.786
[330] Marciano L, Schulz PJ, Camerini A-L. Cyberbullying Perpetration and Victimization in Youth: A Meta-Analysis of Longitudinal Studies. *Journal of Computer-Mediated Communication*. 2020;25(2):163-181. doi:10.1093/jcmc/zmz031

and those related to negative social comparison. Below is a schematic recreated for image clarity from Haugen_00000797, -0864.

Document 114: Meta Trial of Instagram "Priming" Replicated from Haugen_00000864

Both groups were asked the same questions but in a different order. In this way, the study tested the effect of priming of negative social comparisons on Instagram. Priming is a psychological phenomenon where exposure to a stimulus influences how a person responds to subsequent, related stimuli, often without conscious awareness. For example, seeing the word "bakery" makes someone recognize the word "pie" faster than an unrelated word like "telephone." Below is a recreation (again for clarity) of a figure comparing responses to 4 of the 7 questions on the well-being assessment.



Document 115: Wellbeing Treatment Group Chart Replicated from Haugen_00000797, -0866

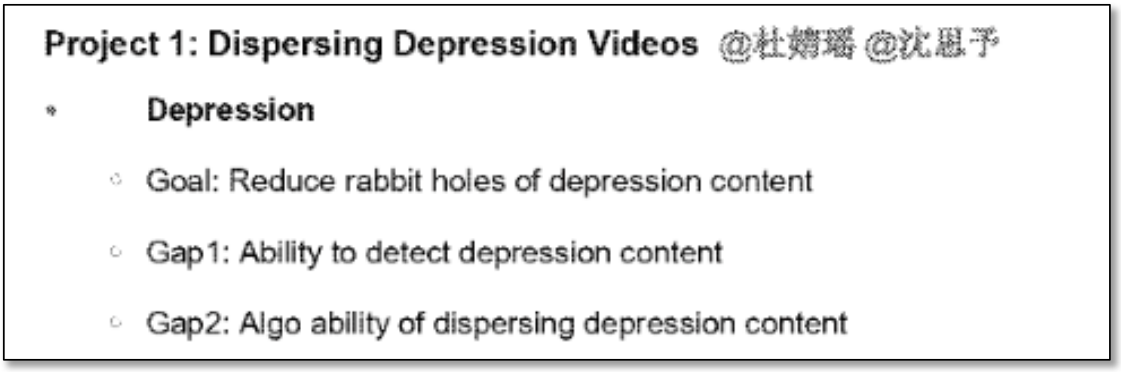
For 4 of the 7 questions, the experimental group that was primed fared worse as a result of it; the other 3 were not statistically different from one another. Given that this was an experimental design, the authors appropriately conclude that these associations are "causal."[331] What was experimentally manipulated here was thinking about negative social comparisons. While this was prompted in the context of the study design, in real life it presumably happens naturally when teens experience negative social comparisons on Instagram. Indeed, the majority (51%) of Instagram users report conducting social comparisons on the site.[332] For females in particular, these negative feelings of social comparison can lower self-esteem which, as reflected in in the conceptual model, Document 1, also leads to and exacerbates depression.

There are many explanations as to why social media use is linked to depression. Among the many mechanistic pathways (including loss of sleep, body dysmorphia, etc.) by which time spent on social media might adversely affect children's mental health and well-being, one must

[331] Haugen_00000797, -0865
[332] Haugen__00000797, 0797

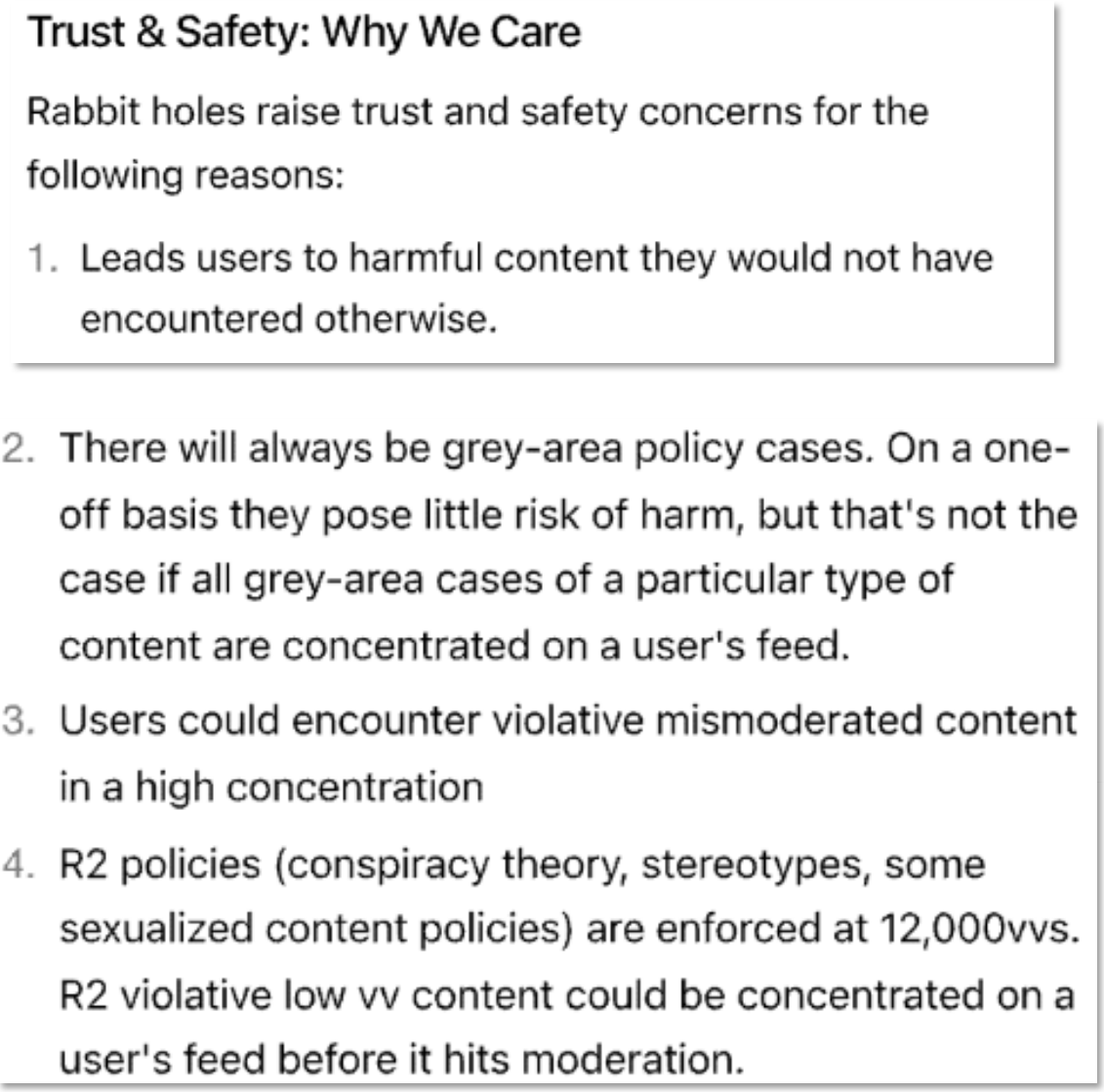
consider unwanted harmful online sexual experiences. This is addressed in detail in Section X.I below. Other pathways include features that lead to social comparison and negative body image and body image comparisons. Time spent on social media can replace otherwise positive mental health activities, including time with friends and family. Social media use can interfere with sleep, which is associated with depressive symptoms in children. Finally, rabbit holes can trap children in a depressive spiral.

For its part, TikTok's own documents reveal a recognition that their highly effective algorithms also can create "rabbit holes" that can cause people with depression to spiral.



Document 116: TIKTOK3047MDL-002-00094384, -4399

TikTok acknowledges the existence of "rabbit holes" created by their algorithms and the problems they can pose when they aggregate content:



Document 117: TIKTOK3047MDL-002-00064418, 4418-19

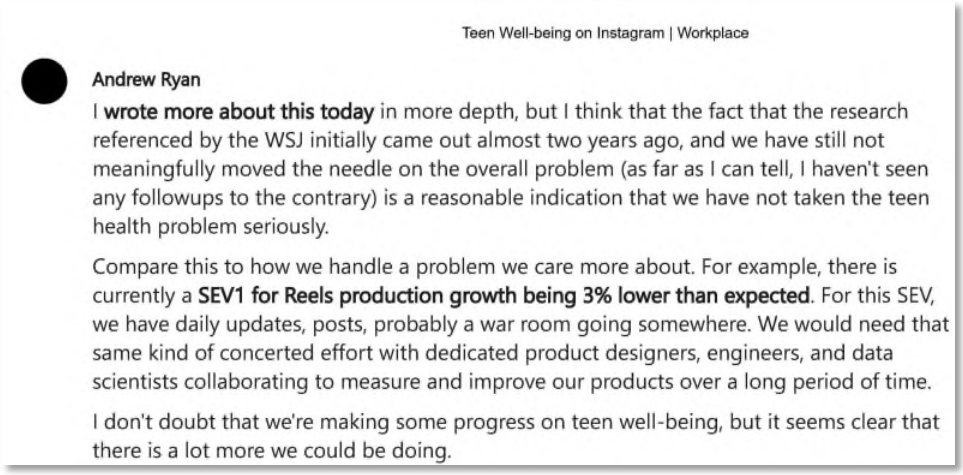
In fact, other documents call out what they refer to as a "negative affect filter bubble" in which a user "regularly sees depressing, triggering, or otherwise inappropriate content."[333] They estimate the "number of daily average users in such bubbles to be approximately 1%.[334] Based on

[333] TIKTOK3047MDL-002-00091521, -1524
[334] TIKTOK3047MDL-002-00091521, -1524

TikTok's daily average user data from 2022, this represents 6,955,514 13–17-year-olds and 20,599,455 18-24-year-olds.[335] Once again, small numbers (and small effects) applied at scale can affect lots of people.

Later in the same exchange, it is noted that "The filter bubble problem on TikTok was publicly broadcasted by the *Wall Street Journal*, very negatively affecting our brand image."[336] This last sentence epitomizes a pervasive attitude that is apparent in many internal company documents. A problem, "the negative affect filter bubble," that is recognized internally as existing, is given added saliency (and resource) once it is publicized and impacts image/revenue. This is corroborated (with respect to Meta) by Ms. Jayakumar in her deposition when she is asked "In your experience, did the amount of external scrutiny from the press regulators and civil advocacy groups play into the priorities that Meta leadership set internally?" and she replies "Yeah, significantly so."[337] Dr. Lee corroborates this in in an internal chat on 10/05/21 related to the Haugen leak, "Although I have real issues with how the whistleblower framed some of this work, I respect why she felt like this was the only way to push for change- if leadership heard this internally, it wouldn't have come to this."[338] Similarly, Andrew Ryan (FB Production Engineer) says in a 2021 chat that, prior to the leaks, the "teen health problem" had not been treated with sufficient urgency:

[335] TIKTOK3047MDL-002-00098058, -8060
[336] TIKTOK3047MDL-002-00091521, -1527
[337] Vaishnavi Jayakumar Dep. Tr. at 125:21-126:9
[338] Alison Lee Deposition Exhibit 13 at -1099



Teen Well-being on Instagram | Workplace

Andrew Ryan

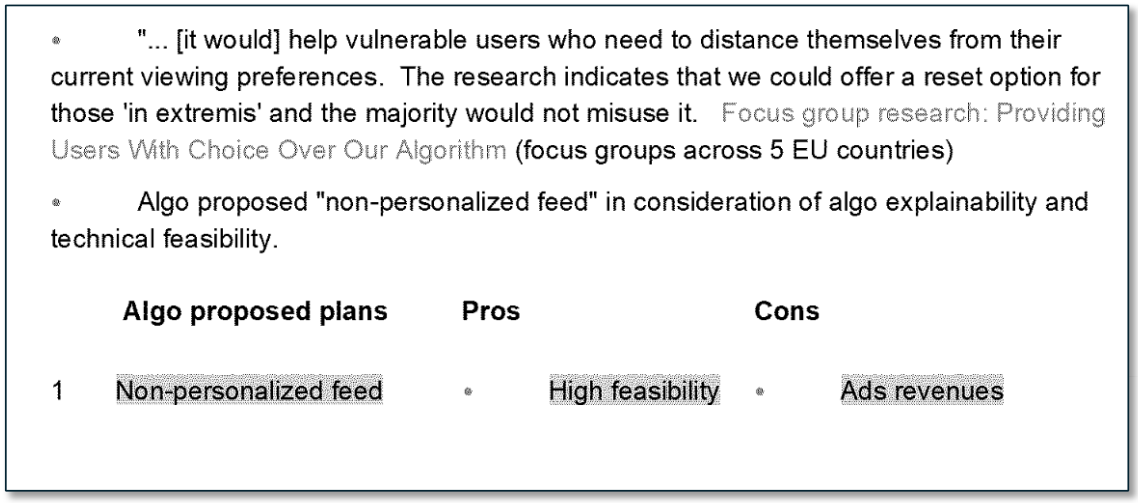
I **wrote more about this today** in more depth, but I think that the fact that the research referenced by the WSJ initially came out almost two years ago, and we have still not meaningfully moved the needle on the overall problem (as far as I can tell, I haven't seen any followups to the contrary) is a reasonable indication that we have not taken the teen health problem seriously.

Compare this to how we handle a problem we care more about. For example, there is currently a **SEV1 for Reels production growth being 3% lower than expected**. For this SEV, we have daily updates, posts, probably a war room going somewhere. We would need that same kind of concerted effort with dedicated product designers, engineers, and data scientists collaborating to measure and improve our products over a long period of time.

I don't doubt that we're making some progress on teen well-being, but it seems clear that there is a lot more we could be doing.

Document 118: META3047MDL-062-00000129, -0134

TikTok considered a solution for people "in extremis" who feel "trapped in a rabbit hole of ineffectively personalized content."[339] It entailed giving them the opportunity to "reset" the algorithm but even for that allegedly "small" percentage of users (1%), the concern was raised about potential loss of ad revenue.



- "... [it would] help vulnerable users who need to distance themselves from their current viewing preferences. The research indicates that we could offer a reset option for those 'in extremis' and the majority would not misuse it. Focus group research: Providing Users With Choice Over Our Algorithm (focus groups across 5 EU countries)
- Algo proposed "non-personalized feed" in consideration of algo explainability and technical feasibility.

	Algo proposed plans	Pros	Cons
1	Non-personalized feed	• High feasibility	• Ads revenues

Document 119: TIKTOK3047MDL-002-00091625, -1625

[339] TIKTOK3047MDL-002-00091621, -1625

Consistent with corporate policy, this proposed change was subject to A/B testing.[340] Those test results found that "~32% of users turn off NP Feed within the week following the change" while "consumption metrics such as play duration, likes per uvv [Unique Video Views], comments per uvv, and shares per uvv decline."[341] TikTok's researchers go on to state that these results "confirms an idea that we already hold as true: that personalization is necessary in order to provide our users with engaging content."[342] This is despite nearly 2/3 of users keeping the default non-personalized feed state and increases in "UVV and session count."[343] Not only is this approach scientifically questionable, it also shows how TikTok's researchers interpreted their data to support their company's ultimate goal—increasing time spent on the platform.

In my opinion, to a reasonable degree of medical and scientific certainty, the totality of the evidence supports a causal relationship between social media use and depressive symptoms. There are numerous mechanistic pathways that explains this relationship. These include addictive design, features that increase negative social comparison, and algorithms that create problematic rabbit holes.

There is ample evidence within internal documents and depositions that support a causal relationship between SM and depression or depressive symptoms. Internal documents reflect a recognition that users were experiencing these symptoms as a result of the algorithms the defendants were developing and deploying. There is little evidence that that the companies undertook to meaningfully mitigate the risk of children developing depression. There is little

[340] TIKTOK3047MDL-002-00091621, -1630
[341] TIKTOK3047MDL-112-04262174, -2176
[342] TIKTOK3047MDL-112-04262174, -2176
[343] TIKTOK3047MDL-112-04262174, -2176

evidence that the company disclosed to parents, children, or the medical community the internally recognized risk of harm.

ii) Anxiety

Like depression, anxiety can be both a clinical diagnosis and a constellation of problematic symptoms. The DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, 5th Edition) outlines specific criteria for diagnosing 6 different types of anxiety disorders including: Generalized Anxiety Disorder, Panic Disorder, Social Anxiety Disorder, Specific Phobia, Separation Anxiety, and Agoraphobia. Each disorder has its unique set of criteria, but all share the common feature of excessive fear or worry. Since the specific disorders are rarely clinically diagnosed in SM research studies, a full summary of each will not be provided but all share these general criteria. The fear, anxiety, or avoidance must:

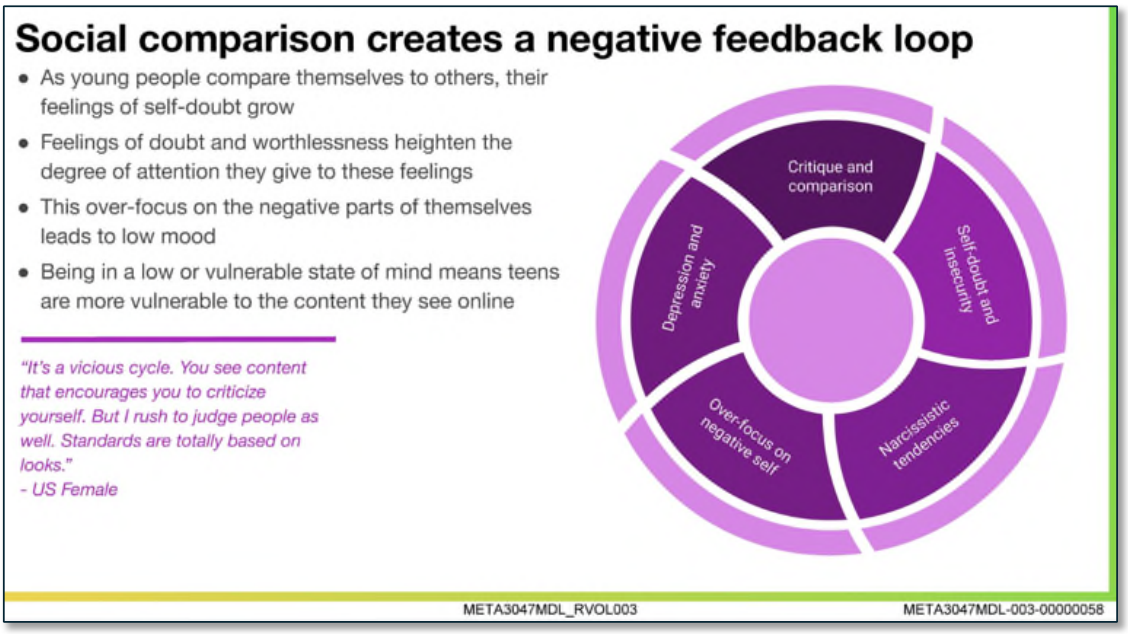
- Cause significant distress or impairment in functioning.
- Not be due to substances, medications, or a medical condition.
- Not be better explained by another mental health disorder.

From a mechanistic standpoint, both FOMO and social comparison can create anxiety. For example, several of the questions from Przybylski's FOMO scale are proxies for anxiousness:

1. I fear others have more rewarding experiences than me.
2. I fear my friends have more rewarding experiences than me.
3. I get worried when I find out my friends are having fun without me.
4. I get anxious when I don't know what my friends are up to.

As for social comparisons, research has shown that "upward" comparisons (comparing oneself to someone that one deems "superior") outnumber downward ones on social media and

that the effects of these comparisons is predominately negative.[344] Facebook's own analysis reveals that social comparison feeds a negative feedback loop.



Document 120: META3047MDL-003-00000029, -0058

George Volichenko, a product engineer at Insta, in his deposition on December 6, 2024, even gives these a name, and a metric. He said "p-NAC is --so NAC stands for negative appearance comparison. P-NAC is basically a probability. So "p" is lowercase, which is often used in statistics as, like, probability. You know, you've heard of p-values also related to probability."[345] Volichenko and his team proposed identifying high risk images for social comparisons (e.g. bikini model versus Christmas tree (*his words*)) and assigning a "probability"

[344] Midgley C, Thai S, Lockwood P, Kovacheff C, Page-Gould E. When every day is a high school reunion: Social media comparisons and self-esteem. *Journal of Personality and Social Psychology,*. 2021;121(2):285-307.
[345] George Volichenko Dep. Tr. at 40:18-24

estimate to their likelihood of instigating negative comparisons so they could be down ranked and less likely to appear in teens feeds. This would create a potential mechanism to mitigate the risk they posed to self-esteem. Volichenko asserts that when the mechanism was proposed to Adam Mosseri, head of Instagram, "he did not approve it."[346]

Considerably fewer studies have examined anxiety symptoms than depression and fewer still an "anxiety diagnosis" as detailed above although many have examined both depressive and anxiety symptoms together as "internalizing" symptoms or overall "mental health." Tang et al's systematic review of longitudinal studies of SM and mental health in young people identified two studies that assessed social media use and subsequent psychological distress and both found significant correlations.[347] One of those, by Riehm et al, warrants a deeper dive as it was a large (6595 people) prospective study.[348] Their measure of "internalizing" symptoms included the following questions:

Figure 41: Questions to Measure Whether a Person "Internalizes" Symptoms of Anxiety

Internalizing Problems[a]	1. Feeling very trapped, lonely, sad, blue, depressed, or hopeless about the future?
	2. Sleep trouble, such as bad dreams, sleeping restlessly, or falling asleep during the day?
	3. Feeling very anxious, nervous, tense, scared, panicked, or like something bad was going to happen?
	4. Becoming very distressed and upset when something reminded you of the past?

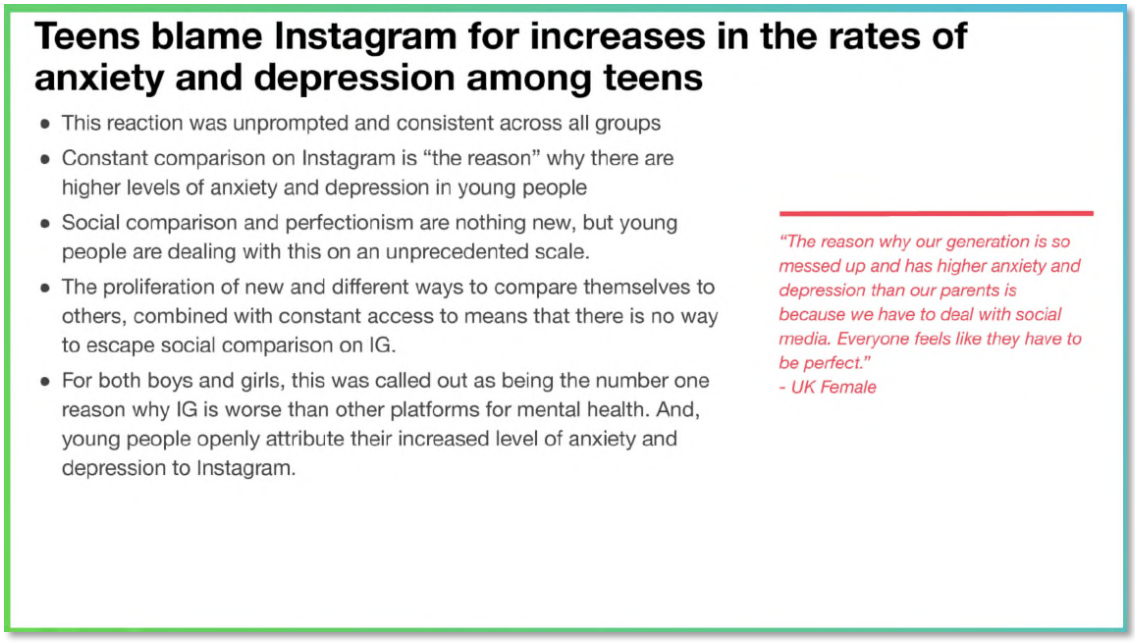
[346] George Volichenko Dep. Tr. at 44:9
[347] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clin Psychol Rev*. Jun 2021;86:102021. doi:10.1016/j.cpr.2021.102021
[348] Riehm KE, Feder KA, Tormohlen KN, et al. Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. *JAMA Psychiatry*. 2019;76(12):1266-1273. doi:10.1001/jamapsychiatry.2019.2325

They found that >3≤6 hours of social media use per day was associated with a 60% increased risk of internalizing problems even when adjusting for co-variates including baseline risk of internalizing problems. More than 6 hours per day was associated with a 78% increased risk. In addition, Bragheiri et al's quasi-experimental study of the Facebook rollout published after Tang's systematic review did specifically examine the effect size for having a diagnosis of an "anxiety disorder in the past year" and found a significant effect size of .07.[349] Finally, the Alcott et. al. experiment (summarized in the depression) did include "feeling anxious" as an outcome and found a significant treatment effect of .09 (larger than for depression) meaning that abstaining from Facebook for a period of one week resulted in a reduction in anxiety. In addition, the Davis SM reduction study in college students (detailed in the FOMO section) also found significant reduction in anxiety symptoms using the Generalized Anxiety Disorder 7 (GAD-7) of 2.35 points (Cohen's d .38).[350] Again, the experimental nature of the design of both of these studies allows for causal inferences to be made.

Meta conducted a "Teen Mental Health Deep Dive" in April 2020 that found the following:

[349] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clin Psychol Rev*. Jun 2021;86:102021. doi:10.1016/j.cpr.2021.102021

[350] Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. *Psychology of Popular Media*. 2025;14(1):1-11. doi:10.1037/ppm0000536



Document 121: META3047MDL-003-00109173, -9196

I conclude to a reasonable degree of medical and scientific certainty that the evidence supports a causal relationship between social media use and anxiety symptoms. Furthermore, internal documents from Meta, Snap, TikTok and Google provide additional support that the use of their platforms and their features – including the algorithms they developed and deployed – increased anxiety in a portion of their users.[351] The actions they took, if any, were weighed against the impact they would have on their core metrics, and ultimately on their bottom line and were minimally effective by design.

E. Suicide, Suicidal Ideation, and Self-Harm

Suicide and suicidal ideation are significant public health concerns that impact individuals across all demographics. Suicide, the act of intentionally ending one's own life, is often preceded

[351] *See e.g.*, TIKTOK3047MDL-004-00137151, -7152; GOOG-3047MDL-00874191 at Slide 29; SNAP0933724

by intense emotional pain, feelings of hopelessness, and mental health struggles, such as depression, anxiety, or trauma. According to the Centers for Disease Control, suicide is a leading cause of death among adolescents in the United States. In 2021, it was the second leading cause of death for individuals aged 10–14 and 20–24, and the third leading cause for those aged 15–19.

Suicidal ideation refers to thinking about, planning, or considering suicide, ranging from fleeting thoughts to detailed planning. These experiences can stem from a combination of factors, including biological, psychological, social, and environmental influences. Suicidal ideation as well as self-injurious actions (self-harm) frequently precedes suicide attempts and is a significant risk factor for them.[352] Because suicide itself remains relatively rare, most studies focus on the elevated odds of self-harm and suicidal ideation occurring as a proxy for suicide risk.

We have already identified social media as a risk factor for depression, anxiety, eating disorders, body image, and sleep disturbances all of which are independent risk factors for suicide. Here we will focus on the evidence linking social media usage to suicidal ideation, self-harm, and suicide itself irrespective of mechanism.

A recent *Morbidity and Mortality Weekly Report* from the Department of Health and Human Services analyzed cross sectional Youth Risk Behavior Survey data of U.S. high school students.[353] They dichotomized self-reported social media use as "frequent" if the respondent

[352] Franklin JC, Ribeiro JD, Fox KR, et al. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychol Bull*. Feb 2017;143(2):187-232. doi:10.1037/bul0000084; Ribeiro JD, Franklin JC, Fox KR, et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. *Psychol Med*. Jan 2016;46(2):225-36. doi:10.1017/S0033291715001804

[353] Young E, McCain J, Mercado M, al. e. Frequent Social Media Use and Experiences with Bullying Victimization, Persistent Feelings of Sadness or Hopelessness, and Suicide Risk Among High School Students — Youth Risk Behavior Survey, United States, 2023. *MMWR Suppl 2024;*. 2024;73(4):23-30.

replied that they used them "several times a day" which 77% reported that they did. Their results are summarized below:

Figure 42: Unadjusted Prevalence Estimates and Adjusted Prevalence Ratios for Bullying, Mental Health, and Suicide Risk Among High School Students

TABLE 4. Prevalence estimates, unadjusted, and adjusted prevalence ratios for bullying victimization, mental health, and suicide risk among high school students, stratified by frequency of social media use — Youth Risk Behavior Survey, United States, 2023*

	Frequent social media use			
	Yes	No		
Health behavior and experience (past 12 months)	% (95%CI)	% (95%CI)	PR† (95% CI)	aPR§ (95% CI)
Bullying victimization				
Bullied at school	19.9 (18.3–21.4)	19.0 (12.9–27.1)	1.05 (0.72–1.52)	1.31 (1.12–1.53)¶
Electronically bullied	17.0 (15.7–18.4)	15.9 (8.1–28.7)	1.07 (0.57–2.02)	1.54 (1.26–1.88)¶
Mental health				
Persistent feelings of sadness or hopelessness	42.6 (40.4–44.8)	31.9 (25.3–39.3)	1.33 (1.07–1.65)¶	1.35 (1.23–1.47)¶
Suicide risk				
Seriously considered attempting suicide	20.2 (18.8–21.8)	18.7 (12.8–26.6)	1.08 (0.75–1.55)	1.21 (1.06–1.37)¶
Made a suicide plan	16.6 (15.1–18.2)	17.5 (10.3–27.9)	0.95 (0.58–1.55)	1.16 (1.00–1.35)¶
Attempted suicide	9.5 (8.4–10.8)	9.5 (6.6–13.5)	1.00 (0.70–1.43)	1.11 (0.89–1.39)

Abbreviations: aPR = adjusted prevalence ratio; PR = prevalence ratio.
* N = 20,103 respondents. The total number of students answering each question varied. Data might be missing because 1) the question did not appear in that student's questionnaire, 2) the student did not answer the question, or 3) the response was set to missing because of an out-of-range response or logical inconsistency. Percentages in each category are calculated on the known data. A total of 15,203 students responded to the social media item.
† Logistic regression models estimated health behaviors and experiences between those who did and did not use social media at least several times a day.
§ Adjusted for age, race and ethnicity, sex, and sexual identity estimated health behaviors and experiences behaviors between those who did and did not use social media at least several times a day.
¶ Estimates were considered statistically significant if the 95% CIs did not include 1.0. Certain statistically significant aPRs have 95% CIs that include 1.0 because of rounding.

As can be seen in the above figure, "frequent" social media use was associated with a 35% increased risk of "persistent feeling of sadness," a 21% increased risk of "seriously considering attempting suicide," and a 16% increased risk of "making a suicide plan." All of those associations were "statistically significant." The authors acknowledge that these associations are cross-sectional and therefore causality cannot be established. It could credibly be asserted that the causality is reversed and that "persistent feelings of sadness" beget social media usage for example. Or more likely, that there is a dyadic, mutually reinforcing relationship where searching for self-harm videos (because one is considering it) leads to content that induces viewing more of it and increasing the likelihood of doing it.

There are at least two mechanisms by which social media usage can spur suicidal thoughts and actions: emulation and increased despair (they are not mutually exclusive). Suicide as a

contagious phenomenon has been reported for years. Niederkrotenthaler and colleagues meta-analyzed studies that examined the risk of suicide after a celebrity suicide was reported in the media.[354] They found that the risk of suicide in the intervening 1-8 days was increased by 13% and the risk of suicide using the method deployed by the celebrity was increased by 30%.[355] This provides strong evidence for "emulation" effects both because of the act itself as well as the methods chosen, but further, social media is assuredly one of the mechanisms by which the information was disseminated.

As for increased despair, the link between social media usage and depression was discussed in section X.D.ii but there are also pathways to despair via cybervictimization/cyberbullying and sextortion (discussed in later sections). A 2021 systematic review and metanalysis by Nesi et al summarized 61 articles relating social media usage to self-injurious thoughts and behaviors (suicidal ideation and self-harm in the model).[356] Their results are summarized below:

[354] Niederkrotenthaler T, Braun M, Pirkis J, et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis. *BMJ*. 2020;368:m575. doi:10.1136/bmj.m575

[355] Niederkrotenthaler T, Braun M, Pirkis J, et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis. *BMJ*. 2020;368:m575. doi:10.1136/bmj.m575

[356] Nesi J, Burke TA, Bettis AH, et al. Social media use and self-injurious thoughts and behaviors: A systematic review and meta-analysis. *Clinical Psychology Review*. 2021/07/01/ 2021;87:102038. doi:https://doi.org/10.1016/j.cpr.2021.102038

Figure 43: Associations Between Social Media Use Variables and Self-Injurious Thoughts and Behaviors

Associations between social media use variables and self-injurious thoughts and behaviors.

	k	*N*	Effect size analyses		
			OR	95% CI	*p*
Cybervictimization					
Suicidal Ideation	45	135,424	2.93	2.43–3.54	<.001
Suicide Plans	10	40,760	3.07	2.18–4.34	<.001
Suicide Attempts	25	106,417	3.38	2.59–4.41	<.001
NSSI	3	532	4.36	2.32–8.20	<.001
Cyberbullying perpetration					
Suicidal Ideation	5	2444	1.89	1.54–2.32	<.001
Suicide Plans	1	650	1.87	1.41–2.48	<.001
Suicide Attempts	3	1890	1.65	1.25–2.18	<.001
SITB-related social media use					
Suicidal ideation	5	3871	2.79	1.85–4.21	<.001
Suicide plans	3	10,980	3.78	1.90–7.55	<.001
Suicide attempts	5	11,735	3.94	2.20–7.07	<.001
NSSI	2	245	2.98	1.46–6.11	.003
Frequency of social media use					
Suicidal ideation	6	2974	1.45	0.95–2.23	.089
Suicide plans	2	391	1.47	0.33–6.43	.612
VNSSI	3	570	2.03	0.79–5.21	.143
Problematic social media use					
Suicidal ideation	4	21,391	2.81	1.72–4.59	<.001
Sexting					
Suicidal Ideation	2	586	2.37	0.98–5.73	.057
Suicide Attempts	1	11,707	4.24	3.13–5.44	<.001
NSSI	2	6103	3.07	2.53–3.74	<.001
Importance of social media					
Suicidal ideation	3	858	1.05	0.96–1.15	.291
Suicide plans	2	391	1.02	0.71–1.49	.902
NSSI	2	391	1.25	1.06–1.47	.007

k = number of unique effects; CI = confidence interval; NSSI = non-suicidal self-injury; SITB = self-injurious thoughts and behaviors.
Note that only outcomes for which at least one effect was identified are listed for each social media predictor. Effect size estimates where $k < 3$ should be considered unstable and interpreted with a degree of caution.

Cybervictimization, cyberbullying perpetration, self-injurious thoughts and behavior related social media, and problematic social media use were all associated with increased odds of self-injurious thoughts and behaviors with odds ratios between 1.7 and 3.9. The vast majority of the included studies are cross-sectional and while the association is plausibly causal based on the

theoretical mechanisms discussed above, reverse causality once again cannot be excluded when studies are merely correlational.

However, there have been a few, well done longitudinal studies that have evaluated the risks posed by social media sites with respect to suicidal ideation. Arendt and colleagues conducted a prospective panel survey of 729 U.S. adults ages 18-29 years.[357] At baseline, participants were asked the following question: *Please think about the social networking site Instagram: How often, if ever, have you seen a post on Instagram showing someone who intentionally harms him- or herself, for example, by cutting? Was it more than once, just once, or never?*

Overall, 43% reported having seen it once or more than once. The outcome of interest at wave 2 (1 month after baseline) was the answer to the question: *Since the first survey, have you ever engaged in self-harming behavior, such as cutting your wrists.* The results of their regression analysis are presented below:

[357] Arendt F, Scherr S, Romer D. Effects of exposure to self-harm on social media: Evidence from a two-wave panel study among young adults. *New Media & Society*. 2019/11/01 2019;21(11-12):2422-2442. doi:10.1177/1461444819850106

Figure 44: Regression Analysis of Effects of Exposure to Self-Harm on Social Media

Outcome = self-harming behavior	Cross-sectional evidence (predicting wave 1 outcome)				Panel evidence (predicting wave 2 outcome)			
	B	*SE*	*OR*	*p*	*B*	*SE*	*OR*	*p*
	Step 2 (effect of Instagram exposure) $\Delta\chi^2_{(2)} = 20.30$, $\Delta R^2 = .044$, $p < .001$				Step 2 (effect of Instagram exposure) $\Delta\chi^2_{(2)} = 28.10$, $\Delta R^2 = .064$, $p < .001$			
Age	0.02	0.03	1.02	.515	−0.08	0.04	0.93	.046
Gender *D*1 (male)	−1.57	0.78	0.21	.045	1.47	1.17	4.37	.209
Gender *D*2 (female)	−1.00	0.75	0.37	.179	1.48	1.14	4.40	.195
Education	−0.13	0.06	0.88	.035	−0.08	0.07	0.92	.281
Race	0.26	0.22	1.30	.236	−0.56	0.25	0.57	.028
Self-harm exposure via other sources	0.16	0.05	1.18	.003	0.02	0.07	1.02	.787
Self-harming behavior (wave 1)	—	—	—	—	1.64	0.24	5.17	<.001
Instagram exposure *D*1 (*just once*)	0.68	0.25	1.97	.007	1.58	0.30	4.87	<.001
Instagram exposure *D*2 (*more than once*)	1.05	0.24	2.87	<.001	0.79	0.32	2.20	.013

SE: standard error; *OR*: odds ratio; R^2: Nagelkerke's R^2; *D*: dummy variable; cross-sectional evidence full model: $\Delta\chi^2_{(8)} = 55.52$, $R^2 = .124$, $p < .001$; panel evidence full model: $\Delta\chi^2_{(9)} = 110.74$, $R^2 = .270$, $p < .001$.
This table only reports step 2 of the hierarchical model (i.e. full model). Both Instagram dummies were added in step 2. Therefore, the change in χ^2 of step 2 indicates whether Instagram exposure explains additional variance.

Focus on the wave 2 outcomes outlined in red which adjust for baseline characteristics and risk factors (wave 1) including exposure to others' sources of self-harm (e.g. newspapers, news reports etc.).

Exposure to self-harming behavior on Instagram was associated with an almost 5-fold increased odds of self-harm at 1 month follow-up. Further, the authors used the validated Eltz suicide risk prediction scale to assess suicidal risk.[358] Specifically, participants were asked to rate six items:

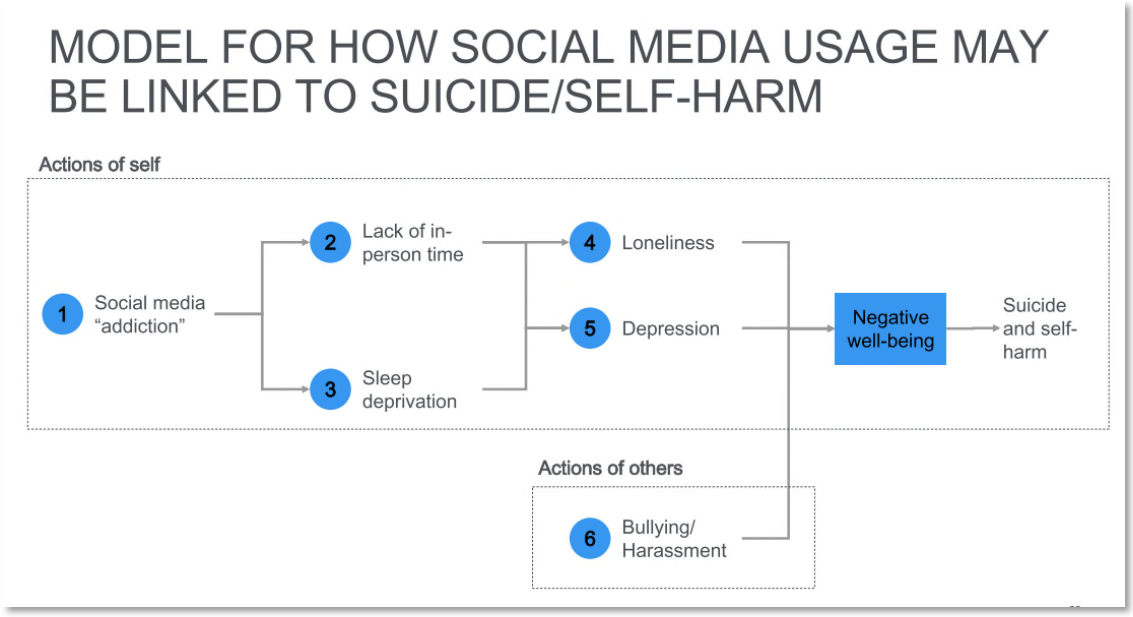
1. I think of suicide
2. I have thoughts about how to end my life

[358] Eltz M, Evans AS, Celio M, et al. Suicide probability scale and its utility with adolescent psychiatric patients. *Child Psychiatry Hum Dev*. Jun 2007;38(1):17-29. doi:10.1007/s10578-006-0040-7

3. I feel it would be less painful to die than to keep living, given the way things are
4. I feel the world is not worth continuing to live in
5. I feel people would be better off if I were dead
6. In order to punish others, I think of suicide.

Again, adjusting for baseline risk factors, exposure to self-harm images on Instagram was associated with a significantly elevated score on the suicide risk score ($p<.006$).

Meta has internally acknowledged that addictive use of Instagram plays a role in suicide and self-injury as is shown in an internal memo:

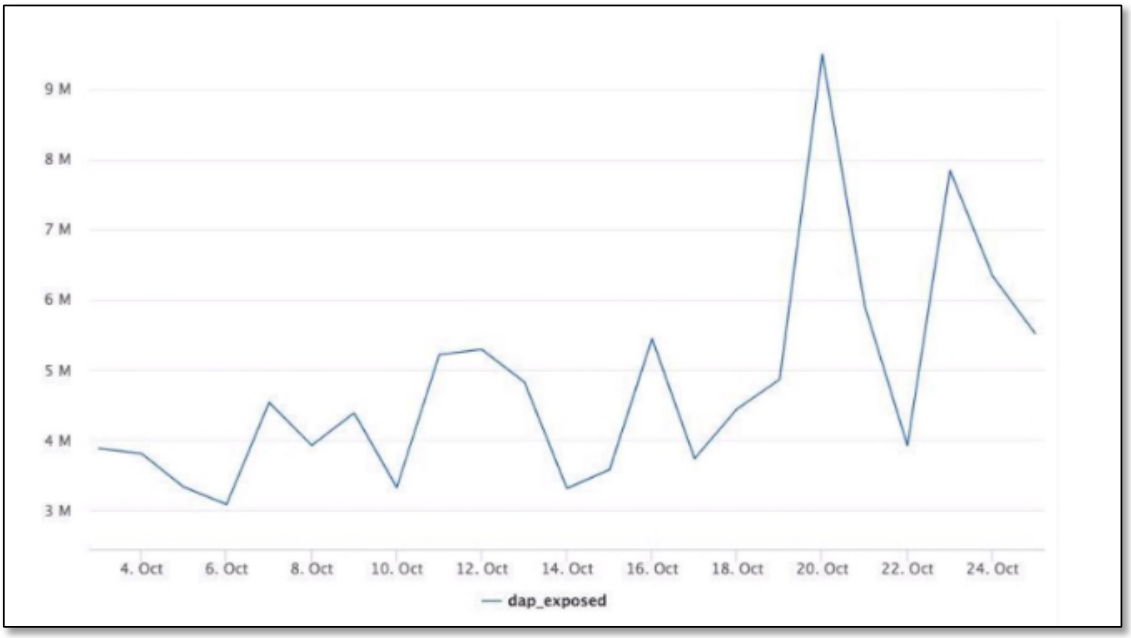


Document 122: META3047MDL-037-00068917 at Slide 30

Instagram's viral promotion of suicide and self-injury-oriented content (including challenges glorifying and encouraging these harms) is a mediator along this causal pathway. Meta internal documents make clear (a) that such content exists on the platform, (b) that Instagram's algorithm promotes it to teenagers (at higher rates than to non-teens), in part through viral

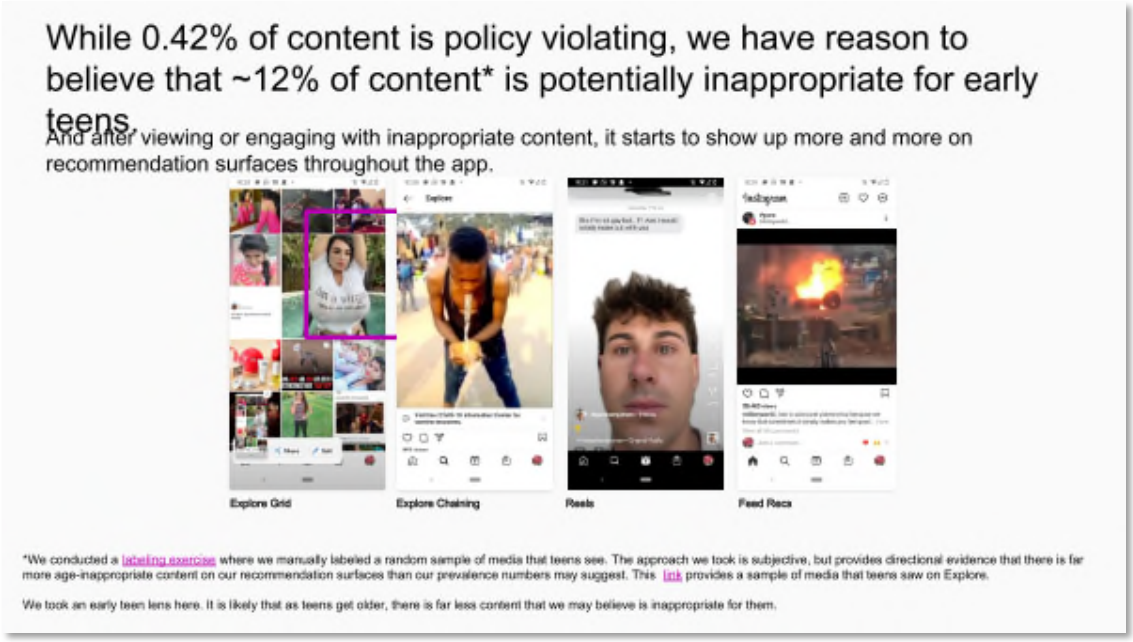
(contagious) algorithmic spreading of such content, (c) that teen viewing of this content sets up a cycle where teens are more likely to post such content, and (d) that the platform's exposure of such content to teens is harmful. As such, this is not simply a question of "bad" content existing on the platform, it is a question of the platform driving that content to a specific set of vulnerable users knowing the attendant risks. Furthermore, let us acknowledge that Meta created this "causal" pathway with the intention of mitigating it. The problem is, in the end, they did nothing about it.

Let us examine in more depth the causal role that Meta may play in promoting SSI. First, the presence of the content itself. Meta's platform is replete with suicidal content with inadequate protections. An internal report notes that "5.1 million daily users are exposed to suicide or self-harm admission or promotion content." Furthermore, the report includes the graph for the three weeks in October 2023 and states that "the spikes are from very viral content (meme-like in quality) that have SSI content."



Document 123: META3047MDL-040-00056476, -6481

Second, the platforms' pushing of this content. An internal audit revealed that, "after viewing or engaging with inappropriate content, it starts to show up more and more" and that this phenomenon applies to content that is "potentially inappropriate for early teens." In other words, the algorithms preferentially foist content on the most vulnerable teenagers.



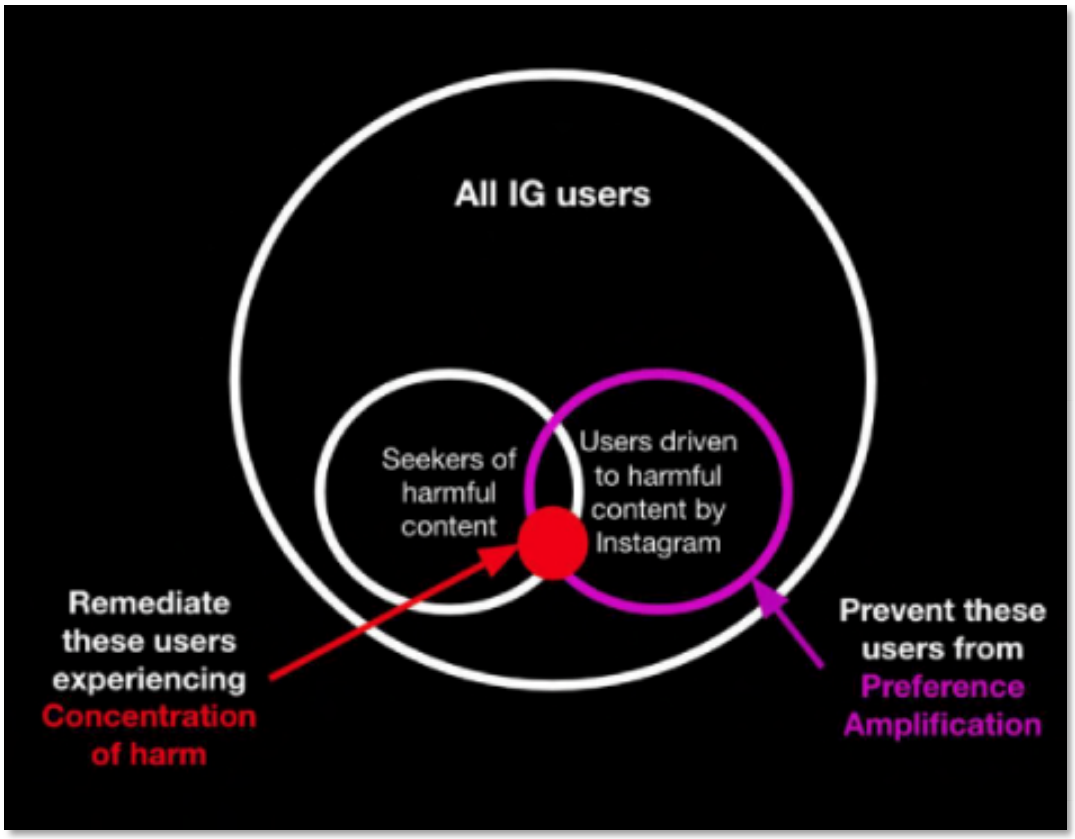
Document 124: META3047MDL-035-00002761 at Slide 46

As Miki Rothschild explained in an internal email from May 28, 2020, viewing "unsafe" content leads to more such content:

> However, I think there might be a simpler and more effective way to tackle the rabbit holing on safety problems (vs the time spent one). Today the primary way we combat rabbit holing you into bad stuff is by trying to detect and filter out bad stuff. This means we treat every recommendation the same even though in practice once you engage with something unsafe we're so much more likely to show you more unsafe recommendations, even though we should actually be better at detecting clusters of recommendations than individual ones. So theoretically we could reduce the bar for what we consider unsafe on subsequent recommendations to avoid rabbit holing on those. Let me check with the team to see if there's more targeted approach we can consider...

Document 125: META3047MDL-003-00064697, -4697

Further, a 2022 "Concentration of Harm" presentation at Instagram refers to "preference amplification" for a subset of Instagram users who are not "seekers" of harmful content but who are "driven" to it by Instagram:



Document 126:META3047MDL-054-00000061, -0063

According to the Oxford English dictionary, the second definition of the verb "drive," after the one pertaining to operating a vehicle, is "propel or carry along by force in a specified direction." That does seem like an apt description of how the algorithms work and by definition assigns culpability to them as "propellers."

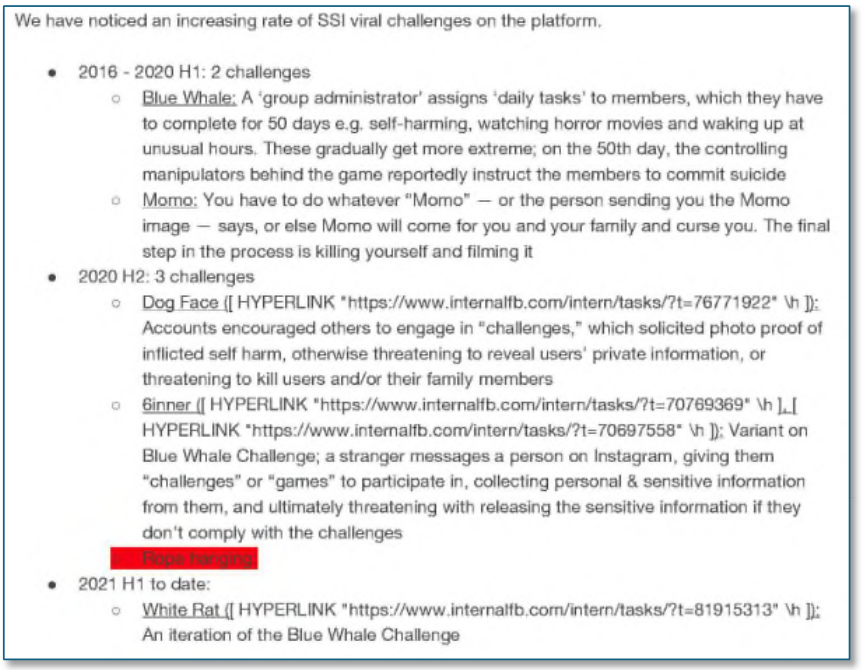
Yet another Meta internal memo explained the "significant risk of contagion" of SSI related content on Instagram:

- **Instagram is a popular platform for communicating about and finding support for suicide and self-injury (SSI) especially among teens.** SSI involves 1/4th as many reporters as B+H and has 1/5th as many content producers as B+H.. But, there is a significant risk of contagion, especially during times of heightened awareness (e.g., high-profile suicide). Indeed, the odds of posting SSI content on Instagram are 7x higher for people who see a suicide admission than for people who do not.

Document 127: META3047MDL-031-00048769, -8769

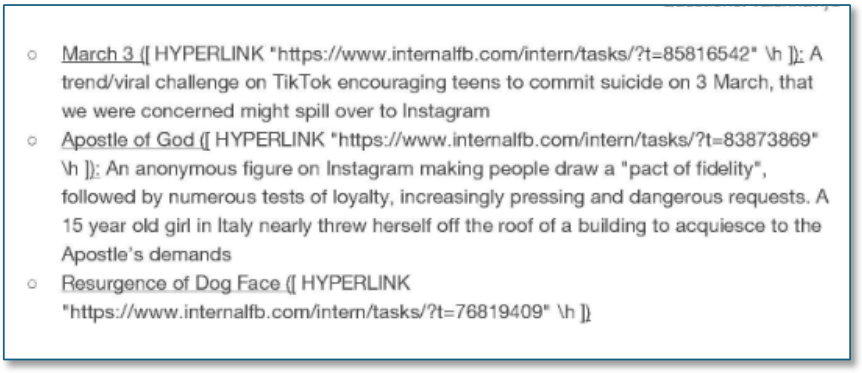
In fact, viral SSI challenges are noted to be an increasing phenomenon in a 2021 memo from Instagram.[359]

[359] META3047MDL-111-00204020, -4020 ("We have noticed an increasing rate of SSI viral challenges on the platform.")



We have noticed an increasing rate of SSI viral challenges on the platform.

- 2016 - 2020 H1: 2 challenges
  - Blue Whale: A 'group administrator' assigns 'daily tasks' to members, which they have to complete for 50 days e.g. self-harming, watching horror movies and waking up at unusual hours. These gradually get more extreme; on the 50th day, the controlling manipulators behind the game reportedly instruct the members to commit suicide
  - Momo: You have to do whatever "Momo" — or the person sending you the Momo image — says, or else Momo will come for you and your family and curse you. The final step in the process is killing yourself and filming it
- 2020 H2: 3 challenges
  - Dog Face ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=76771922" \h]): Accounts encouraged others to engage in "challenges," which solicited photo proof of inflicted self harm, otherwise threatening to reveal users' private information, or threatening to kill users and/or their family members
  - 6inner ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=70769369" \h], [HYPERLINK "https://www.internalfb.com/intern/tasks/?t=70697558" \h]): Variant on Blue Whale Challenge; a stranger messages a person on Instagram, giving them "challenges" or "games" to participate in, collecting personal & sensitive information from them, and ultimately threatening with releasing the sensitive information if they don't comply with the challenges
  - Rope hanging
- 2021 H1 to date:
  - White Rat ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=81915313" \h]): An iteration of the Blue Whale Challenge



- March 3 ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=85816542" \h]): A trend/viral challenge on TikTok encouraging teens to commit suicide on 3 March, that we were concerned might spill over to Instagram
- Apostle of God ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=83873869" \h]): An anonymous figure on Instagram making people draw a "pact of fidelity", followed by numerous tests of loyalty, increasingly pressing and dangerous requests. A 15 year old girl in Italy nearly threw herself off the roof of a building to acquiesce to the Apostle's demands
- Resurgence of Dog Face ([HYPERLINK "https://www.internalfb.com/intern/tasks/?t=76819409" \h])

Document 128: META3047MDL-111-00204020, -4020-21 (emphasis in original)

As indicated in this document, a 15-year-old girl in Italy "nearly threw herself off the roof of a building" because of the challenge.[360] Given this example, it is particularly astonishing that the memo goes on to say:

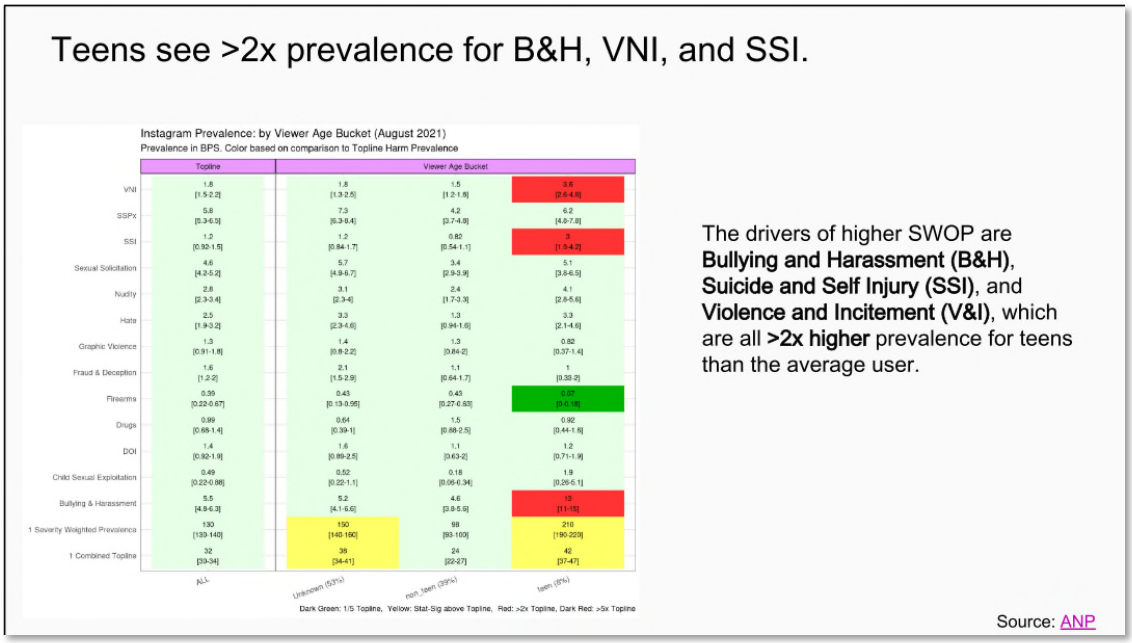
[360] META3047MDL-111-00204020, -4021

- We've historically taken a reactive approach to dealing with viral events (i.e. we deal with it once it's become so viral that media outlets catch wind of it). It's very difficult to predict/surface trends before they become viral, so it's tough to proactively ID them.

Document 129: META3047MDL-111-00204020, -4022

Meta well understood the potentially fatal consequences of its "reactive approach" (dealing with viral suicide challenges after "media outlets catch wind of it").

Third, the promotion of suicide-oriented content specifically to teens. Instagram's own documents reveal that teens see more than two times the prevalence of suicide and self-injury compared to non-teens:



Document 130:META3047MDL-035-00002761 at Slide 44

I am not sure what "prevalence" means in this context. One meaning is the percent of users who see each of these types of content in a given time period. If that is the case, it is not only concerning that teens see more than twice the amount of Suicide and Self Injury Content but that 3% do at all.

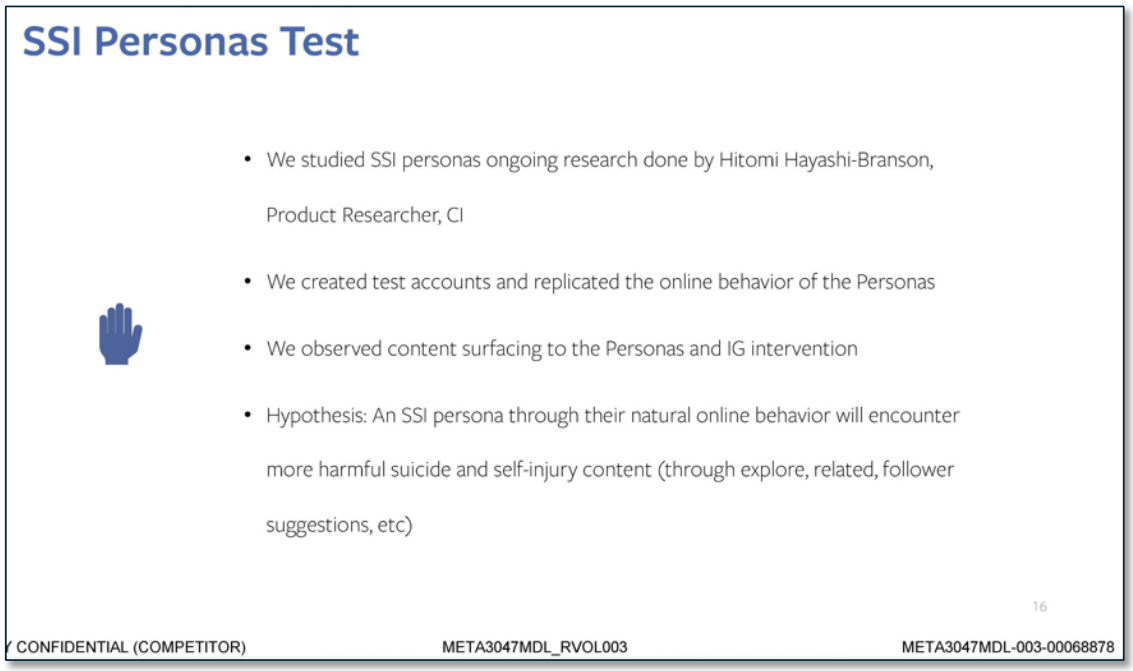
Further, Meta knew through internal research that viewing of SSI is significantly associated with posting it (see below):

Logistic Regression: Actioned SSI Post	Odds ratio (unadjusted model)	Odds ratio (adjusted for confounders)
Suicide admission	15.72 (12.05, 20.49)	7.16 (5.42, 9.46)
Suicide promotion	1.64 (1.09, 2.46)	1.29 (0.86, 1.93)
Self-harm admission	3.92 (2.86, 5.38)	2.88 (2.10, 3.96)
Self-harm promotion	1.51 (0.94, 2.44)	1.30 (0.80, 2.11)

(Source: People Exposed to Suicide / Self Injury Content on Instagram)

Document 131: META3047MDL-014-00298174, -8196

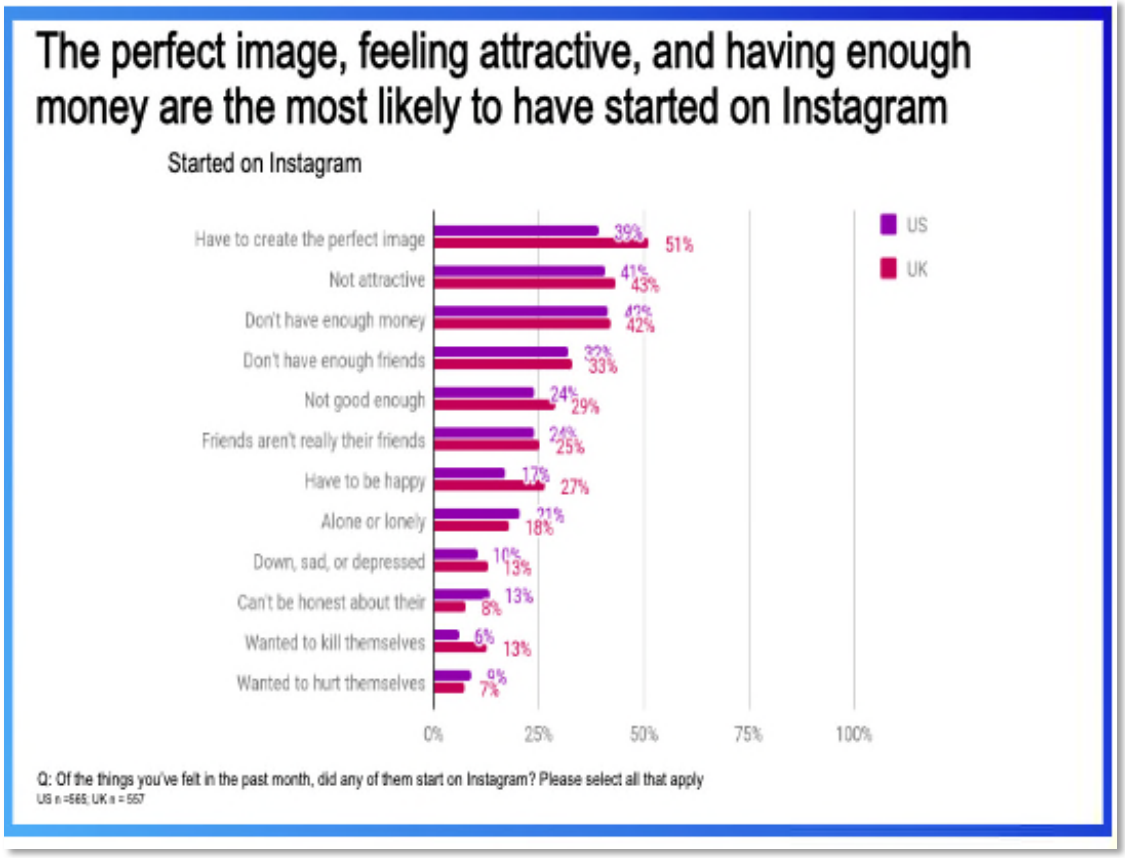
Finally, Meta's awareness of the harm from all this. Meta conducted an internal study where they created suicide, self-injury "personas" and then created test accounts for them.



Document 132: META3047MDL-003-00043617, -3632.

This test revealed that Instagram Explore "serves content based on user's distressed online behavior"[361] and that numerous hashtags leading to suicide-promoting content were allowed, such as #sucidal, #killmyselfnow, and #sucidalthoughts. (The misspellings are intentional.)

In 2019, Meta did its own survey of 2503 teen users in the US and UK and asked the question: "*Of the things you've felt in the past month, did any of them start on Instagram? Check all that apply*":



Document 133: META3047MDL-035-00002796 at Slide 16

[361] META3047MDL-003-00043617, -43637

The slide and its attendant text "calls out" the top three responses which include image, attractiveness and money, but does not make specific mention of the fact that 6 and 13% of US and UK teens respectively wanted to kill themselves and 9 and 7% wanted to hurt themselves and those thoughts "started on Instagram"[362]

Those statistics are tragically illustrated by the story of 14-year-old Molly Russell, a British girl who while battling depression, was inundated with graphic self-harm images, videos, and messages on social media (including Instagram) and took her life in 2017. After a five-year investigation, including a proceeding at which Meta witnesses were summoned to testify, the coroner concluded:

> Molly had become depressed, a common condition affecting children of this age. This then worsened into a depressive illness. Molly subscribed to a number of online sites. At the time that these sites were viewed by Molly some of these sites were not safe as they allowed access to adult content that should not have been available for a 14-year-old child to see. The way that the platforms operated meant that Molly had access to images, video clips and text concerning or concerned with self-harm, suicide or that were otherwise negative or depressing in nature. The platform operated in such a way using algorithms as to result in some circumstances of binge periods of images, video clips and text, some of which were selected and provided without Molly requesting them.[363]

In 2019, a full two years after Molly's tragic death, Instagram reported that "All graphic images of self-harm will be removed."[364]

Despite that claim, limitations in Instagram's ability or willingness to limit access to SSI content are acknowledged in a Sept 2020 document:

[362] META3047MDL-035-00002796 at Slide 16
[363] Vaishnavi Jayakumar Dep. Exhibit 20 at p. 2
[364] *See* Vaishnavi Jayakumar Dep. Exhibit 21

- **IG:**
  - lack classifiers to detect and take action on problematic aggregated content on surfaces like Explore, hashtag pages, Reels
  - spaces like IGD being used to encourage or promote suicide e.g., group suicides in Norway that occurred last year and we don't scan there

Document 134: META3047MDL-004-00027423, -7437

Further, when Ms. Jayakumar was asked at her deposition (in 2025), "Does Instagram's algorithm sometimes push content that promotes suicide?" she responded, "The algorithm does sometimes push content that, in aggregate, could be seen as encouraging suicide but not at the individual level."[365]

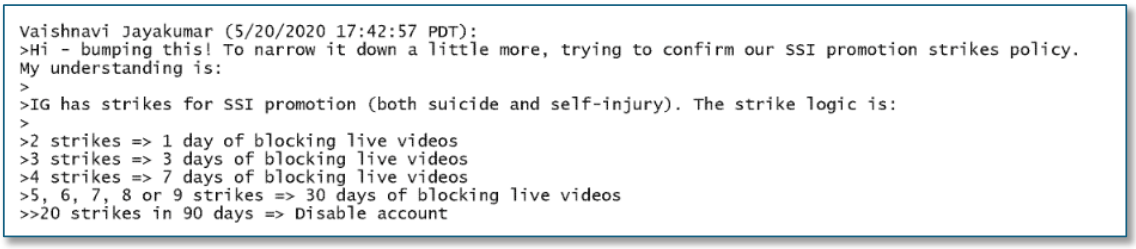
In March of 2020 Instagram held focus groups with both news-informed parents and young people (18-24) about what they viewed Instagram's responsibility to be related to SSI content. Emma Collins (IG Program Policy Manager) stated that the "biggest take away" from the groups was it "absolutely confounded them that we could be working on an issue so long, yet we are where we are. Rather than it seeming responsible, they took it as 'so you've known about this all this time and you still haven't fixed it.'"[366] Reflecting on those same focus groups during her deposition, Jayakumar recalls:

> This session was specifically about the messaging around SSI and the types of messages or narratives that parents and young people would find compelling and make them feel more favorable about Instagram. It wasn't about specific product interventions or policy interventions that we could take.[367]

These focus groups "focused" if you will on Instagram's public messaging about SSI and were convened 3 years after Molly's death and one year after Mosseri's promise to take action.

[365] Vaishnavi Jayakumar Dep. Transcript at 221:9-11
[366] META3047MDL-040-00544758, -4758
[367] Vaishnavi Jayakumar Dep. Tr. at 227:13-17

Ultimately, Meta did create a "strike" policy for posting SSI promotional materials (see below):


Vaishnavi Jayakumar (5/20/2020 17:42:57 PDT):
>Hi - bumping this! To narrow it down a little more, trying to confirm our SSI promotion strikes policy. My understanding is:
>
>IG has strikes for SSI promotion (both suicide and self-injury). The strike logic is:
>
>2 strikes => 1 day of blocking live videos
>3 strikes => 3 days of blocking live videos
>4 strikes => 7 days of blocking live videos
>5, 6, 7, 8 or 9 strikes => 30 days of blocking live videos
>>20 strikes in 90 days => Disable account

Document 135: META3047MDL-020-00270857, -0857

By most measures, the policy could be deemed "lenient" or "forgiving." It takes several strikes to be blocked for any reasonable period of time. In the meantime, the multiple contagions have been released multiple times. And rather than just blocking live videos, why was a policy of parental notification not created or some other similar mechanism to ensure that frequent posters were given help? This is a good example of the general and pervasive phenomenon Dr. Lee described in her deposition: "I think that the integrity guardrails that they put in place were not sufficient to seriously consider the integrity impacts and that there were other alternative strategies that could have been used."[368]

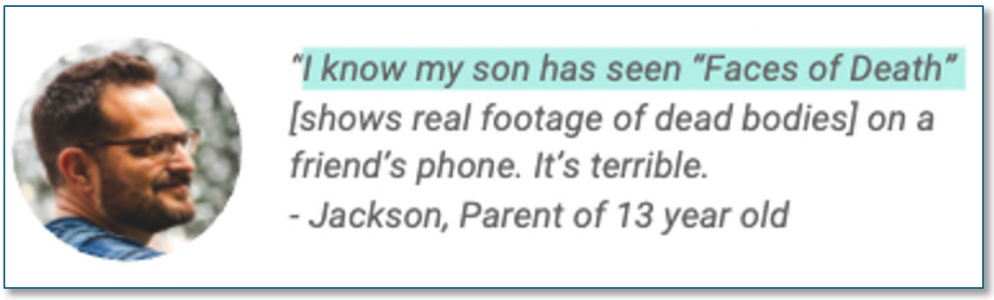
What's more, accounts promoting suicide and self-injury remained searchable. As Sophie Vogel (Policy Communications Manager) stated in an email September 11, 2020, "We currently block inherently violating hashtags so that no results appear when you search for them. These include things like #proana and #thinspo. BUT — we don't block any results for accounts. So when you search for these terms, there are no results under the 'hashtag' tab, but there are endless results under the 'Top Accounts' and 'Accounts' tab, and almost all are violating."[369]

[368] Alison Lee Dep. Tr. at 53:17-21
[369] META3047MDL-031-00246746, -6761

Importantly, and as confirmed in Jayakumar's deposition, despite these critical gaps, there were no substantive changes in Meta's suicide and self-injury posting policy between 2020 and 2025.[370] That policy has consistently stated, "we do not allow people to intentionally or unintentionally celebrate or promote suicide, self-injury or eating disorders" and "[w]e remove any content that encourages suicide, self-injury or eating disorders," even though it is apparent (and Jayakumar confirmed) these statements are inaccurate—as she acknowledged, "there's a disconnect between the suicide and self-injury policy and the aggregated content that actually gets recommended by Instagram's algorithm."[371] Put another way, there was no real way for any parent to understand the risks that suicide and self-injury promoting content would be pushed to their kids—Meta's stated policy indicated that it would *not*.

For its part, YouTube labels content as "gray" when it falls into a questionable area that although it does not technically violate its guidelines could still be problematic for some people. Their internal analysis reveals that in spite of "high parent and expert concern, <1% of watch time is gray content WT on YT."[372] It is unclear what the denominator for "watch time" is. Total time everyone in the world watches YouTube? Total time teens watch? It likely is not total time teens at risk for suicide watch because aggregation algorithms will concentrate content on select individuals. For this reason, using a denominator of total watch time is not appropriate. A YouTube report has the following inset:

[370] Vaishnavi Jayakumar Dep. Exhibits 22 & 23; *See also* Vaishnavi Jayakumar Dep. Tr. at 217:1-21
[371] Vaishnavi Jayakumar Dep. Tr. at 222:6-12
[372] GOOG-3047MDL-00236723 at Slide 12



Document 136: GOOG-3047MDL-00236723 at Slide 12 (emphasis in original)

Deemed "The Ultimate Taboo" by *Entertainment Weekly*, *Faces of Death*, according to the box description is "Possibly one of the most talked about series of all-time [and] examines the many guises of death in the extreme close-up. Sure to shock, horrify and even repulse, these brutal films are not meant for the faint of heart." Unrated in the US, banned in Finland and parts of Canada, and heavily age-restricted in many other countries, the movie is surely not appropriate for a 13-year-old regardless of their underlying mental health challenges. Having viewed it. either because it was chanced upon or suggested via algorithmic curation, YouTube will feed a teen more such content. When I opened an incognito chrome page (so as to have no history) on February 15, 2025, and searched for "Faces of Death" on YouTube, I found the following:

Figure 45: Sample YouTube Search Result for "Faces of Death"

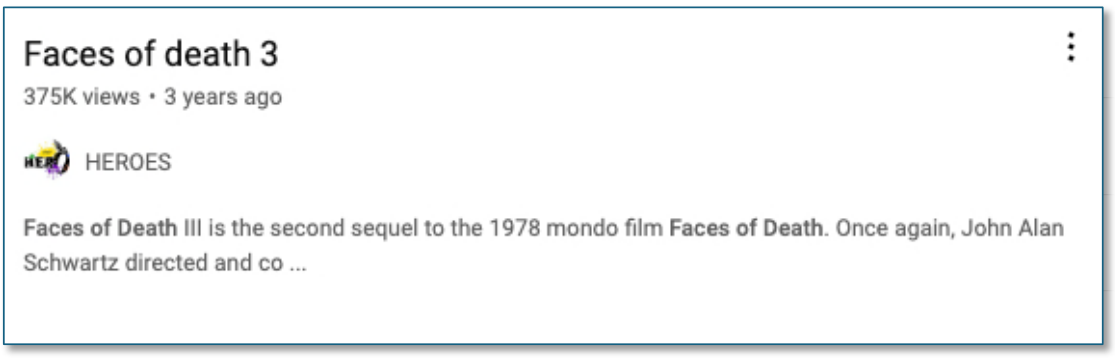
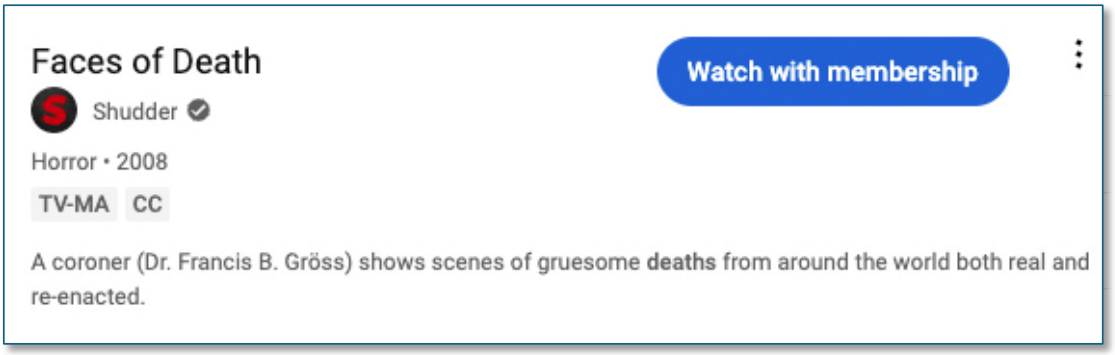


Figure 46: Sample YouTube Search Result for "Faces of Death"



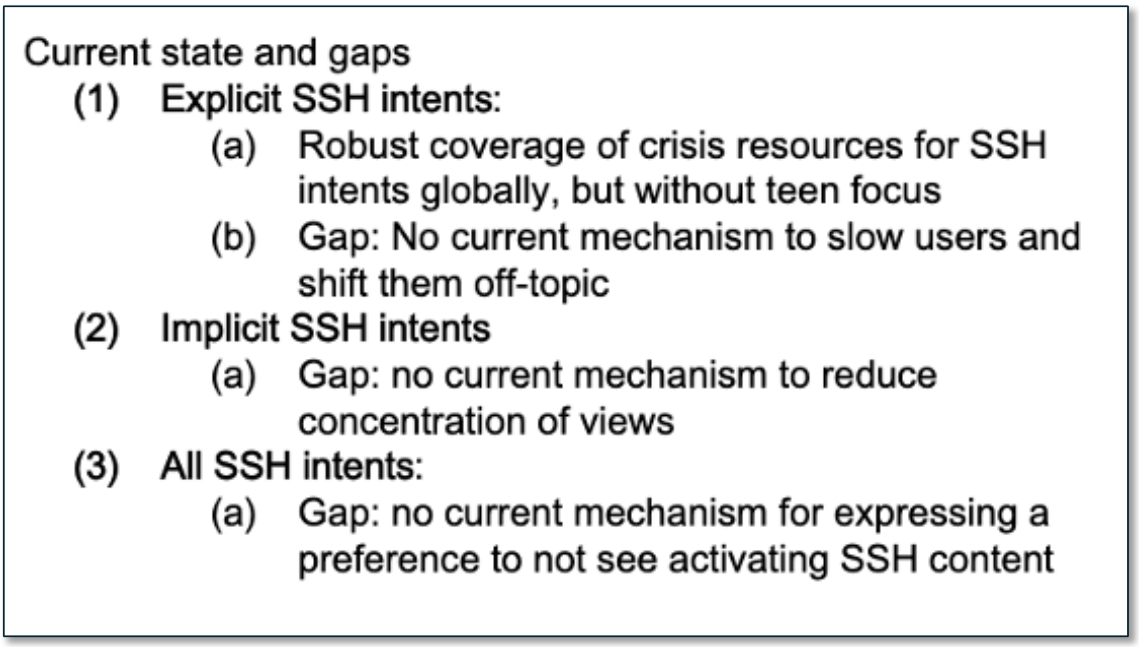
The "Shudder" video link required a subscription and the "Heroes" link (Figure CC) asked for age verification. It is unclear when that gating was added or how easy it is to circumvent, but the link below also instantly popped up and autoplayed for me a "disturbing" clip from the movie which I did not watch in its entirety.

Figure 47: Sample YouTube Search Result for "Faces of Death"

What's more, the same search also provided links to several other videos including:

Figure 48: Sample YouTube Search Result for "Faces of Death"

I am imagining that my feed would soon be populated with multiple such videos defaulted to autoplay. YouTube does appear to recognize that it is failing its teen users by providing suggestions that could be triggering, not reducing the concentration of views, and not allowing them to turn off SSH content.



Document 137: GOOG-3047MDL-00864164 at Slide 25

YouTube was aware that its algorithm was suggesting suicide and self-harm content alongside of "helpful" advice (see below).

Suicide / Self-Harm / 'Nihilist' Content
Features have been put in place by a number of platforms used by teenagers in particular e.g. Instagram, in relation to Suicide / Self-Harm / Nihilist content - not to remove all of the content - but to provide prompts and potential support for users searching for such content. This does not appear to be a feature on the YouTube platform. It appears that a large % of videos appearing through common searches in this area are offering prevention / helpful advice, but problematic content is easily discovered through related videos against these. E.g.,

- Search "how to kill yourself"
- Click into 2nd video "How to kill yourself. properly" 1.3M views. Appears to be a comedy/drama type video of a person trying unsuccessfully to kill themselves. Age gated. Comments troubling.
- Recommended videos: "Easy Steps to tie the perfect hangmans noose". Screen shot of recommendation (ranked 6th in list).
- **@Dina**, would you be ok to partner with us to understand the S&D implications in this space?

Separately, there is a genre of 'depressing edits' videos (example) - contains a number of triggering elements which could inspire those thinking of self harming, or those struggling with the issue. The comments section appears to contain a lot of these individuals. **@Shadie**, does a tear sheet already exist on this topic?

Document 138: GOOG-3047MDL-00488901, -8905

The document acknowledges that as of 2019 (at least) they were behind their competition in providing warnings about this.

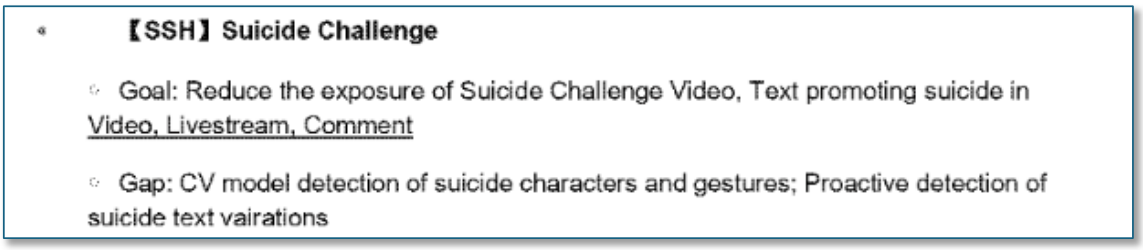
TikTok, for its part, uses the following true case study as illustrative of how its algorithms can do harm to people with underlying mental health conditions.

A young person with undiagnosed obsessive compulsive disorder started watching videos of people doing checking behaviours (tidying things, straightening rows, making beds with neat edges etc). None of it was violative or problematic for the majority of viewers. The more he watched, the more he got served. He got caught in a loop and, following his diagnosis, had to come off TikTok. The young person wants to come back on to TikTok and asks for a reset button so he can leave his problematic viewing behind.

Document 139: TIKTOK3047MDL-002-00075240, -5240

Although they used obsessive compulsive disorder in this example, SSI would have functioned in much the same way.

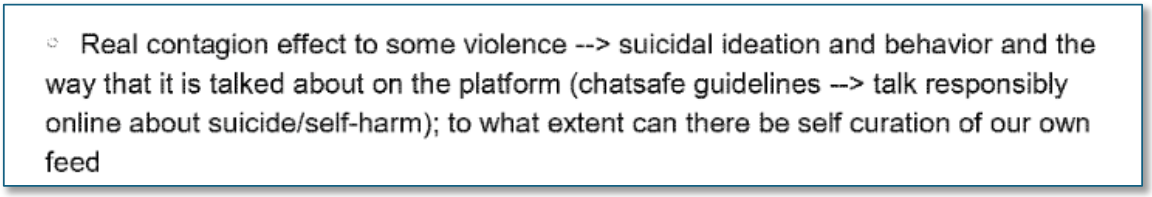
Proactively identifying which videos will go viral may indeed be challenging, although for a company founded on predictive analytics it seems highly achievable. In fact, as part of their 2021 "wellness goals," TikTok had the following:



- **【SSH】Suicide Challenge**
  - Goal: Reduce the exposure of Suicide Challenge Video, Text promoting suicide in Video, Livestream, Comment
  - Gap: CV model detection of suicide characters and gestures; Proactive detection of suicide text vairations

Document 140: TIKTOK3047MDL-002-00094384, -4419

Reducing exposure to "Suicide Challenge Videos" is a commendable goal, but anything short of 100% effectiveness poses real risks at scale to severely depressed teens. What's more, elsewhere, they explicitly acknowledge the "contagion" effect such videos can have:



- Real contagion effect to some violence --> suicidal ideation and behavior and the way that it is talked about on the platform (chatsafe guidelines --> talk responsibly online about suicide/self-harm); to what extent can there be self curation of our own feed

Document 141: TIKTOK3047MDL-004-00144763, -4763

It is my opinion to a reasonable degree of medical and scientific certainty that a causal relationship exists between social media use and suicidal ideation, suicide, and self-harm. Furthermore, there is ample support in the internal documents and depositions that the Defendant platforms because of algorithms developed and deployed and addictive design increased the risk of suicidal ideation and self-harm. Based upon the internal documents, Defendant actions to mitigate these risks were minimal, and any action was weighed against the impact they would have on their core metrics.

F. Attentional Capacity

There are at least two mechanisms whereby digital media usage in general, and social media use in particular may diminish attentional capacity. One is direct, and the other indirect. The direct pathway is mediated through the "scan and shift" hypothesis which states that the frequent diversions afforded by digital media can condition the brain to expect high levels of input—to seek distraction—impeding its ability to focus on a specific task at length.[373] The second pathway is mediated through the displacement of other activities. Simply put, time spent on digital devices comes at the expense of other activities (e.g. physical activity and sleep) which can impact attentional capacity.

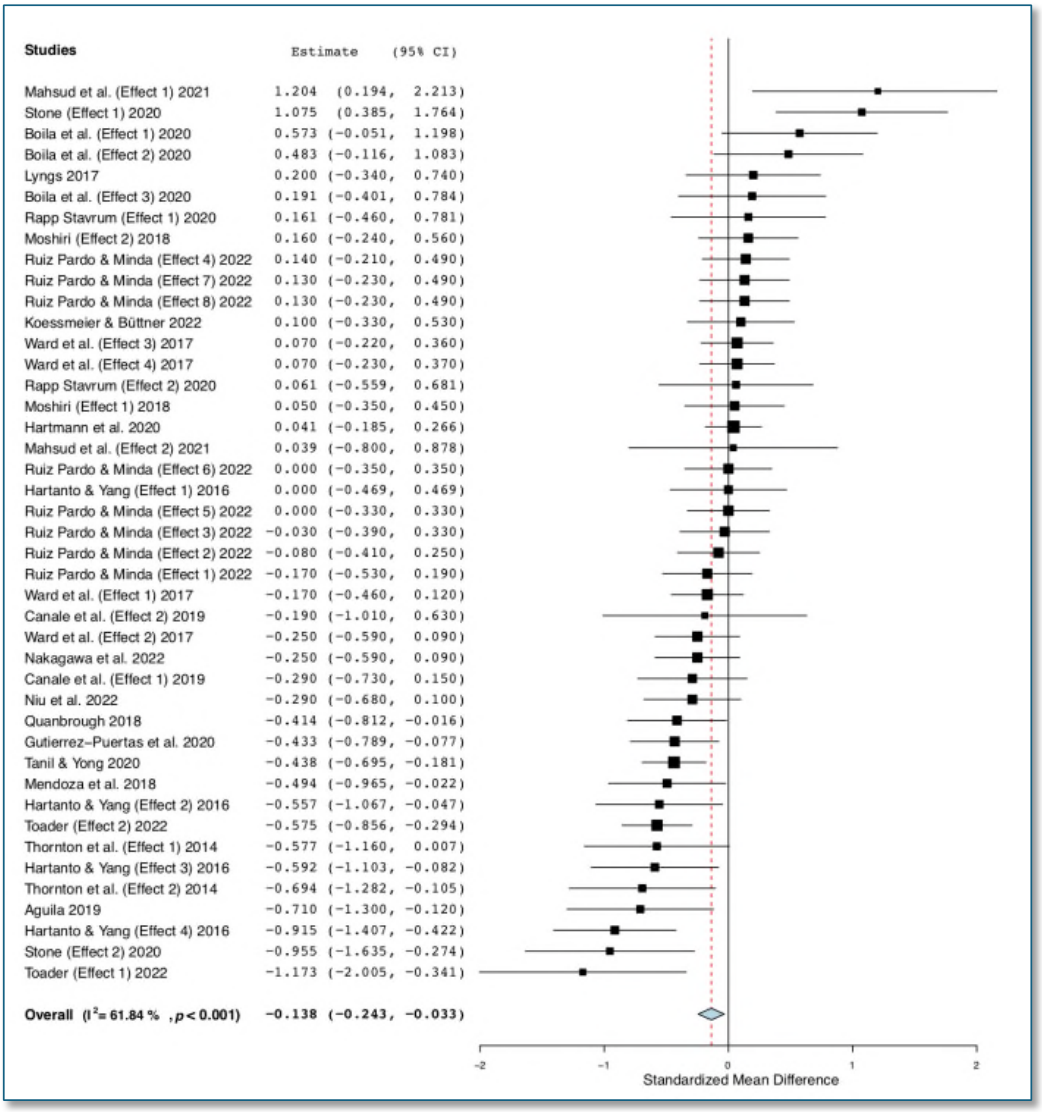
Some have thought that the mere presence of a phone is distracting and negatively impacts learning and attention, leading to what they call "brain drain."[374] This phenomenon recapitulates what we discussed in the sleep section (Section X.C) where a metanalysis found that the presence of a phone in the bedroom is associated with sleep disorders. Bottger and colleagues conducted a focused metanalysis of "brain drain" by synthesizing 22 studies that assessed smartphone presence and cognitive function.[375] There was significant heterogeneity in the studies. Nevertheless, applying a random effects approach, the summary results are as follows:

[373] Jensen PS, Mrazek D, Knapp PK, et al. Evolution and revolution in child psychiatry: ADHD as a disorder of adaptation. *J Am Acad Child Adolesc Psychiatry*. Dec 1997;36(12):1672-9; discussion 1679-81. doi:10.1097/00004583-199712000-00015v

[374] Ward A, Duke K, Gneezy A, Bos M, Drain B. The mere presence of smartphones reduces cognitive capacity. *J Assoc Consum Res*. 2017;2:140-54.

[375] Böttger T, Poschik M, Zierer K. Does the Brain Drain Effect Really Exist? A Meta-Analysis. *Behav Sci (Basel)*. Sep 11 2023;13(9)doi:10.3390/bs13090751

Figure 49: Summary of Metanalyses of Relationship Between Smartphones and Cognitive Function[376]



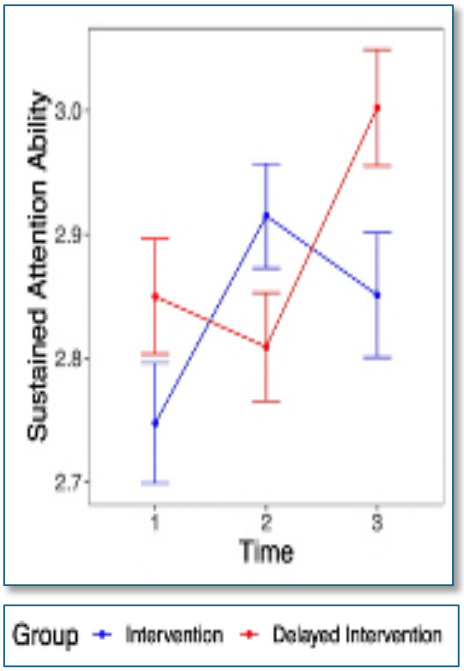
[376] Böttger T, Poschik M, Zierer K. Does the Brain Drain Effect Really Exist? A Meta-Analysis. *Behav Sci (Basel)*. Sep 11 2023;13(9)doi:10.3390/bs13090751

Overall, the presence of a smartphone was associated with a small but statistically significant negative effect (-0.138) on cognition. Sub-analyses reported that the effects were larger for memory and lower for attention and general cognitive performance.[377]

The Castelo et. al. study of making smartphones "dumb" detailed in Section X.D.i. also assessed attentional capacity using both self-reported attention and the "gold standard" approach of continuous performance task (CPT). Briefly, the CPT measures how well people can focus on a tedious task over time by having them stare at a blank screen and push buttons when prompted to do so based on the appearance of a specific symbol. It is based on a procedure used to screen cadets for service as radar operators during WWII, a task for which focused attention was of paramount importance to alert commanders to incoming aircraft. The results are presented below.

[377] Böttger T, Poschik M, Zierer K. Does the Brain Drain Effect Really Exist? A Meta-Analysis. *Behav Sci (Basel)*. Sep 11 2023;13(9)doi:10.3390/bs13090751

Figure 50: Sustained Attention Ability[378]



The effect size was .24 (p<.008). To put that into perspective, the authors report that it is the same magnitude of a 10-year age related decline in cognition and about ¼ of the magnitude of difference between healthy adults and those with ADHD.

Ra and colleagues conducted a large longitudinal study.[379] His team surveyed 2587 15–16-year-old adolescents in 10 Los Angeles high schools without ADHD symptoms at baseline over the course of 2 years. High-frequency digital media use (defined as past-week use of 14 different media activities, such as checking social media, liking or commenting on others' posts, online browsing, or streaming videos) many times a day was associated with an 11% increased risk of

[378] Castelo N, Kushlev K, Ward AF, Esterman M, Reiner PB. Blocking mobile internet on smartphones improves sustained attention, mental health, and subjective well-being. *PNAS Nexus*. 2025;4(2)doi:10.1093/pnasnexus/pgaf017

[379] Ra CK, Cho J, Stone MD, et al. Association of Digital Media Use With Subsequent Symptoms of Attention-Deficit/Hyperactivity Disorder Among Adolescents. *JAMA*. 2018;320(3):255-263. doi:10.1001/jama.2018.8931

attentional problems at 12 and 24 months of follow-up (p<.001). Briefly, an effect size of .11, if true, has significant public health implications at scale and a p. value of less than .001 means that there is less than a 1/1000 chance that the association *is a false positive*. The major limitations of this study were that it relied on self-report of media usage and that it was observational meaning there could still be residual confounding, although the authors adjusted for multiple possible confounders including depression, delinquent behavior, socioeconomic status, substance use etc.

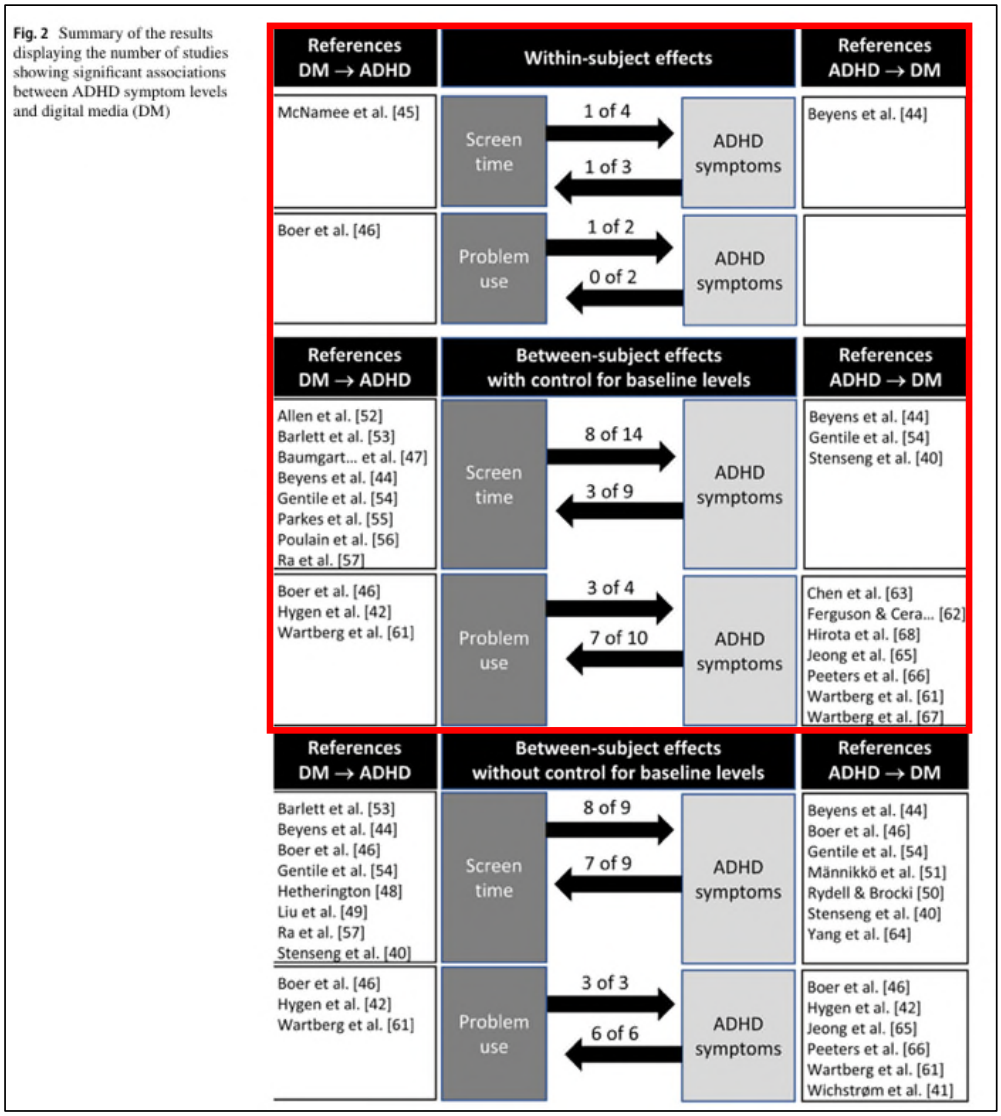
I next used the web of science database to see what studies have cited this high profile one since its publication. That strategy yielded several relevant studies as well as a systematic review "Longitudinal associations between digital media use and ADHD symptoms in children and adolescents."[380] Because that systematic review includes all the relevant studies I identified except one that was published after it was published, I will present its findings and then the subsequent study briefly.

Thorell and colleagues' systematic review identified 25 relevant studies related to use of digital devices and subsequent ADHD symptoms. The studies were too heterogenous (varying ages, follow-up periods, outcome measures, digital media usage measures etc.) to create a meta-analytic summary estimate so they were summarized in narrative format. Also notable was that some studies assessed the role of problematic screen use either at baseline or at follow-up. They also explored the bidirectionality of the relationship meaning they looked both at screen use predicting ADHD symptoms and ADHD symptoms predicting screen use. To the below is a summary figure from their paper. The most robust analyses are those that are within subject

[380] Thorell LB, Buren J, Strom Wiman J, Sandberg D, Nutley SB. Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. *Eur Child Adolesc Psychiatry*. Aug 2024;33(8):2503-2526. doi:10.1007/s00787-022-02130-3

(meaning they looked at changes to individuals over time) or those that are between subjects but controlled for baseline levels (highlighted in red).

Figure 51: Summary of the Number of Studies Showing Significant Associations Between ADHD Symptom Levels and Digital Media (DM)[381]



[381] Thorell LB, Buren J, Strom Wiman J, Sandberg D, Nutley SB. Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. *Eur Child Adolesc Psychiatry*. Aug 2024;33(8):2503-2526. doi:10.1007/s00787-022-02130-3

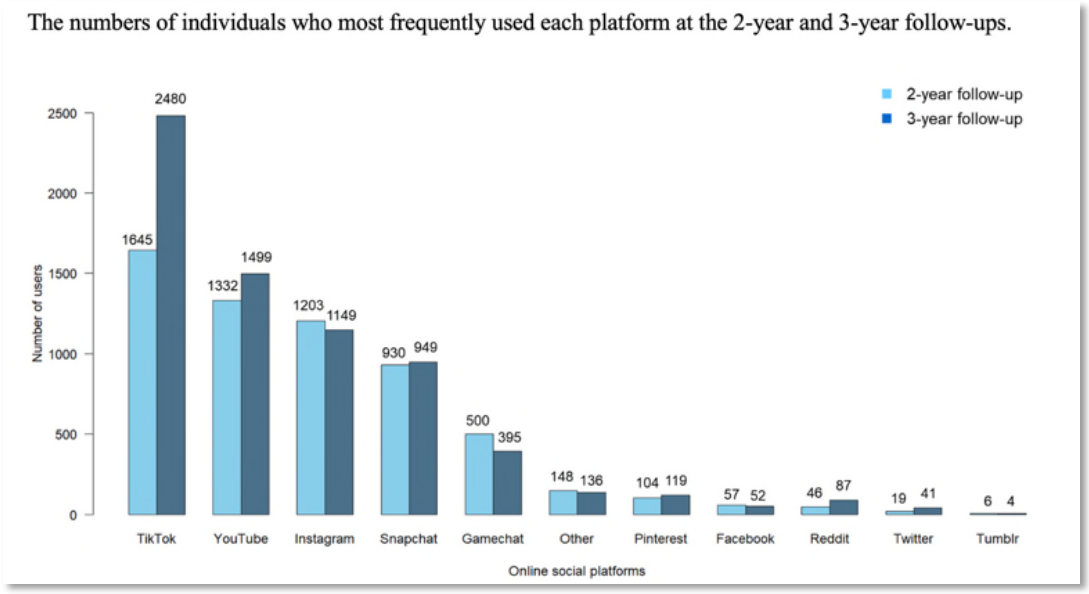
Overall, the authors (rightly in my opinion) conclude that the majority (74%) of studies found significant associations between digital media and subsequent ADHD symptoms. The effect sizes were on in general less than .30. Although these are not experimental studies, they are longitudinal and within subject which supports causality versus merely cross-sectional observational study.

Again, the primary limitations of the studies were reliance on self-reported media use and the observational nature of them all even though they were longitudinal. As before, experimental studies in this space, with sufficiently long follow up periods would be exceedingly difficult to deploy. Further, relevant to this case, digital media usage included all forms although as expected the predominant forms were social media sites as detailed above.

Deng and colleagues used the over 11,000 individuals from the ABCD study, a large, national US cohort of early adolescents followed longitudinally with extensive and comprehensive data collection to look at online social activity *specifically* and subsequent ADHD symptoms over a 3-year follow-up period adjusting for baseline characteristics.[382] The social media sites they examined are presented below. Overall, the most frequently used platforms were TikTok (36%), YouTube (22%), Instagram (17%) and Snapchat (14%). The rest comprised ~11% of usage. They found a small effect but highly statistically significant effect size of .07 ($p<.001$). Again, this overall effect may be more pronounced in specific sub populations at greater risk of ADHD.

[382] Deng H, Song K, Geng X, et al. Online social activity time predicts ADHD problems in youth from late childhood to early adolescence in the ABCD study. *European Child & Adolescent Psychiatry*. 2024/12/26 2024;doi:10.1007/s00787-024-02620-6

Figure 52: Chart Summarizing the Number of Individuals Who Most Frequently Used Each Platform 2-year and 3-year Follow-ups[383]



This phenomenon is reflected in Defendants' internal documents. For example, in a survey of clinicians regarding "the role of Social Media in Mental Health," some participants reported that social media "exacerbates some symptoms in particular that AHDH already causes, such as irritability and anxiety" and in children can lead them to be "more hyperactive, [and] more impulsive."[384] Likewise, YouTube's documents support a similar conclusion finding that "[t]he short form viewing experience exacerbates concerns of addiction and ADHD."[385] The same is true for TikTok, whose documents reported that an analysis of 28 studies "showed a bi-directional relationship between usage and [ADHD] symptoms" and that "children with ADHD symptoms

[383] Deng H, Song K, Geng X, et al. Online social activity time predicts ADHD problems in youth from late childhood to early adolescence in the ABCD study. *European Child & Adolescent Psychiatry*. 2024/12/26 2024;doi:10.1007/s00787-024-02620-6
[384] META3047MDL-019-00099847 at Slide 37.
[385] GOOG-3047MDL-00793501 at Slide 290.

were at higher risk for excessive use, and excessive use was related to more ADHD symptom development."[386]

It is my opinion to a reasonable degree of medical and scientific certainty, that social media usage causes cognitive impairment and ADHD symptomology. This observation is well-supported in the literature and occurs through both direct and indirect mechanisms. There is additional support within the companies' internal documents for a causal relationship between their platforms and ADHD symptoms.

G. School Performance

There are concerns about cell phone usage during school hours which can detract from learning, distract teachers, increase bullying, and reduce opportunities for physical play and in person interaction. Reliable data using passive sensing during school time are limited. In the context of the same study reference above, Common Sense Media assessed it and reported that children spend a median of 43 minutes per day on phones during school hours.[387] I have also published on this issue. Our study using both Android and iOS (also referenced above) found that they spend an average of 1.5 hours (95% CI, 1.31-1.73) on smartphones during the 6.5 hours of school, accounting for approximately 27% of average 24-hour phone use of 5.59 hours daily. Furthermore, in our sample, 25% of adolescents spent more than 2 hours on their phone during school.[388] Results are presented below.

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[386] TIKTOK3047MDL-062-01192752, -2752

[387] Radesky J, Weeks HM, Schaller A, Robb M, Mann S, Lenhart ACCAWitLoaYPsSUSF, CA: Common Sense. Constant Companion: A Week in the Life of a Young Person's Smartphone Use. 2023;

[388] Christakis DA, Mathew GM, Reichenberger DA, Rodriguez IR, Ren B, Hale L. Adolescent Smartphone Use During School Hours. *JAMA Pediatrics*. 2025;doi:10.1001/jamapediatrics.2024.6627

Figure 53: Summary of Adolescent Daily Smartphone Use[389]

Characteristic	No. of participants[a]	Minimum	25th Percentile	Median	75th Percentile	Maximum	Participants. %[b]
Smartphone use, h							
24-h Smartphone use	117	0.16	3.62	5.49	7.04	19.18	5.59 (5.06-6.12)
24-h Social media use	117	0.00	0.47	2.00	3.13	6.31	2.14 (1.84-2.45)
School-day smartphone use	117	0.04	0.68	1.11	2.16	5.84	1.52 (1.31-1.73)
School-day social media use	117	0.00	0.20	0.39	0.76	2.46	0.60 (0.49-0.71)
Smartphone application use during school day, min							
Messaging and chat	88	1.00	2.69	5.82	26.92	186.96	19.46 (13.39-25.53)
Instagram	82	1.18	8.64	13.32	26.42	269.42	24.61 (17.91-31.31)
TV, movie, or video streaming	68	1.22	4.02	7.86	21.67	132.49	17.19 (10.99-23.39)
Music, media, and podcasts	58	1.01	1.81	3.21	4.82	99.49	4.48 (2.79-6.17)
Email	53	1.02	1.33	2.74	5.21	15.63	3.92 (2.94-4.89)
TikTok	48	1.17	6.05	9.23	35.75	71.99	18.88 (13.23-24.54)
Shopping and entertainment	47	1.01	1.28	2.22	4.45	39.02	5.21 (3.01-7.41)
Games	44	1.01	3.11	9.68	18.88	100.29	13.43 (8.84-18.02)
Facebook	40	1.18	2.97	7.33	20.27	87.39	19.88 (11.05-28.71)
Utilities	39	1.03	1.30	2.38	5.51	21.40	4.27 (2.82-5.71)

By any measure, more than 2 hours of phone usage during school negatively impacts the time and attention available for learning and engaging with fellow students and teachers.

By number of users, the top 5 most frequented apps or categories (excluding internet browsers) were messaging, Instagram, video streaming, audio, and email. This study found that teens spend approximately 25% of the school day on their phones either in or out of class but in either case it diminishes engagement in human face to face interactions that are foundational to socio-emotional and cognitive learning. Studies in this area continue.

A highly publicized and recently completed cross-sectional study in England assessed the association between school phone policies, phone use during school hours, and mental well-being. They found that although restrictive policies result in less phone use during school hours, there

[389] Christakis DA, Mathew GM, Reichenberger DA, Rodriguez IR, Ren B, Hale L. Adolescent Smartphone Use During School Hours. *JAMA Pediatrics*. 2025;doi:10.1001/jamapediatrics.2024.6627

was no significant differences in mental well-being.[390] The median cell phone usage in restrictive schools was about 45 minutes less than non-restrictive ones. However, the 10th-90th percentiles were the same. They also reported that social media time *during* school was associated with small increases in anxiety (.06) and depression (0.11). And *overall* social media usage per week was cross-sectionally associated with decreased well-being, and increased anxiety and depression consistent with many other similar studies discussed in greater detail elsewhere in the report. This study suggests that phone policies alone—or failure to enforce them better-- are not effective at fully addressing children's mental health.

Finally, it should be noted that all the above mental health harms – increased depression, anxiety, negative social comparison, FOMO, sleep disruption, body image issues and eating disorders – do not dissipate in the classroom. These conditions instead adversely affect the learning environment. A recent National Education Association report documented marked increases in student mental health issues at school, an inability of students to concentrate, and negative impacts such as cyberbullying and underdeveloped social skills that carry over into the classroom.[391]

Children spend more time in school than in any other place but their homes. Accordingly, all untoward outcomes of social media ultimately impact their school experience and their school performance. For that reason, the "School" section of this report is situated near the end: all paths ultimately lead to it. The problems students bring to school, they also bring into the classroom where teachers—tasked with educational responsibilities—must also address or attempt to

[390] Goodyear VA, Randhawa A, Adab P, et al. School phone policies and their association with mental wellbeing, phone use, and social media use (SMART Schools): a cross-sectional observational study. *The Lancet Regional Health – Europe*. doi:10.1016/j.lanepe.2025.101211
[391] https://www.nea.org/resource-library/impact-social-media-and-personal-devices-mental-health

overcome them. Suffice it to say that sleep-deprived, distracted, anxious, depressed, bullied students are more challenging to teach.

The literature on social media's direct effects on school performance is minimal. To wit, the review criteria entered for systematic reviews about social media and school only yielded results that were mediated by the other outcomes discussed above (e.g. Sleep, Anxiety etc). As these reviews largely recapitulated and overlapped with the prior ones already reviewed except insofar as they sometimes narrowly focused on "grades," I will not revisit them here but will focus instead on what we know (so far) about the other pathways that might impact school performance.

H. Cyberbullying and Risky Behaviors

Many studies connect social media use to an increase in cyberbullying and risky behaviors. These behaviors impact the school environment. "Risky behaviors" can include drug or alcohol use, sexting, high risk sexual encounters, weapon carrying, or violence perpetration. Cyberbullying includes sending hurtful messages, spreading gossip about others, and getting others to disclose private information that is then shared online.[392] It is recognized in the medical and scientific community that these behaviors tend to occur among peers from school. This necessitates the need for schools to address cyberbullying, notwithstanding the difficulties in doing so.[393]

The mechanism driving an increased risk in risky behaviors with social media use can be explained by examining Social Cognitive Theory, or SCT. Dr Albert Bandura (1925-2021) was a world-renowned professor of social science and psychology at Stanford University who originated SCT, a psychological theory that explains how people learn by observing others, emphasizing the dynamic interaction between a person's thoughts, behaviors, and their environment, with a key

[392] Handbook of Children and Screens at p. 433.
[393] Handbook of children and Screens at p. 434-436.

concept being "reciprocal determinism" where these factors continuously influence each other. Essentially, SCT posits that people learn not just through direct experience but also by watching and imitating others, with their own cognitive processes playing a significant role in how they interpret and apply what they observe.

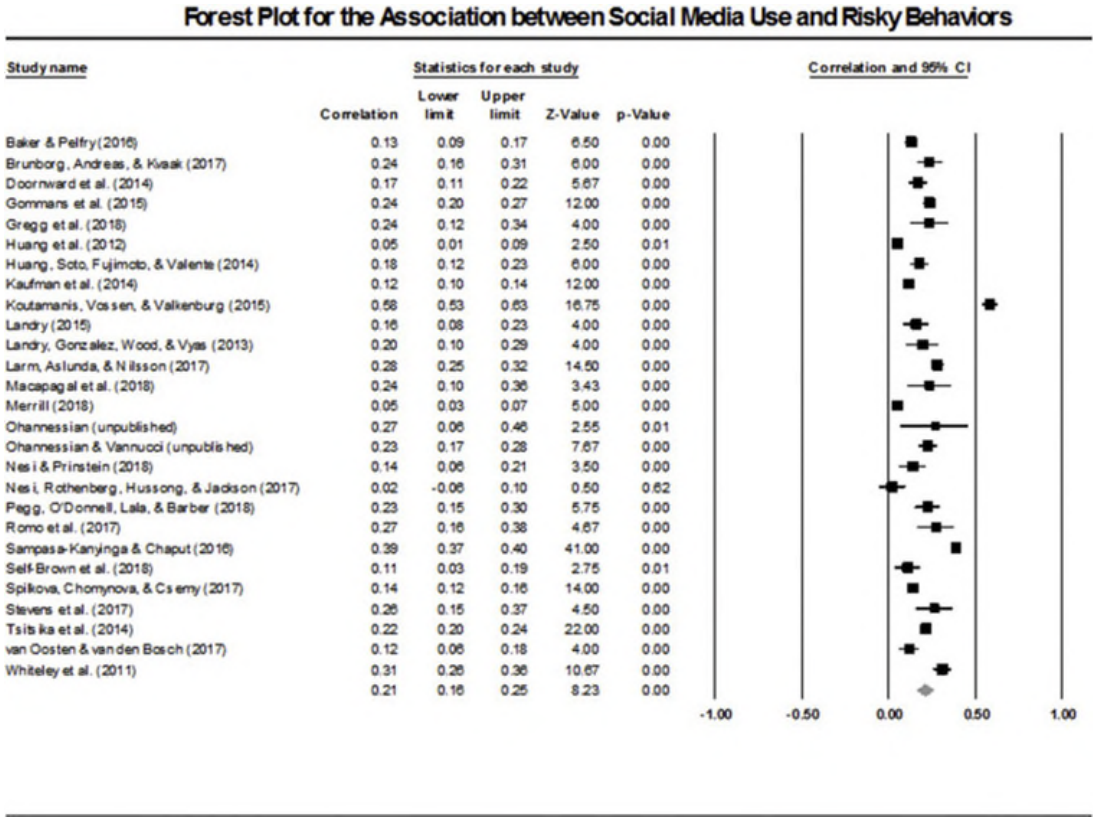
In his early, pioneering work, Dr. Bandura demonstrated through a series of experiments that children would imitate novel behaviors—even unusual or violent ones—if they say them modeled and they were even more likely to imitate them if they were performed by people or characters (including cartoons) the children respected for some reason.

SCT informs behaviors at all ages but younger people, especially those without fully developed pre-frontal cortices are more prone to its effects. Adolescents are especially developmentally suspectable to behavioral suggestions as they seek to differentiate their emerging "adult" identity from their childhood one, to adapt behaviors that they perceive as "cool," popular, or desirable, but lack the self-control to limit the impulse to take undue risk. SM provides copious opportunities for pre-teens, teens, and emerging adults to emulate behaviors – good and bad. Notably, SM companies are eager to take credit for the spread of virtuous behaviors via their platforms (e.g. the Ice Bucket Challenge for ALS research) but equally eager to distance themselves from the pernicious ones (e.g. Blue Whale Challenge as a suicide pact). But the mechanism is the same for both; they are, if you will, two sides of the same Bandurian SCT coin.

A metanalyses of 27 cross sectional studies examining the association between self-reported risky behaviors and self-reported social media use found a small to medium effect size (.21) (see below for summary table) The modest effect size should be interpreted as conservative because the predictor variable was *overall* social media use and the key driver would be the content

viewed (e.g. risky behavior) which was not collected.[394] Further, the effect is likely to be greater among adolescent boys given their predisposition, but data were not stratified by gender.

Figure 54: Forest Plot for the Association Between Social Media Use and Risky Behaviors[395]



"Risky behaviors" in the context of this study were defined as drug or alcohol use, sexting, high risk sexual encounters, weapon carrying, or violence perpetration. These are the most common adolescent risk behaviors but the mechanism underlying undertaking them is the same as that for other less common "risky behaviors" (i.e. subway surfing).

[394] Vannucci, Anna & Simpson, Emily & Gagnon, Sonja & Ohannessian, Christine. (2020). Social media use and risky behaviors in adolescents: A meta-analysis. Journal of Adolescence. 79. 258-274. 10.1016/j.adolescence.2020.01.014.

[395] Vannucci, Anna & Simpson, Emily & Gagnon, Sonja & Ohannessian, Christine. (2020). Social media use and risky behaviors in adolescents: A meta-analysis. Journal of Adolescence. 79. 258-274. 10.1016/j.adolescence.2020.01.014.

This metanalytic summary is not without limitations, most notably that the studies were all cross-sectional so causality cannot be proven; it could be that risk taking adolescents also seek risk taking posts online. There was also significant heterogeneity among studies, making combining the results questionable and conservative.

Longitudinal studies of SM exposure to risky behavior and subsequent risk taking are limited but there are ample studies of other media exposures (e.g. tobacco and alcohol use and in movies and advertising) and subsequent drinking and smoking.[396] The Bridge *et al* study detailed before also examined the impact of viewing suicide relevant content to risk of committing suicide.[397]

Finally, a metanalytic summary of 29 studies examined the effects of exposure to tobacco on social networking sites and subsequent smoking.[398] In the figure below which includes both cross-sectional and longitudinal studies, exposure to tobacco use on SMS was associated with a 1.5 to 2.4 increased risk of smoking (depending on how it was defined) and even when the analysis was restricted to longitudinal studies the risk remained 1.5 times higher (data not shown).

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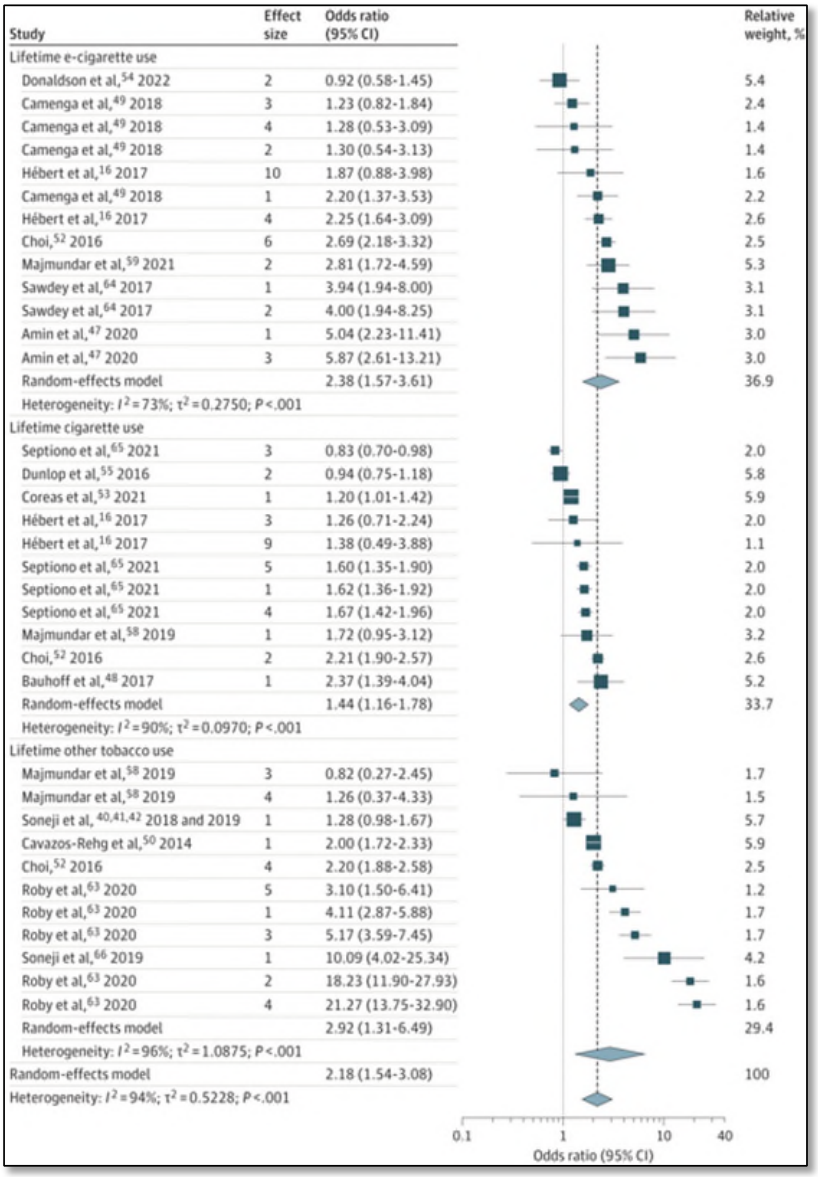
[396] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clin Psychol Rev*. Jun 2021;86:102021. doi:10.1016/j.cpr.2021.102021; Franklin JC, Ribeiro JD, Fox KR, et al. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychol Bull*. Feb 2017;143(2):187-232. doi:10.1037/bul0000084

[397] Bridge JA, Greenhouse JB, Ruch D, et al. Association Between the Release of Netflix's 13 Reasons Why and Suicide Rates in the United States: An Interrupted Time Series Analysis. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2020/02/01/ 2020;59(2):236-243. doi:https://doi.org/10.1016/j.jaac.2019.04.020

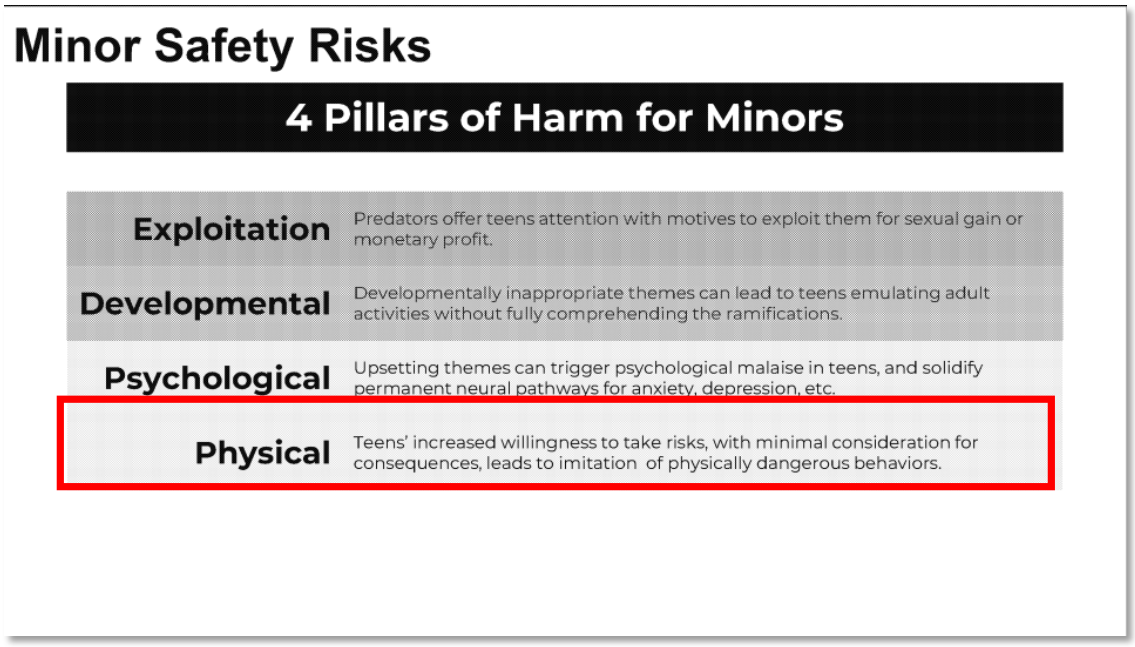
[398] Donaldson SI, Dormanesh A, Perez C, Majmundar A, Allem JP. Association Between Exposure to Tobacco Content on Social Media and Tobacco Use: A Systematic Review and Meta-analysis. JAMA Pediatr. 2022 Sep 1;176(9):878-885. doi: 10.1001/jamapediatrics.2022.2223. PMID: 35816331; PMCID: PMC9274450.

Figure 55: Forest Plot of 3-Level Meta-analysis for Exposure to Tobacco Content on Social Media and Lifetime Tobacco Use, Including e-Cigarettes, Cigarettes, and Other Tobacco Use[399]

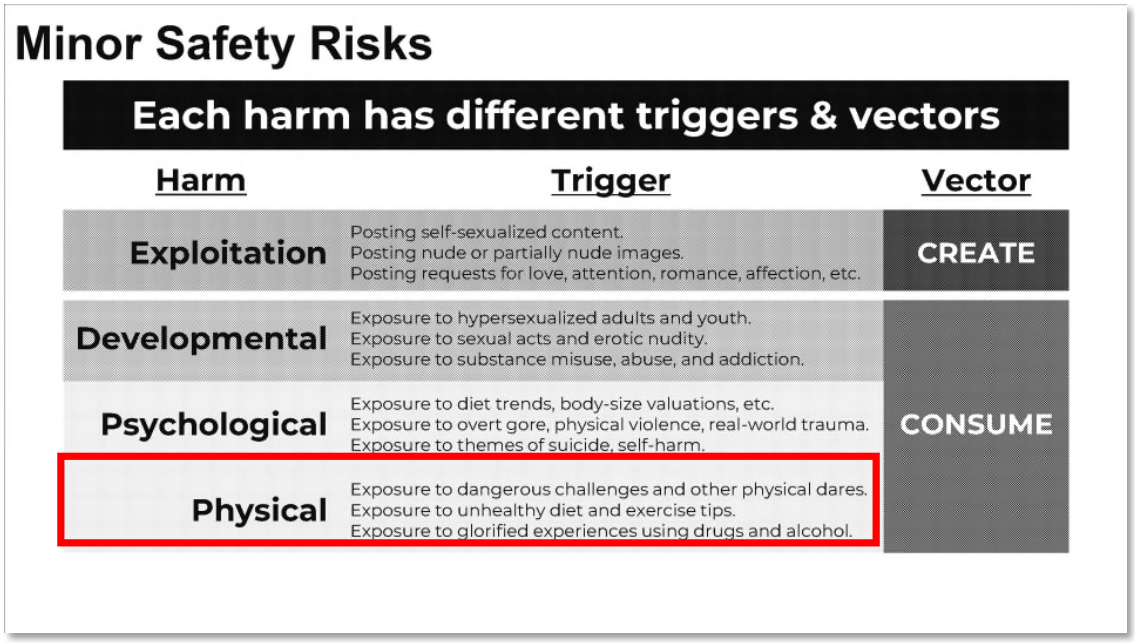


[399] Donaldson SI, Dormanesh A, Perez C, Majmundar A, Allem JP. Association Between Exposure to Tobacco Content on Social Media and Tobacco Use: A Systematic Review and Meta-analysis. JAMA Pediatr. 2022 Sep 1;176(9):878-885. doi: 10.1001/jamapediatrics.2022.2223. PMID: 35816331; PMCID: PMC9274450.

TikTok for its part appears to be aware of the risk posed by "harmful" and "dangerous" challenges. Below are two slides from TikTok presentations (Red boxes added):



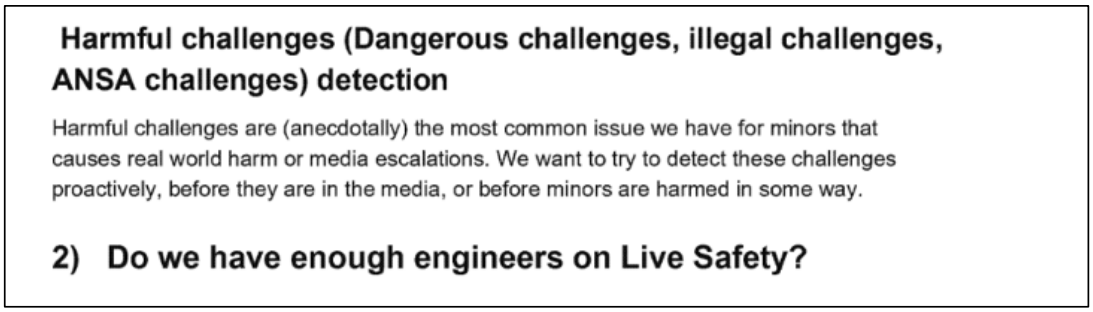
Document 142: TIKTOK3047MDL-001-00060986, -1000



Document 143: TIKTOK3047MDL-001-00060986, -1001

These documents confirm that internally, such videos were viewed as posing risks to teens, enough so that tracking them and removing them was a goal although it appears to have been an under resourced one:

Tiktok Challenge	4	• #1: **Lug nut Challenge**, (Old, 2 escalation this week, 2 in history) ◦ Users call it the "lug nut challenge" and are loosening or removing lugs from car tires in hopes of gaining likes online. ◦ No related cases were located by IM/Algo. Related bits ticket [HYPERLINK "https://bits.byteoversea.net/rocket/story?projectId=2648&type=list&viewType=require&viewId=2415&rid=1074548&storyTab=detail" \h] • #2: **Dryscooping Challenge**, (Old, 1 escalation this week, 1 in history) ◦ The challenge was dimmed violative in Jun and sweeping was done. We still find some dry scooping challenge related videos on the platform. New request for sweeping has been submitted. ◦ Related bits ticket [HYPERLINK "https://bits.byteoversea.net/rocket/story?projectId=2571&type=list&viewType=require&viewId=2502&storyTab=detail&rid=1049385" \h] • #3: **Slap Teacher Challenge**, (Old, 1 escalation this week, 1 in history) ◦ A video showing students punching teacher was shared offline, uploaded to Instagram first then uploaded to Tiktok (all removed now). So far haven't find neither much cases nor evidence of students being inspired by Tiktok contents. ◦ Related bits ticket [HYPERLINK "https://bits.byteoversea.net/rocket/story?projectId=2648&type=list&viewType=require&viewId=2415&rid=1074697&storyTab=detail" \h]



Document 144: TIKTOK3047MDL-004-00290064, -4380064

In summary, it is my opinion that to a reasonable degree of medical and scientific certainty, social media via the algorithms it developed and deployed and addictive design increases the risk of both risky behaviors and cyberbullying. These effects impact the school environment, as these issues tend to arise between classmates. A review of internal documents provides additional support that social media use increases the risk of these two behaviors.

I. Unwanted Interactions from Adults

As discussed extensively in Section VI above, children are uniquely vulnerable by virtue of both brain and social development, and social media is a largely unregulated environment that can pose unique dangers that exploit these vulnerabilities. One particularly disturbing safety risk is the Defendant platforms' facilitation of child predators contacting and grooming children—a phenomenon that is well-documented in Defendants' internal documents, that Defendants did not successfully address despite notice of the same, and that no Defendant appears to have warned children or parents about. When children are being constantly pulled back online by the addictive features of social media, it's more likely that they will experience unwanted interactions with adults especially if the algorithms have already begun to target them. This is even more harmful when one considers that children are being targeted in a forum in which their ability to access crucial in-person support is limited.

The scope of the problem was known within Meta since at least 2020. A memo from Sayed Otaru (IG Safety Product Manager) to Chris Williams (FB Safety Product Manager) on June 24th, 2020, related to Inappropriate Interactions with Children (IIC) states it as follows:

> **Problem Summary**
> Messenger implements a classifier that predicts adult accounts that engage in IIC with underage accounts. Messenger subsequently restricts those flagged adult accounts from being able to make friend requests to all non-adult accounts. Messenger does not de-platform flagged adult accounts and believes the restriction is a sufficient deterrent. Instagram (IG) has historically not been able to classify non-adult accounts, until recently. The CI team has concluded a study (the numbers have not yet been formalized) and currently show that **500,000 IG underage accounts receive IIC on a weekly basis**. The IG prevalence number is 3x Messenger's.

Document 145: META3047MDL-003-00028214, -8218

The actual figure according to Malia Andrus, who joins the discussion is "**500k victims per DAY in ENGLISH markets ONLY**" (*emphasis in original*).[400]

The persistence of the problem stems in part from the lack of classifiers according to Michael Rothschild, Senior Director of Product Management at Meta:

[400] META3047MDL-003-00028214, -8216

Michael Yehuda Rothschild (3/29/2020 14:34:33 PDT):
>Btw, according to Manoli we don't have CEI/IIC classifiers integrated to filtering in recommendations. The only protection we have is tiering – ie 1 strike will filter that account out for 90 days. Does that seem right from what you know?

Yoav Shapira (3/29/2020 14:39:20 PDT):
>Yup. Those classifers are somewhere between non-existent and shitty.

Michael Yehuda Rothschild (3/29/2020 14:39:36 PDT):
>I see. Bummer

Yoav Shapira (3/29/2020 14:39:41 PDT):
>The list of signals we have available is here:
https://our.internmc.facebook.com/intern/wiki/Instagram_Content_Signal_Service/#system-map

Michael Yehuda Rothschild (3/29/2020 14:40:15 PDT):
>So the only protection is tiering which relies on strikes which are significantly lower volume due to CO shutdown

Yoav Shapira (3/29/2020 14:40:21 PDT):
>Correct.

Yoav Shapira (3/29/2020 14:40:31 PDT):
>But those low-prevalence problems are in a shitty state across all of Facebook, Inc.

Yoav Shapira (3/29/2020 14:41:01 PDT):
>People seem to refuse to believe it, sadly, across teh family of apps. Everyone wants those classifiers to be better, but they suck, and they're not improving fast.

Document 146: META3047MDL-014-00349418, -9418

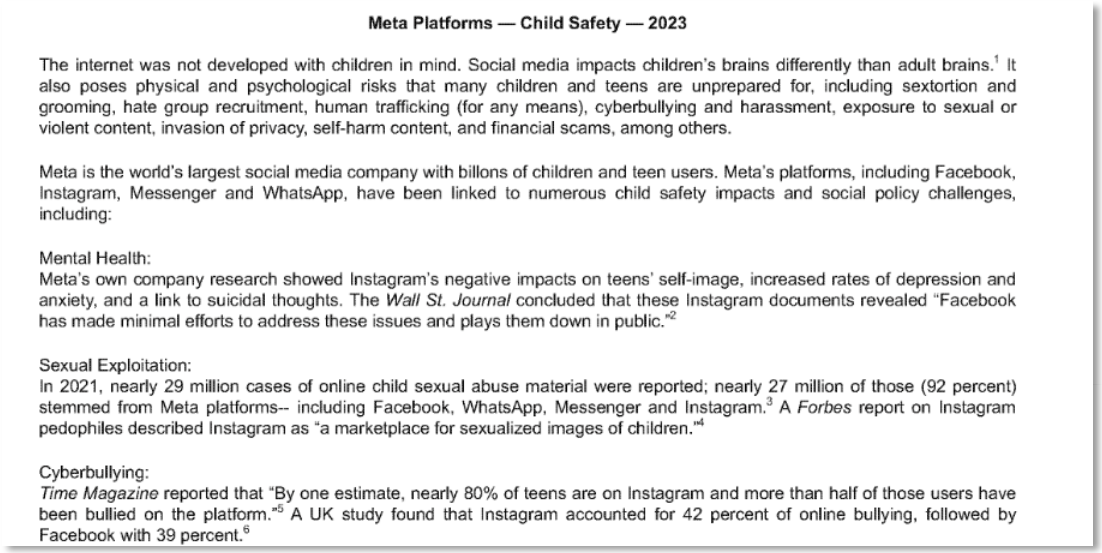
Shapira goes on to say, "Most of our policies I don't believe will have really good classifiers for years, if ever."[401] In an email a few months after this chat, with apparent indifferent resignation, Shapira states on June 26, 2020, "Child Safety is explicitly called out as a non-goal in our H2 plans. So if we can do something here, cool. But if we can do nothing at all, that's fine too."[402] Rothschild writes, "I agree that Rothschild writes, "I agree that [child safety] is a non-goal but also agree that these numbers [500k IIC's per day] are quite alarming."[403]

In November 2020, Meta summarized what it called its "vulnerabilities" in this space in a slide entitled "Child Sexual Exploitation: State of Play":

[401] META3047MDL-014-00349418, -9419
[402] META3047MDL-014-00350155
[403] META3047MDL-014-00350154, -0155

Document 147: META3047MDL-004-00027515, -1518

The long list of "vulnerabilities," many of which were known for years, could be read as a "to-do" list (one that lacked completion). That Meta failed to address these issues is amply demonstrated by a shareholder proposal submitted three years later to Meta's Board of Directors (which the board recommended voting against):



Meta Platforms — Child Safety — 2023

The internet was not developed with children in mind. Social media impacts children's brains differently than adult brains.[1] It also poses physical and psychological risks that many children and teens are unprepared for, including sextortion and grooming, hate group recruitment, human trafficking (for any means), cyberbullying and harassment, exposure to sexual or violent content, invasion of privacy, self-harm content, and financial scams, among others.

Meta is the world's largest social media company with billons of children and teen users. Meta's platforms, including Facebook, Instagram, Messenger and WhatsApp, have been linked to numerous child safety impacts and social policy challenges, including:

Mental Health:
Meta's own company research showed Instagram's negative impacts on teens' self-image, increased rates of depression and anxiety, and a link to suicidal thoughts. The *Wall St. Journal* concluded that these Instagram documents revealed "Facebook has made minimal efforts to address these issues and plays them down in public."[2]

Sexual Exploitation:
In 2021, nearly 29 million cases of online child sexual abuse material were reported; nearly 27 million of those (92 percent) stemmed from Meta platforms-- including Facebook, WhatsApp, Messenger and Instagram.[3] A *Forbes* report on Instagram pedophiles described Instagram as "a marketplace for sexualized images of children."[4]

Cyberbullying:
Time Magazine reported that "By one estimate, nearly 80% of teens are on Instagram and more than half of those users have been bullied on the platform."[5] A UK study found that Instagram accounted for 42 percent of online bullying, followed by Facebook with 39 percent.[6]

Document 148: META3047MDL-050-00343376, -3465

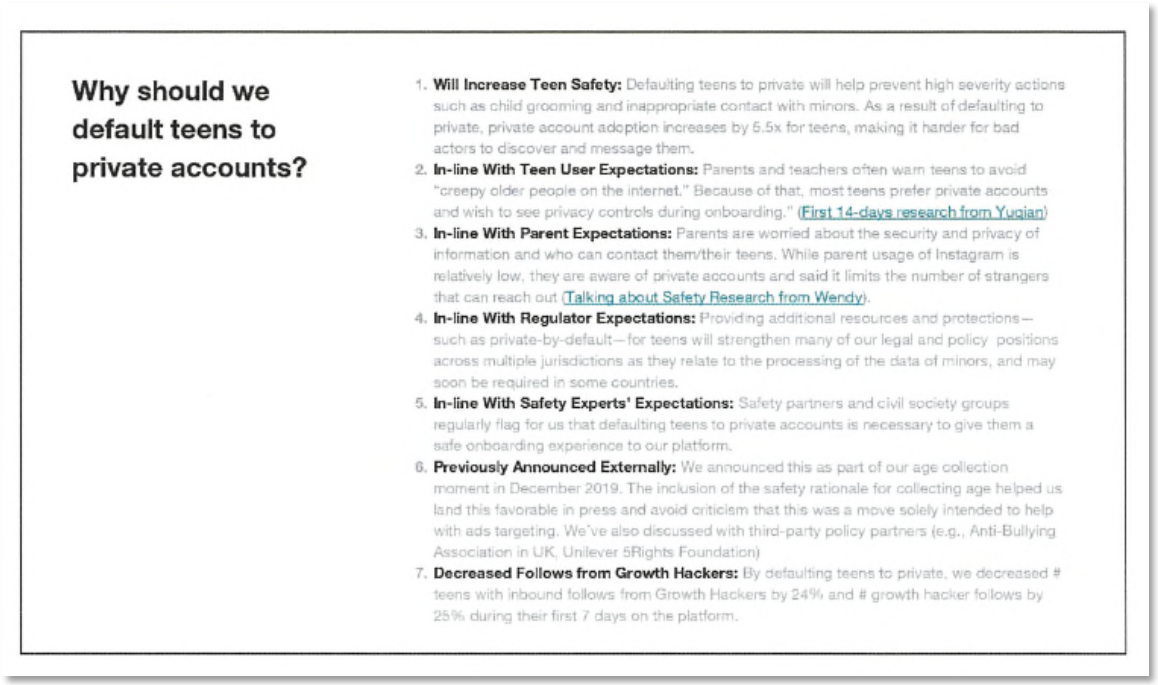
"Discoverability" and "reachability" of minors by unknown adults and in particular predators was a longstanding and long ignored issue at Instagram in particular. Instagram allows people to find each other and while there can be additional privacy settings that restrict who can see one's content, the default setting for teens for many years was set to "public." When set that way, anyone can direct message (DM) someone they find on Instagram.

In July 2019, a researcher at Instagram, Hitomi Hayashi-Branson. recommended that this setting be changed and that "smart defaults" be applied "to make it easier for users to leverage and benefit from existing privacy and security tools so they can feel safe on Instagram."[404] The researcher recommended applying new privacy defaults because "most users don't know about the tools we have …And are not likely to go into settings to find them."[405] The researcher explained how, "In a research study on US Tweens and their social media use tweens were concerned with their safety online and were particularly aware of stranger-danger and bullying online. And while

[404] Diego Castaneda Dep. Ex. 14 at -8266.
[405] Diego Castaneda Dep. Ex. 14 at -8248

they did not seek out trouble, they were aware that trouble could find them. In this study, parents had similar concerns around privacy and bad actors."[406]

Other internal documents at Instagram make the case for why teen account should be set to "private," including that these defaults would be "in-line" with "teen user expectations," "parent expectations," and "safety experts' expectations."



Why should we default teens to private accounts?

1. **Will Increase Teen Safety:** Defaulting teens to private will help prevent high severity actions such as child grooming and inappropriate contact with minors. As a result of defaulting to private, private account adoption increases by 5.5x for teens, making it harder for bad actors to discover and message them.
2. **In-line With Teen User Expectations:** Parents and teachers often warn teens to avoid "creepy older people on the internet." Because of that, most teens prefer private accounts and wish to see privacy controls during onboarding." (First 14-days research from Yuqian)
3. **In-line With Parent Expectations:** Parents are worried about the security and privacy of information and who can contact them/their teens. While parent usage of Instagram is relatively low, they are aware of private accounts and said it limits the number of strangers that can reach out (Talking about Safety Research from Wendy).
4. **In-line With Regulator Expectations:** Providing additional resources and protections—such as private-by-default—for teens will strengthen many of our legal and policy positions across multiple jurisdictions as they relate to the processing of the data of minors, and may soon be required in some countries.
5. **In-line With Safety Experts' Expectations:** Safety partners and civil society groups regularly flag for us that defaulting teens to private accounts is necessary to give them a safe onboarding experience to our platform.
6. **Previously Announced Externally:** We announced this as part of our age collection moment in December 2019. The inclusion of the safety rationale for collecting age helped us land this favorable in press and avoid criticism that this was a move solely intended to help with ads targeting. We've also discussed with third-party policy partners (e.g., Anti-Bullying Association in UK, Unilever 5Rights Foundation)
7. **Decreased Follows from Growth Hackers:** By defaulting teens to private, we decreased # teens with inbound follows from Growth Hackers by 24% and # growth hacker follows by 25% during their first 7 days on the platform.

Document 149: Darius Kilstein Dep. Exhibit 57 at -6982.

Unfortunately, it took Meta several years (and thousands of lawsuits) to act on these findings. The reasons for the delay are made clear by the documents. In a 2019 exchange between Darius Kilstein and Maria Ioveva, design lead for growth at Instagram, Mr. Kilstein predicted that private by default would "smash engagement, DAP, MAP, etc."[407]

[406] Diego Castaneda Dep. Ex. 14 at -8251
[407] Darius Kilstein Dep. Ex. 29 at -5175

Darius Kilstein (8/29/2019 14:20:03 PDT):
>holy shit

Darius Kilstein (8/29/2019 14:20:21 PDT):
>What's the rationale for the push?

Darius Kilstein (8/29/2019 14:20:41 PDT):
>This will likely smash engagement, DAP, MAP etc

Maria Ioveva (8/29/2019 14:20:53 PDT):
>current climate? policy pressure? potentially contributing to teen suicides?

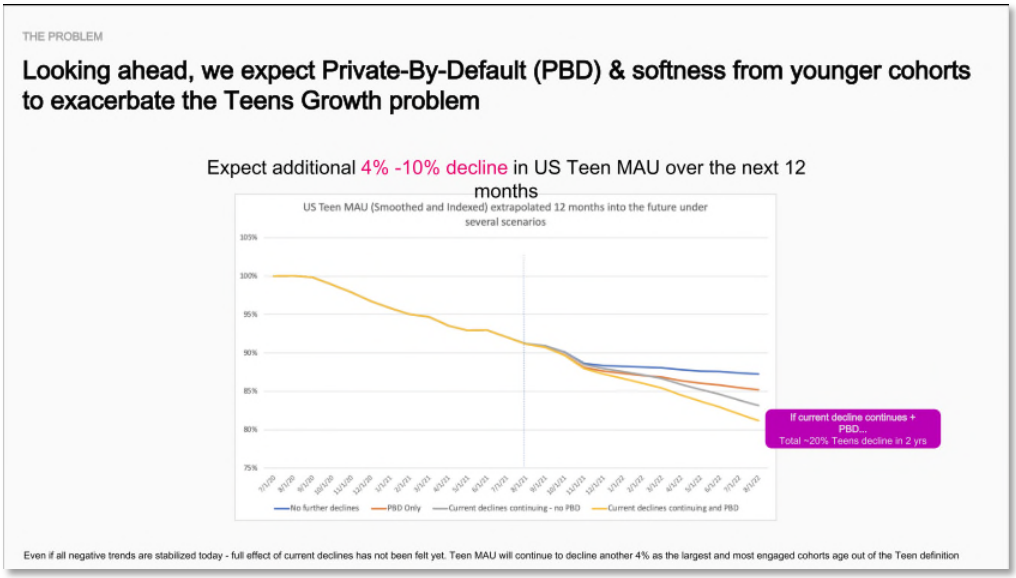
Darius Kilstein (8/29/2019 14:21:24 PDT):
>What policy pressure?

Maria Ioveva (8/29/2019 14:21:36 PDT):
>What are we doing to protect minors

Darius Kilstein (8/29/2019 14:21:40 PDT):
>i see

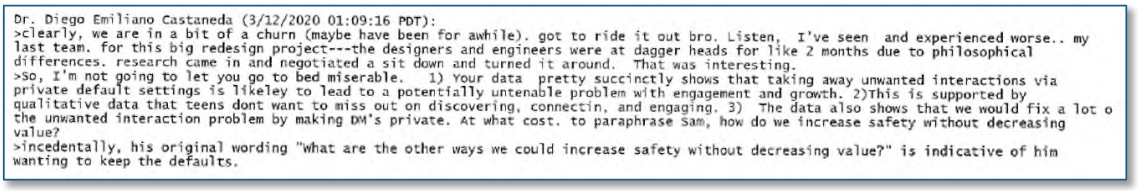
Document 150: META3047MDL-003-00005175, 5175

The concern that "engagement" might be "smashed" came at a time when Instagram was already concerned about losing young teen market share as the below graphic illustrates.



Document 151: META3047MDL-035-00002761 at Slide 32

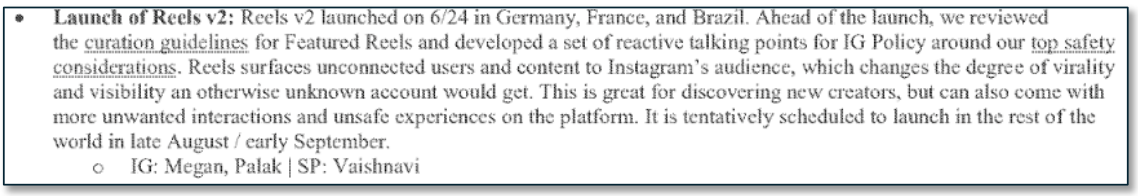
Hence, despite considering a change, in March 2020 Meta leadership wrote researchers to "explicitly say that we will not be defaulting anyone to new interaction settings."[408] The documents I have reviewed leave little room for doubt that growth considerations motivated this decision. Dr. Castaneda acknowledged in a private message that the project was shelved due to "a potentially untenable problem with engagement and growth":


Dr. Diego Emiliano Castaneda (3/12/2020 01:09:16 PDT):
>clearly, we are in a bit of a churn (maybe have been for awhile). got to ride it out bro. Listen, I've seen and experienced worse.. my last team. for this big redesign project---the designers and engineers were at dagger heads for like 2 months due to philosophical differences. research came in and negotiated a sit down and turned it around. That was interesting.
>So, I'm not going to let you go to bed miserable. 1) Your data pretty succinctly shows that taking away unwanted interactions via private default settings is likeley to lead to a potentially untenable problem with engagement and growth. 2)This is supported by qualitative data that teens dont want to miss out on discovering, connectin, and engaging. 3) The data also shows that we would fix a lot o the unwanted interaction problem by making DM's private. At what cost. to paraphrase Sam, how do we increase safety without decreasing value?
>incedentally, his original wording "What are the other ways we could increase safety without decreasing value?" is indicative of him wanting to keep the defaults.

Document 152: Diego Castaneda Dep. Exhibit 12 at 5

Ms. Jayakumar communicated to Ms. Gartland (IG Privacy Lead) that the proposed launch of "teen private by default was scrapped due to growth concerns."[409]

This was particularly worrisome given that the potential problem posed by predators DM'ing minors on Instagram was recognized as it prepared to launch "Reels" in order to compete with TikTok, which had become the dominant platform in short order.

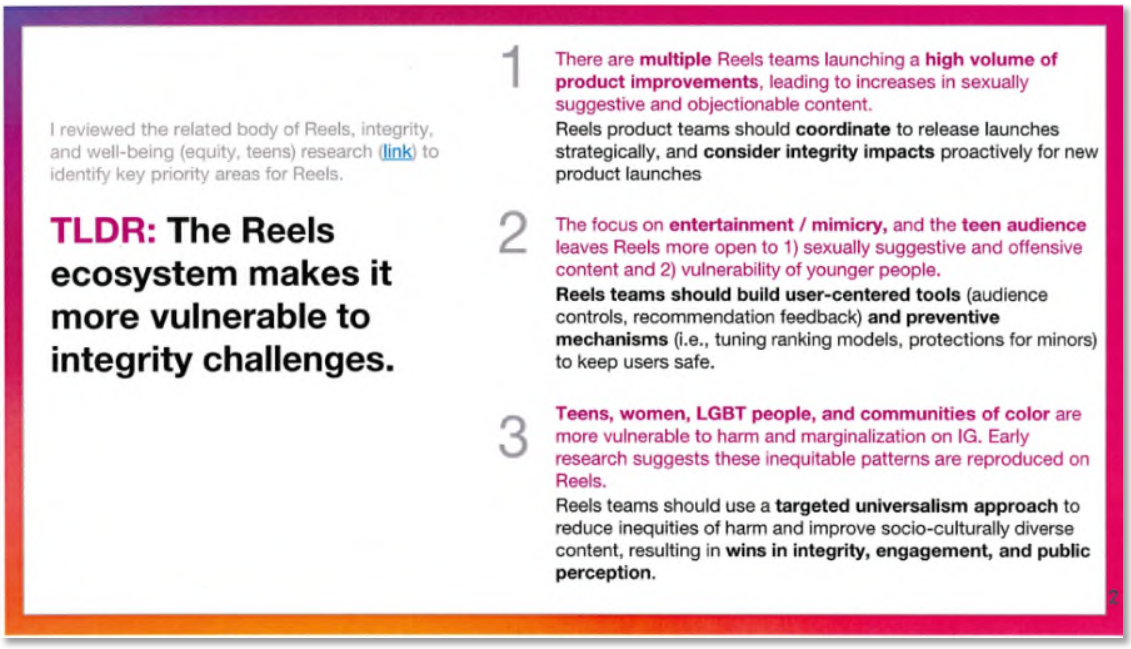

- **Launch of Reels v2:** Reels v2 launched on 6/24 in Germany, France, and Brazil. Ahead of the launch, we reviewed the curation guidelines for Featured Reels and developed a set of reactive talking points for IG Policy around our top safety considerations. Reels surfaces unconnected users and content to Instagram's audience, which changes the degree of virality and visibility an otherwise unknown account would get. This is great for discovering new creators, but can also come with more unwanted interactions and unsafe experiences on the platform. It is tentatively scheduled to launch in the rest of the world in late August / early September.
    - IG: Megan, Palak | SP: Vaishnavi

Document 153: META3047MDL-020-00271173

Jayakumar expressed concerns that "viral" reels created by teens would expose them to a wide array of adults including potential predators who could then DM them, leading to grooming and

[408]Castaneda Dep. Ex. 12
[409] Vaishnavi Jayakumar Dep. Tr. at 69:6-10

sextortion. She proposed not making Reels public or at least restricting access once they reached a certain view threshold, but that recommendation was likewise not followed.[410] A presentation by Lee summarized her team's concerns about Reels:



Document 154: Alison Lee Deposition Exhibit 4 at Slide 2

The introduction of "Reels" at Meta in August of 2020 did, in fact, increase the prevalence of sexual content featuring minors.[411] In fact, "Sexually suggestive content featuring minors is 2-3 times higher on Reels than Explore."[412] Lee further stated:

> I think that were content that was being distributed on reels that were reaching audiences that users did not intent as original audience. And we also conducted research that showed that young people had a preferred audience that they wished to reach.
>
> And there was also research that suggested that particularly young women who were producing content on Reels were experiencing unwanted interactions as a

[410] Vaishnavi Jayakumar Deposition Transcript at 47:1-48:13
[411] Alison Lee Dep. Tr. at 49:16-21
[412] Alison Lee Dep. Tr. at 98:6-10

> result of their content being shown to people that they did not wish to have it be shown to.[413]

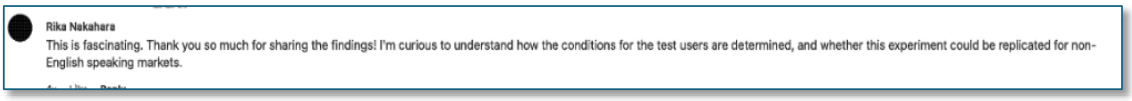
In response she was asked was that one example where the algorithmic distribution could endanger young users?" Her reply, "Yes, it could endanger young users as a result of that distribution."[414]

What is more, Exhibit 6 in the Lee deposition has the following quote, "New approaches to protect children and teens (i.e. Preventing visibility between known IIC [Inappropriate Interactions with Children] adults should be ported to Reels."[415] Lee confirmed in her deposition that there are accounts that have been "flagged" as having "had previous inappropriate interactions with children."[416] She later confirmed that said adults were being limited in their ability to contact teens on other surfaces but not (yet) on Reels.[417] One might rightly ask why such individuals are allowed on the platform at all given the "adjudicated risk" they pose. Or at least, why parents were not informed that the site did not, by policy or practice, ban people they suspected might be child predators.

To their credit, for reasons that are not clear in the documents, in June of 2020, Johanna Somerville on the Instagram investigation team performed a test in which she created a fake user and followed 70 accounts that were either sexualizing minors or talking about them inappropriately. In response, within 24 hours, the Instagram algorithms filled her Feed, Explore, and Recommended accounts with "almost exclusively minor sexualization content and accounts" including CEI.[418] When she reported this on a group chat, one of the first responses was:

---

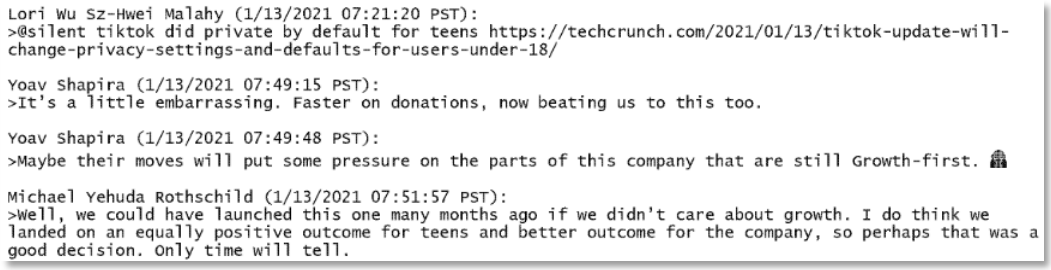
[413] Alison Lee Dep. Tr. at 56:6-18
[414] Alison Lee Dep. Tr. at 58:24-25
[415] Alison Lee Dep. Exhibit 6 at -8942
[416] Alison Lee Dep. Tr. at 106:9-12
[417] Alison Lee Dep. Tr. at 106:17-107:11
[418] Vaishnavi Jayakumar Dep. 31 at -0324



Document 155: META3047MDL-144-00000324, -0325

The precise verbiage warrants repeating. "This is ***fascinating***. (emphasis added) Thank you so much for sharing the findings!" Fascination and gratitude are not the first reactions most people—certainly most parents—would have to this revelation. Shock and outrage would be more appropriate. The tepid response may explain why in spite of there being 38x as many victims (of IIC) on Instagram as on Facebook, CEI deletes on Instagram were 21x lower and IIC auto-enforcing on Instagram was 90x lower compared to Facebook.[419]

In January 2021, Lori Malahy (IG Well-Being Research Lead), Yoav Shapira (IG Well-Being Engineering Lead), and Miki Rothschild (IG Well-Being Product Management Lead) discussed how the delay in launching private by default close to a year earlier resulted in Instagram getting beat by TikTok on this exact safety feature:



Document 156: META3047MDL-014-00351807, -1807

As Mr. Rothschild acknowledged, "Well, we could have launched this one many months ago if we didn't care about growth."

[419] META3047MDL-031-00192305, -2307

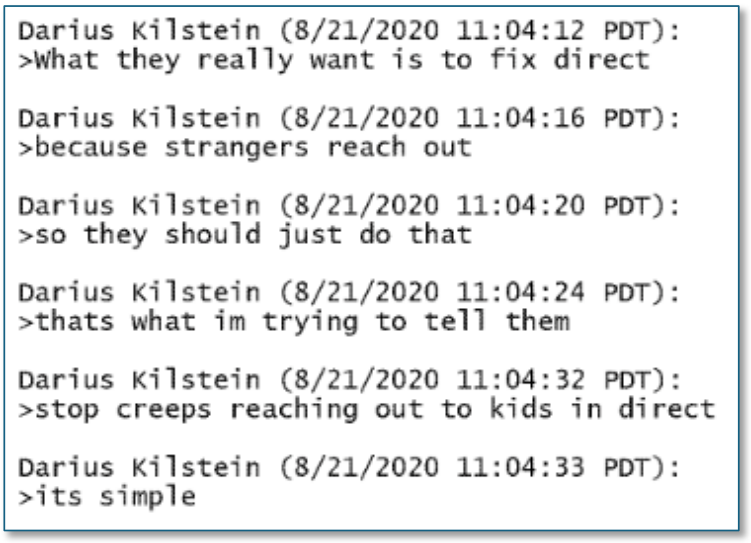
In the above exchange, Mr. Rothschild speculates that the company "landed on an equally positive outcome for teens" by not defaulting teens to private accounts. But the documents tell a different story. An internal Instagram document quantified multiple undesirable experiences in the past 7 days for users ages 13-24 and reported the following:

	I know them offline/ in real life	I know them, but only online	I don't know them
Negative comparison	15.5%	19.6%	64.9%
Bullying target	14.6%	16.0%	69.4%
Impersonation	9.9%	21.1%	69.0%
Drugs	9.7%	12.3%	78.0%
Self harm	9.5%	19.2%	71.3%
Political posts	8.9%	16.2%	75.0%
Bullying witness	6.4%	17.6%	76.0%
Violence	5.1%	13.7%	81.2%
Hate witness	4.6%	14.3%	81.1%
Misinfo	4.5%	9.7%	85.8%
Nudity	3.7%	9.1%	87.1%
Unwanted sexual advances	2.1%	4.2%	93.8%

Document 157: Alison Lee Deposition Exhibit 25 at Slide 13.

The above columns show that the vast majority of bad experiences come from complete strangers. In his deposition, when asked if setting the default to private would prevent teens from being "groomed" by a sexual predator for abuse, Kilstein responded, "Well, I don't know if it would prevent all the cases, but it would prevent some cases, yes."[420] But that understates the issue; the data above indicate that fully 94% of unwanted sexual advances could have been prevented through this feature change. Kilstein himself acknowledged (in internal documents) that this was the point of the private by default concept:

[420] Darius Kilstein Dep. Tr. at 382:25-383:2

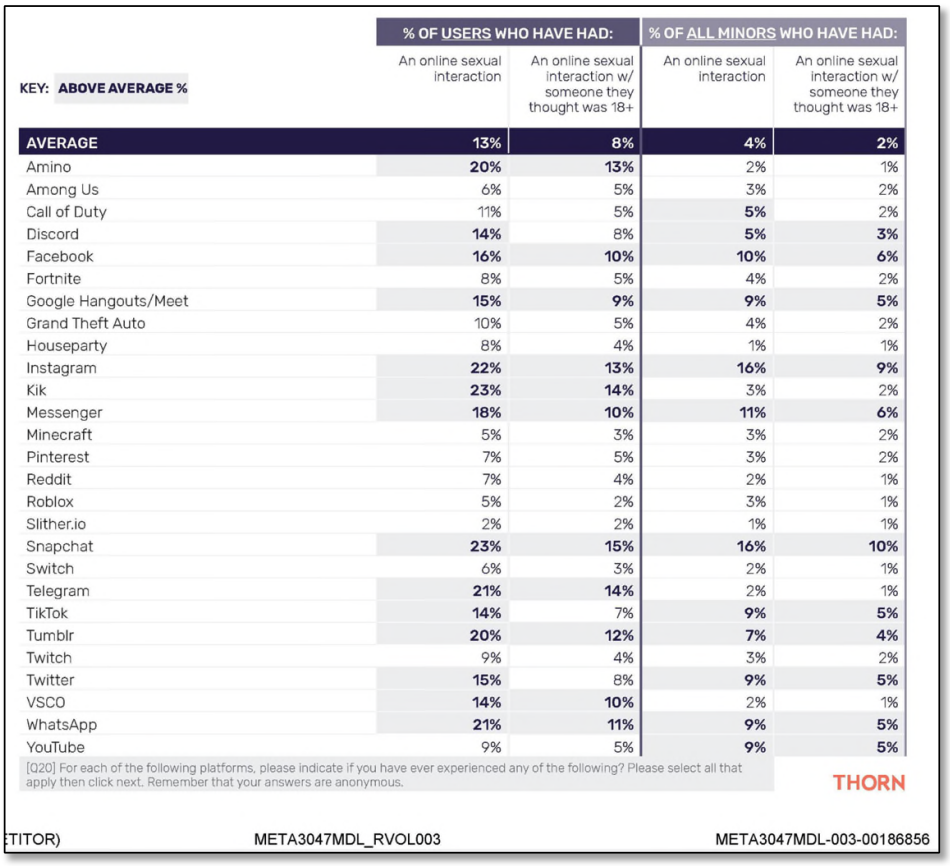


Document 158: Darius Kilstein Dep. Exhibit 31 at -8210.

Again, "strangers reaching out" is no idle concern, especially given that fully half of message requests to teen users are from non-teens.[421] While Facebook messenger was "locked down" for minors, DM'ing at Instagram was not,[422] which resulted in 38 times as many inappropriate or illicit contact with children on Instagram as on Facebook.[423]

A 2020 study conducted by Thorn and produced (for me) via discovery surveyed 1,000 minors ages 9-17 about their online sexual interactions across multiple online platforms and reported the following:

[421] *See* Diego Castaneda Dep. Tr. at 280 ("50 percent of message requests to predicted teen DAU are from predicted non-teens").
[422] Vaishnavi Jayakumar Deposition Transcript at 453:1-5
[423] META3047MDL-031-00192307



KEY: **ABOVE AVERAGE %**

	% OF USERS WHO HAVE HAD:		% OF ALL MINORS WHO HAVE HAD:	
	An online sexual interaction	An online sexual interaction w/ someone they thought was 18+	An online sexual interaction	An online sexual interaction w/ someone they thought was 18+
AVERAGE	**13%**	**8%**	**4%**	**2%**
Amino	**20%**	**13%**	2%	1%
Among Us	6%	5%	3%	2%
Call of Duty	11%	5%	**5%**	2%
Discord	**14%**	8%	**5%**	**3%**
Facebook	**16%**	**10%**	**10%**	**6%**
Fortnite	8%	5%	4%	2%
Google Hangouts/Meet	**15%**	**9%**	**9%**	**5%**
Grand Theft Auto	10%	5%	4%	2%
Houseparty	8%	4%	1%	1%
Instagram	**22%**	**13%**	**16%**	**9%**
Kik	**23%**	**14%**	3%	2%
Messenger	**18%**	**10%**	**11%**	**6%**
Minecraft	5%	3%	3%	2%
Pinterest	7%	5%	3%	2%
Reddit	7%	4%	2%	1%
Roblox	5%	2%	3%	1%
Slither.io	2%	2%	1%	1%
Snapchat	**23%**	**15%**	**16%**	**10%**
Switch	6%	3%	2%	1%
Telegram	**21%**	**14%**	2%	1%
TikTok	**14%**	7%	**9%**	**5%**
Tumblr	**20%**	**12%**	**7%**	**4%**
Twitch	9%	4%	3%	2%
Twitter	**15%**	8%	**9%**	**5%**
VSCO	**14%**	**10%**	2%	1%
WhatsApp	**21%**	**11%**	**9%**	**5%**
YouTube	9%	5%	**9%**	**5%**

[Q20] For each of the following platforms, please indicate if you have ever experienced any of the following? Please select all that apply then click next. Remember that your answers are anonymous.

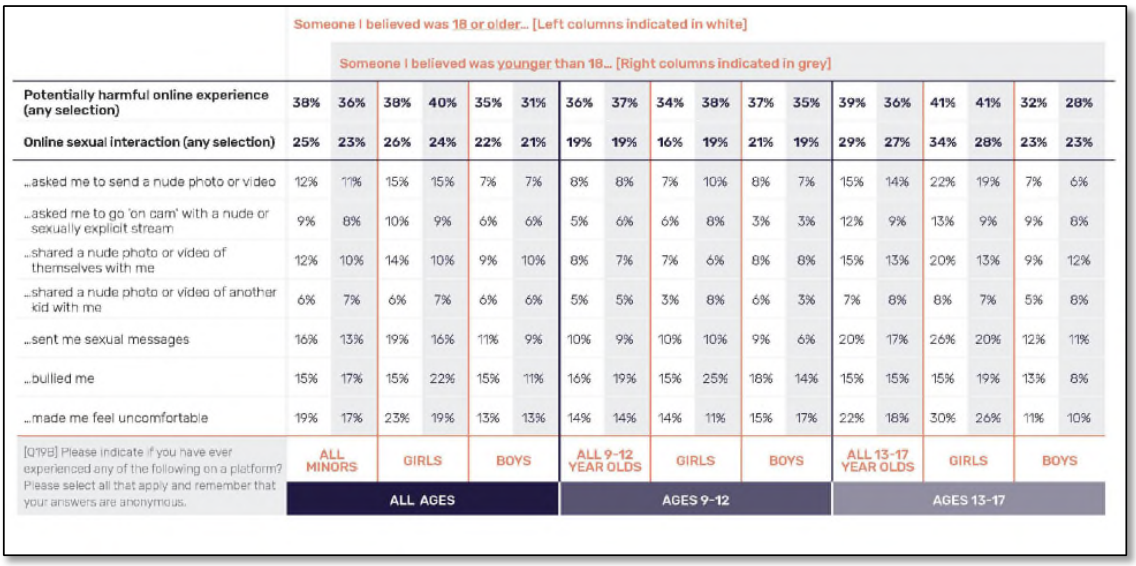
THORN

TITOR) META3047MDL_RVOL003 META3047MDL-003-00186856

Document 159: META3047MDL-003-00186841, -6856

There is a lot to call out in this table. Of relevance to this case, Facebook, Google, Instagram, Messenger, Snapchat, TikTok, and WhatsApp are all above the median value in terms of the percent of *users* who report online sexual activity with someone they thought was over 18 ranging from 9-15% of users. The right-hand column (all minors) puts the percentages into a population-based perspective which is to say what percentage of *all* minors are experiencing these interactions as a result of these sites (5-10%). This dilutes the direct effect since it includes minors with no social media presence. At the same time, it estimates the total public health impact of SM.

The report goes on to characterize the nature of these interactions stratified by age of respondent and age of offender.



	Someone I believed was 18 or older... [Left columns indicated in white] / Someone I believed was younger than 18... [Right columns indicated in grey]																	
Potentially harmful online experience (any selection)	38%	36%	38%	40%	35%	31%	36%	37%	34%	38%	37%	35%	39%	36%	41%	41%	32%	28%
Online sexual interaction (any selection)	25%	23%	26%	24%	22%	21%	19%	19%	16%	19%	21%	19%	29%	27%	34%	28%	23%	23%
...asked me to send a nude photo or video	12%	11%	15%	15%	7%	7%	8%	8%	7%	10%	8%	7%	15%	14%	22%	19%	7%	6%
...asked me to go 'on cam' with a nude or sexually explicit stream	9%	8%	10%	9%	6%	6%	5%	6%	6%	8%	3%	3%	12%	9%	13%	9%	9%	8%
...shared a nude photo or video of themselves with me	12%	10%	14%	10%	9%	10%	8%	7%	7%	6%	8%	8%	15%	13%	20%	13%	9%	12%
...shared a nude photo or video of another kid with me	6%	7%	6%	7%	6%	6%	5%	5%	3%	8%	6%	3%	7%	8%	8%	7%	5%	8%
...sent me sexual messages	16%	13%	19%	16%	11%	9%	10%	9%	10%	10%	9%	6%	20%	17%	26%	20%	12%	11%
...bullied me	15%	17%	15%	22%	15%	11%	16%	19%	15%	25%	18%	14%	15%	15%	15%	19%	13%	8%
...made me feel uncomfortable	19%	17%	23%	19%	13%	13%	14%	14%	14%	11%	15%	17%	22%	18%	30%	26%	11%	10%
[Q19B] Please indicate if you have ever experienced any of the following on a platform? Please select all that apply and remember that your answers are anonymous.	ALL MINORS		GIRLS		BOYS		ALL 9-12 YEAR OLDS		GIRLS		BOYS		ALL 13-17 YEAR OLDS		GIRLS		BOYS	
	ALL AGES						AGES 9-12						AGES 13-17					

Document 160: META3047MDL-003-00186841, -6850

In addition, the Thorn report found that LGBTQ+ youth were at considerably increased risk for all such unwanted interactions: 47% overall vs. 35% for non-LGBTQ+.

More concerning still is how few minors reported that they turned to anyone for support. Overall, only 6% of 9–17-year-olds turned to a parent/caregiver/trusted adult after receiving a nude by someone they thought was an adult. When asked why they did not seek help, the reasons reported were:

% said reason why they turned to 'no one' for support	...a potentially harmful online experience (any selection)	...an online sexual interaction (any selection)*
You felt this was not a big deal	62%	49%
You worried your report would not be anonymous	24%	23%
You felt embarrassed and worried of being judged	23%	17%
You worried about being in trouble with your family	19%	26%
You worried about police or law enforcement getting involved	15%	19%
You worried about not being allowed to use a platform	15%	19%
You felt like you were to blame or partly to blame for the situation	15%	12%
You worried about losing friends	8%	9%
You worried about being in trouble with your school	5%	6%
You worried about getting bullied at school	5%	2%

[Q34] Which of the following describe why you did not look for additional support following experiences you have had on a platform?

*Base size is < 100; Columns will total more than 100 because question was select multiple

Document 161: META3047MDL-003-00186841, -6858

The low percentage of children who sought help and the reasons why they fail to do so highlight the importance of there being structural, anonymous, and effective protective features within the platforms to empower them to be safe since 5-24% of them feel reporting the encounter to others could cause them some source of distress. These features would not be substitutes for a mechanism to inform responsible adults, but they are clearly needed since changing attitudes to make children feel less judged or worry less about getting in trouble (among other things), will prove challenging. In fact, one of the "key insights" of the Thorn report is that "minors are more than twice as likely to use online safety tools to combat potentially harmful online sexual interactions than they are to use offline support systems such as caregivers and parents."

Unfortunately, reporting and blocking, the two most accessible and deployed tools for unwanted contact appear to be minimally effective. Most minors who have either reported or blocked someone say they have been recontacted by that person. Over half of all participants (54%) who had blocked someone they only knew online said they were recontacted by that same person. For those who reported a user they only knew online to the platform, the rate of recontacts was only slightly lower (51%). But 70% of 9–12-year-old boys and 47% of 9–12-year-old girls who

blocked someone they only knew online were recontacted by that person.[424] Not surprisingly then, 41% of minors said they thought "nothing happens if you try and report an inappropriate photo or video to an online platformer app," and "63% of minors that have shared their own nudes said the same."[425] I found no evidence that these failures were disclosed to parents or users.

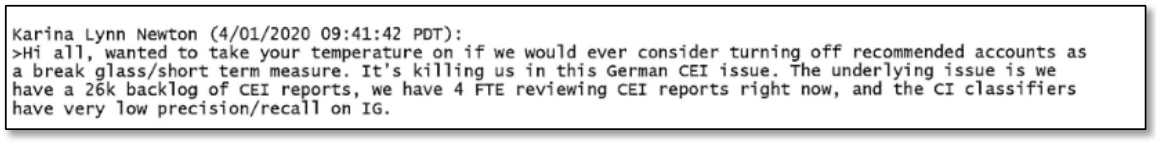
Meta's lackadaisical approach to receiving reports of, and removing, child sexualization content was tested during the COVID pandemic. Maria Lanz, a safety policy representative in sub-Saharan Africa sent an urgent email on March 28, 2020 asking "Is anyone else receiving child abuse reports on platform? In the last 24 hours I've receive a ton ☹ I've seen terrible things, we're not detecting it:((((".[426] In response to these reports, Meta's platform generated a pop up that read the following:

> We couldn't review your report. We have fewer people available to review the reports because of the coronavirus (COVID-19) pandemic, so we're only able to review content with the most potential for harm. If you don't want to see amyloves0916 on Instagram, you can unfollow, mute or block them to hide their posts and comments from your feed. Reports like yours are an important part of making Instagram a safe and welcoming place for everyone.[427]

According to Jayakumar's deposition, what was reported was determined by an algorithmic classifier and not the purported victim or a reporter of it.[428] When pressed as to why humans didn't have the agency to directly report child exploitation or abuse, Ms. Arcamona (IG Product Policy Manager) responded that she'd be "concerned that people would abuse the reporting option to report anything they want reviewed and they would need to review it because it's being reported as CEI [Child Exploitation Imagery]."[429] Putting aside for a moment that abusing the system in

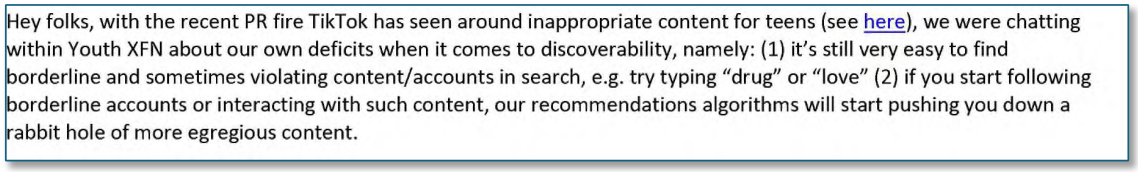
[424] META3047MDL-003-00186841, -6881
[425] META3047MDL-003-00186841, -6847
[426] Vaishnavi Jayakumar Dep. Exhibit 29 at -1113
[427] Vaishnavi Jayakumar Dep. Exhibit 30 at -5734
[428] Vaishnavi Jayakumar Deposition Transcript at 271:6-8
[429] Vaishnavi Jayakumar Dep. Tr. at 275:6-10

this way might be expected to be a rare occurrence, the approach Instagram opted for would be akin to the 911 system not answering phones since sometimes people use it for non-emergencies (locked out of house, cat in tree, long line at drive thru etc.). It's a further indication that child safety was not the number one priority in spite of attestations made to the contrary. As of 2020, the backlog was indeed sizeable. Karina Lynn Newton (Head of IG Public Policy) on April 1 texted:


Karina Lynn Newton (4/01/2020 09:41:42 PDT):
>Hi all, wanted to take your temperature on if we would ever consider turning off recommended accounts as a break glass/short term measure. It's killing us in this German CEI issue. The underlying issue is we have a 26k backlog of CEI reports, we have 4 FTE reviewing CEI reports right now, and the CI classifiers have very low precision/recall on IG.

Document 162: META3047MDL-014-00349432, -9432

Compounding Meta's inability to facilitate and act on reports of Child Exploitation Imagery, its algorithms continued to affirmatively push that content onto users. In 2021, Miki Rothschild (IG Well-Being Product Management Lead) opines:


Hey folks, with the recent PR fire TikTok has seen around inappropriate content for teens (see here), we were chatting within Youth XFN about our own deficits when it comes to discoverability, namely: (1) it's still very easy to find borderline and sometimes violating content/accounts in search, e.g. try typing "drug" or "love" (2) if you start following borderline accounts or interacting with such content, our recommendations algorithms will start pushing you down a rabbit hole of more egregious content.

Document 163: META3047MDL-003-00077939, -7939

Rothschild acknowledges that a search beginning with something as potentially innocuous as "love" or "drug" can trigger Meta's algorithms towards showing teens more "egregious" content. In fact, in a notorious, and apparently viral story of Meta's autocomplete logic in March 2018, typing in "video of" suggested completing with: "little girl suck," "giving oral," "suck dick," and "minor sex," among others.[430]

[430] META3047MDL-014-00346869, -6869

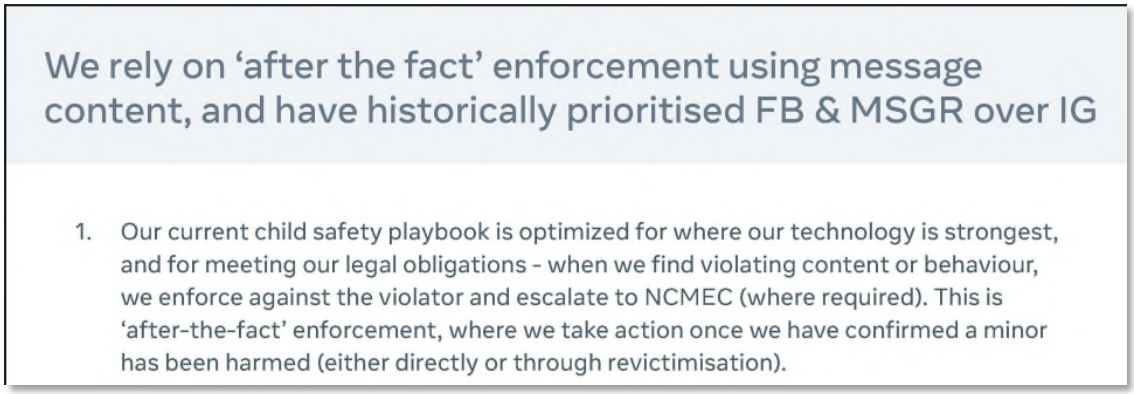
In March 2021, close to two years after Hitomi Hayashi-Branson had recommended doing so, Meta issued a press release stating it would "restrict[] DMs between teens and adults they don't follow" and "encourage[e] teens to make their accounts private."[431] While a positive step on paper, in execution these measures were incomplete at best. First, this version of private "by default" only applied to new accounts, not existing ones (which did not get the feature until the end of 2024). Second, what was deployed is not what would be considered "private by default" (which entails requiring someone to take active steps to change their account to "public"). Rather, on signing up teens were given the option to select private or public. Jayakumar explained in her deposition, "Generally speaking, most users, not just within Instagram, don't change their default settings until they are in a moment of crisis."[432] Later, "[s]ix out of ten teens said that they weren't changing their settings. They were just going to go with whatever the app suggested."[433]

Further, Instagram's March 2021 promise to "restrict[] DMs between teens and adults they don't follow" was riddled with loopholes that the company does not appear to have warned the public about. As of March 2022, it remained the case that Instagram still allowed senders with stated age 18-20, or no stated age at all, to send DM requests to teens.[434] It also remained the case that Instagram allowed senders outside the U.S. who claimed to be teens (but weren't) to send such DM requests.[435] As a consequence of these gaps, teens were 50% more likely than non-teens to receive a DM request and twice as likely than non-teens to receive an *unwanted* DM request—causing one researcher to conclude "previous effort[s] to block non-teens from sending DM

[431] Diego Castaneda Dep. Ex. 18 at 2, 6.
[432] Vaishnavi Jayakumar Dep. Tr. at 72:14-18
[433] Vaishnavi Jayakumar Dep. Tr. at 74:15-19
[434] Jayakumar Dep. Ex. 71 at 15
[435] Jayakumar Dep. Ex. 71 at 15

requests to teens haven't solved teen problems."[436] Another internal report put the matter even more bluntly: "Teens receiving DM requests from unconnected adults [is] breaking public commitment that we made."[437] Meta does not appear to have closed all these loopholes until September 2024, with the launch of Instagram Teen Accounts—over five years after smart defaults were first proposed.[438] Despite the argument that restricting access to teen accounts might even reduce suicides, since unrestricted access facilitates sextortion, cyberbullying, etc., Meta elected to allow teen users to remain reachable by many adult strangers until it launched "Teen Accounts."[439]

The foregoing history shows how Meta has taken a reactive rather than proactive approach to child safety issues, to the detriment of its users. Indeed, internal Meta documents acknowledge as much, such as this slide deck from 2021:

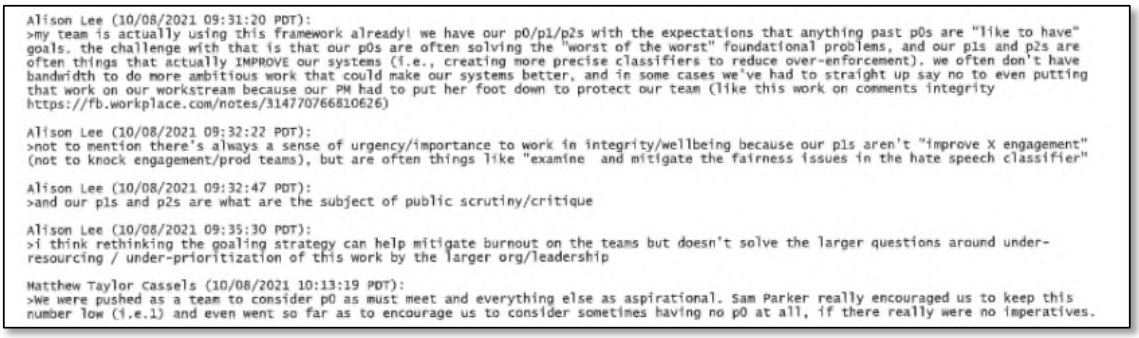


Document 164: META3047MDL-003-00029989, -996

[436] Jayakumar Dep. Ex. 71 at 11-12
[437] META3047MDL-046-00495408, 5408
[438] Castaneda Dep. 301:14-304:24.
[439] *Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents*, INSTAGRAM (Sep. 17, 2024), https://about.instagram.com/blog/announcements/instagram-teen-accounts ("Teens will be placed in the strictest messaging settings, so they can only be messaged by people they follow or are already connected to.").

Another internal memo similarly stated that "leadership was unwilling to prioritize mitigations" that would reduce unwanted CEI sharing.[440] Repeatedly throughout this memo, the need for additional resources to support safety efforts is called out (e.g. p. 29. 30, 31, 32, 34 among others).

A chat from the same year between Alison Lee and Mathew Cassels (IG User Experience Researcher), excerpted below, explains the dynamics further. (Meta has a priority system with p0 being emergent, and p1, p2 following in terms of urgency.)



Alison Lee (10/08/2021 09:31:20 PDT):
>my team is actually using this framework already! we have our p0/p1/p2s with the expectations that anything past p0s are "like to have" goals. the challenge with that is that our p0s are often solving the "worst of the worst" foundational problems, and our p1s and p2s are often things that actually IMPROVE our systems (i.e., creating more precise classifiers to reduce over-enforcement). we often don't have bandwidth to do more ambitious work that could make our systems better, and in some cases we've had to straight up say no to even putting that work on our workstream because our PM had to put her foot down to protect our team (like this work on comments integrity https://fb.workplace.com/notes/314770766810626)

Alison Lee (10/08/2021 09:32:22 PDT):
>not to mention there's always a sense of urgency/importance to work in integrity/wellbeing because our p1s aren't "improve X engagement" (not to knock engagement/prod teams), but are often things like "examine and mitigate the fairness issues in the hate speech classifier"

Alison Lee (10/08/2021 09:32:47 PDT):
>and our p1s and p2s are what are the subject of public scrutiny/critique

Alison Lee (10/08/2021 09:35:30 PDT):
>i think rethinking the goaling strategy can help mitigate burnout on the teams but doesn't solve the larger questions around under-resourcing / under-prioritization of this work by the larger org/leadership

Matthew Taylor Cassels (10/08/2021 10:13:19 PDT):
>We were pushed as a team to consider p0 as must meet and everything else as aspirational. Sam Parker really encouraged us to keep this number low (i.e.1) and even went so far as to encourage us to consider sometimes having no p0 at all, if there really were no imperatives.

Document 165: Alison Lee Deposition Exhibit 14, -2150

Meta's "reactive" approach–waiting for harm to occur, rather than trying to prevent it (by leaving as "'like to have' goals" the "things that actually IMPROVE our systems") is akin to summer camps not doing background checks on counselors and waiting instead to see how they act at camp. Slide 14 in the 2021 slide deck excerpted above states the following, "Instead of whack-a-moling [sic] abuse when we find it, we need to pivot our resources to stopping it happening in the first place." Later in the same presentation it states:

[440] META3047MDL-004-00027423, -7425

3. We're underinvested in minor sexualisation on IG, notably on sexualised comments on content posted by minors. Not only is this a terrible experience for creators and bystanders, it's also a vector for bad actors to identify and connect with one another.

Document 166: META3047MDL-003-00029989, -9996

The fact that Meta was still adopting a "whack a mole" approach in 2021 is a bit surprising given Sheryl Sandberg's "Urgent" email in the wake of a story in the Sunday Times about 30 families claiming social media killed their children. In it, she says the following:

> If these are the right things to do, we should not need an article to push us to do them. We have reviewed our policies and enforcement in areas like this over and over with this in mind—and then we always fine more to do. I am really alarmed by this. We absolutely have to solve this problem. In obvious areas of concern (guns, opiots [sic], harm, etc) we should be ahead of all of this.[441]

The truth appears to be closer to what others lower in Meta's ranks acknowledged privately. In Kilstein's opinion, "[It] was never about increasing safety. It was all for the PR wins."[442] This is reiterated in a subsequent exchange between Michale Kane, a data engineer, and James Holland, a data scientist (both are at Instagram):

Michael Chad Kane (7/29/2021 15:22:45 PDT):
>Thanks both. I'm still kinda confused about the goal. We want to make sure teens don't accidentally share more than they want, and avoid creepers, but then some of them totally want that and then if we boost them, we are inviting people to see more teens in their suggestions. Is it about decoupling clear privacy control from integrity issues, or is it about saying we want to reduce integrity problems, but not wanting the consequence of less interactions and follows?

Document 167: Darius Kilstein Dep. Exhibit 37 at -6693

To which James Holland Replies:

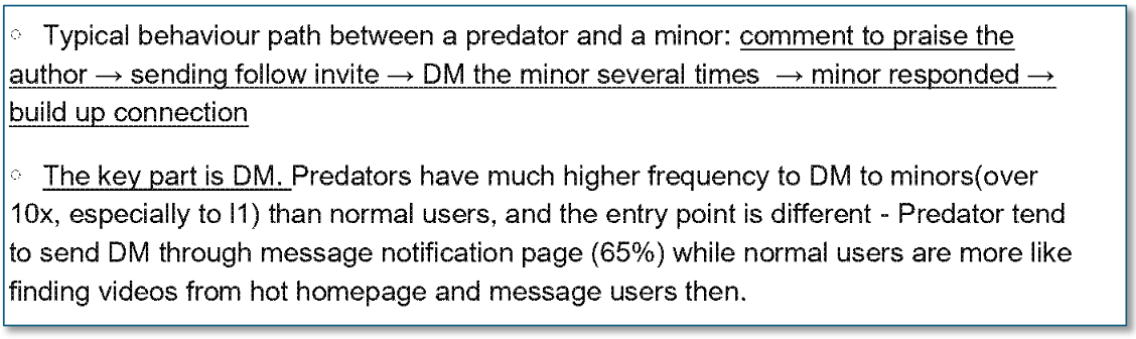
>It is about looking good to regulators so that they don't block our under 13 year old IG version we are working on. Thats it. It has a terrible impact on teen engagement and retention and no detectable benefit on integrity metrics

Document 168: Darius Kilstein Dep. Exhibit 37 at -6694

[441] META3047MDL-004-00025094, -5094
[442] Darius Kilstein Dep. Exhibit 30 at -8138

In the end, it is not clear how serious Meta's efforts were when it came to keeping children safe from adult predators on Instagram in particular.

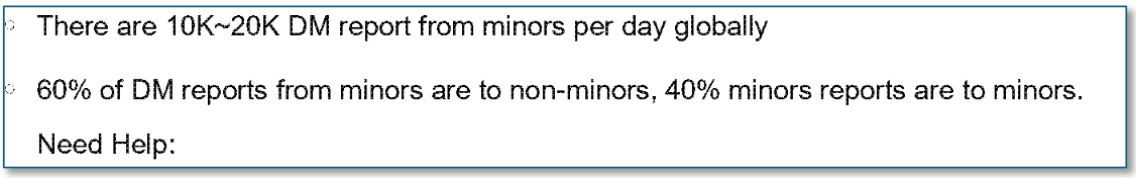
I turn now, briefly, to similar issues as they surfaced on other defendant platforms. For its part, TikTok documents recognize that DMs to children are an important part of the strategy child predators deploy:



- Typical behaviour path between a predator and a minor: comment to praise the author → sending follow invite → DM the minor several times → minor responded → build up connection
- The key part is DM. Predators have much higher frequency to DM to minors(over 10x, especially to I1) than normal users, and the entry point is different - Predator tend to send DM through message notification page (65%) while normal users are more like finding videos from hot homepage and message users then.

Document 169: TIKTOK3047MDL-002-00094384, -4400

By their own estimates, these "key" DMs are common:



- There are 10K~20K DM report from minors per day globally
- 60% of DM reports from minors are to non-minors, 40% minors reports are to minors.

Need Help:

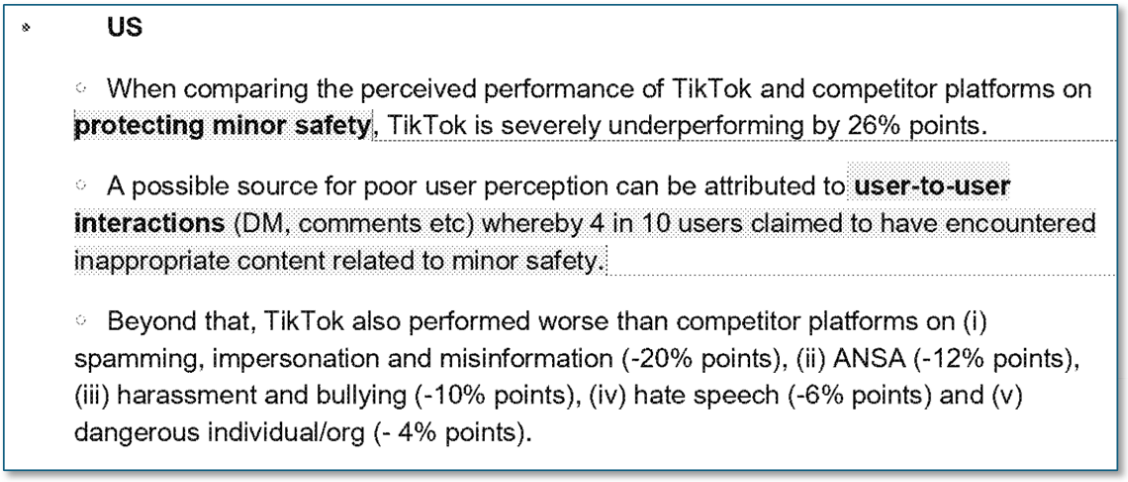
Document 170: TIKTOK3047MDL-002-00094384, -4392

As noted above, in January 2021, TikTok did turn its under 17-year-old accounts to private by default.[443] This was done as part of a concerted public relations campaign. Complete with queued up complementary quotes from the president of the National PTA, and the CEO of the Family Online Safety Institute, it was touted as an "industry leading initiative, and as a "proactive

[443] TIKTOK3047MDL-002-00119426, -9426

change rather than as a result of regulatory or media pressure."[444] Importantly, however, this change was made in the context of TikTok continuing to allow people to self-report age (TikTok's lax age verification is discussed in more detail below, at Section XII.B.(ii).) The consequences were predictable. Mathew Tenenbaum (Senior Product Manager) writing to James Cummings (Senior Product Manager) on May 5, 2023 said, "The weird data point is that 85% of 'teen' users are age gated 18+."[445] In other words, private by default impacted fewer than 15% of teen users.

Despite launching a version of private by default before Instagram, by its own internal assessment, TikTok lagged behind the industry on minor safety issues.



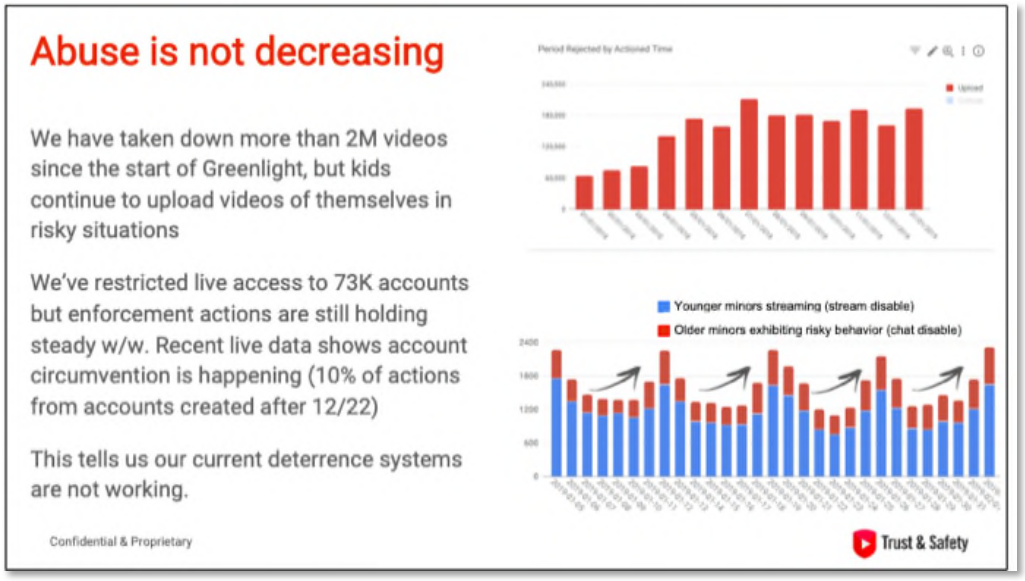
- **US**
  - When comparing the perceived performance of TikTok and competitor platforms on **protecting minor safety**, TikTok is severely underperforming by 26% points.
  - A possible source for poor user perception can be attributed to **user-to-user interactions** (DM, comments etc) whereby 4 in 10 users claimed to have encountered inappropriate content related to minor safety.
  - Beyond that, TikTok also performed worse than competitor platforms on (i) spamming, impersonation and misinformation (-20% points), (ii) ANSA (-12% points), (iii) harassment and bullying (-10% points), (iv) hate speech (-6% points) and (v) dangerous individual/org (- 4% points).

Document 171: TIKTOK3047MDL-002-00102517, -2527

Finally, I have seen indication in internal company documents that YouTube has had difficulty successfully addressing child exploitation issues on its platform. As of an August 2021 YouTube presentation by [redacted] (Software Engineering Manager), "**20%** of

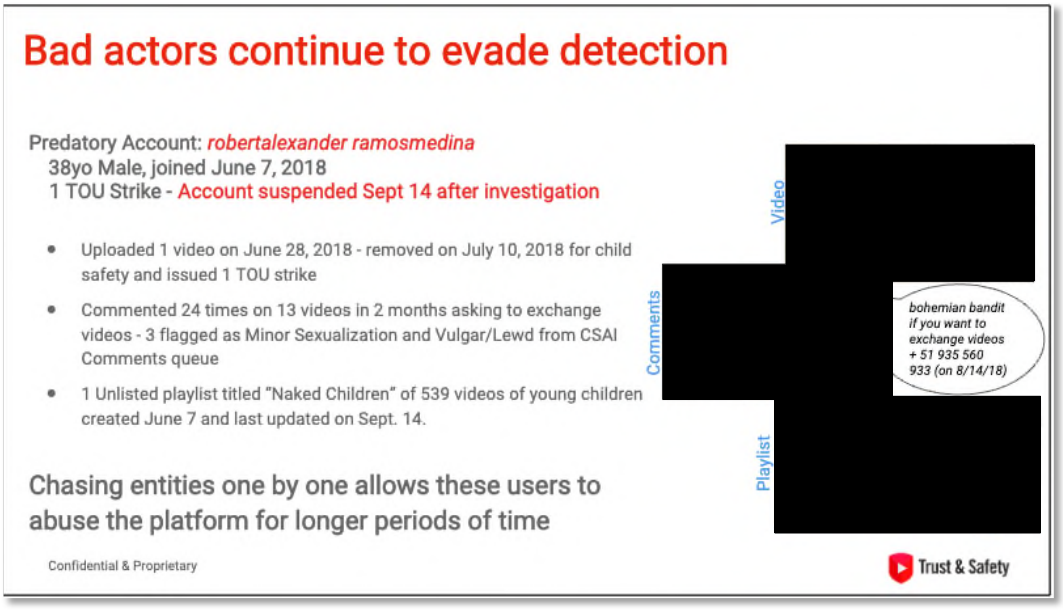
[444] TIKTOK3047MDL-002-00119426, -9426
[445] TIKTOK3047MDL-067-LARK-01022641, -2641

YouTube users uploading shorts are unsupervised minors (1**.8M users/week**).”[446] This poses real safety risks, as YouTube’s “Trust and Safety” Division’s internal investigation revealed:



Document 172: GOOG-3047MDL-00246776 at Slide 15

[446] GOOG-3047MDL-01262144 at Slide 3 (emphasis in original)



Document 173: GOOG-3047MDL-00246776 at Slide 14

The net result of the Defendants platforms' failure to act, failure to alert, and failure to impose structural barriers to using social media platforms as vehicles for exploitation of children is as tragic as it is predictable. A recent metanalysis of online child sexual exploitation and abuse (OCSEA) synthesized data from 123 studies. It defined OCSEA as unwanted, forced, or non-consensual exposure to technology-facilitated abuse and reported the following global prevalences:

Figure 56: Effect Estimates from Meta-Analysis of the OCSEA Prelvalence and Heterogeneity[447]

	Prevalence estimates				Heterogeneity		
	Studies (n)	Incidents (n)	Observations (n)	Pooled prevalence (95% CI)	τ^2	95% prediction interval	I^2
Past year recall							
Online solicitation	50	13 364	112 852	12·5 (10·5–14·7)	0·48	3·4–36·6	99·0%
Non-consensual taking, sharing, and exposure to sexual images and videos	73	17 717	146 868	12·6 (9·7–16·2)	1·64	1·1–65·2	99·5%
Online sexual exploitation	15	1277	21 155	4·7 (2·9–7·3)	0·87	0·6–28·1	93·7%
Sexual extortion	12	652	12 552	3·5 (1·9–6·4)	1·21	0·3–31·9	94·6%
Lifetime recall (childhood)							
Online solicitation	22	25 732	136 331	11·5 (7·2–18·0)	1·55	0·9–64·9	99·6%
Non-consensual taking, sharing, and exposure to sexual images and videos	20	2873	78 819	4·0 (2·3–6·9)	1·78	0·2–42·2	99·4%
Online sexual exploitation	3	480	5894	7·3 (2·2–21·8)	1·23	0·0–100·0	99·1%
Sexual extortion	5	612	11 862	5·1 (4·0–7·2)	0·16	1·3–17·8	93·1%

OCSEA=Online Child Sexual Exploitation and Abuse.

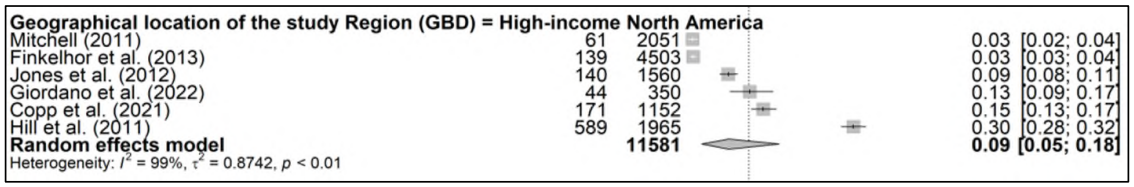
Table 2: **Effect estimates from meta-analysis of the OCSEA prevalence and heterogeneity, by subtype and recall period**

Not surprisingly, there is considerable heterogeneity to the results given the global scope, the varied platforms and sampling methods, the recall frames, and the ages of the victims, so the "pooled" estimate may not be entirely accurate. But no matter, the 95% confidence interval accurately and conservatively represents the range of "true" values and even at the "low" end, the estimates range from 1.9% (sexual extortion) to 10.5% (online solicitation) of teens receiving OSCEA in the past year.

Focusing for a moment on North America alone where many of the victims in these cases or their families live, the following is Figure 10 from the appendix to the article.

[447] Fry D, Krzeczkowska A, Ren J, et al. Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis. *The Lancet Child & Adolescent Health*. doi:10.1016/S2352-4642(24)00329-8

Figure 57: Past year experience of online solicitation in all respondents[448]



The best estimate, derived from six studies, is that 9% of underage children in North American report unwanted online solicitation in the past year. That prevalence merits restating in a different format: **1 in 11 children in North America have experienced unwanted online solicitation annually.** In comparison, the most common chronic disease of childhood is asthma which affects about 1 in 12 children.

Again, the platforms were aware of this problem. In closing, consider a 2018 Meta document containing well-being "Highlights": "Highly sexual content (including N/P, solicitation, CEI/IIC) is a big problem on IG both in terms of reach and intensity. Solicitation has the third highest reach among violating content types in terms of DAP exposed and the fifth highest report rate," and teens are at greater risk than non- teens.[449] It goes on to say, "3% of searches on Instagram result in a violating entity."[450] These are troubling and avoidable statistics.

XI. Selected High Profile Dissenting Studies

As discussed in sections above, this report prioritizes systematic reviews and metanalyses (the top of the pyramid in Figure 1) over individual studies and experimental or longitudinal studies over cross-sectional ones. It does so because of the sheer volume of studies, the heterogeneity of methods and populations, and the at times conflicting results. That said, several individual studies

[448] Fry D, Krzeczkowska A, Ren J, et al. Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis. *The Lancet Child & Adolescent Health*. doi:10.1016/S2352-4642(24)00329-8
[449] META3047MDL-031-00048769, -8769
[450] META3047MDL-031-00048769, -8769

because of their size, scope, or novelty have garnered considerable attention in both the press and in academic circles and present arguments that countervail my findings. I will selectively review a few of them here and place them into the larger context of the report.

J. Orben and Przybylski (2019)

Orben A, Przybylski AK. The association between adolescent well-being and digital technology use. *Nature Human Behaviour*. 2019/02/01 2019;3(2):173-182. doi:10.1038/s41562-018-0506-1.

Briefly, this paper used three large existing publicly available data sets, Monitoring the Future (MTF), Youth Risk and Behavior Survey (YRBS) and the Millenium Cohort Study (MCS) to look at the associations between a number of variables including "technology use" and wellbeing. Technology use was defined based on existing variables within each database but included summations of "TV use," "mobile phone use," "electronic device use," "computer use," and "internet use," among others. They found that although there were small, negative associations between "technology use" and diminished wellbeing the size of the association was smaller than others including substance use, bullying, sleep, fruit consumption, and about the same size as eating "potatoes." In that context, they conclude that "the outsized weight given to digital screen time in the scientific and public discourse might not be merited."[451]

There are several notable limitations of the analyses, some of which the authors themselves acknowledge:

[451] Orben A, Przybylski AK. The association between adolescent well-being and digital technology use. *Nature Human Behaviour*. 2019/02/01 2019;3(2):173-182. doi:10.1038/s41562-018-0506-1

First, the study is cross-sectional and accordingly cannot draw causal inferences.

Second, the measure of technology use is heterogenous, blunt, and dated. For example, "computer use" includes doing homework or video chatting neither of which have been implicated either theoretically or empirically in wellbeing effects. Mobile phone use (the term itself is dated) includes talking which again is not viewed as being harmful. Including variables that are unlikely to have associations, dilutes those that do or might and biases findings towards the null.

Third, all of these measures relied on self-report of media usage which correlates only weakly to moderately (r=.38) with actual usage.[452]

Fourth, some of the studies collected data from as far back as 2007 which explains why the surveys included questions about "cell phones" instead of "smartphones," and "television" which is no longer a predominate media. The media landscape has evolved considerably since then. In fact, teen usage of Facebook peaked in 2014-15 a full 17 years after initial data collection.

Fifth, they treat mediators as confounders in their analyses. Recall our prior exegesis on this distinction. A mediator is in the causal pathway and should not be adjusted for but rather examined as a means of explaining a mechanism that links an exposure to an outcome (high paying job in our example linking college with subsequent wealth). Orben and Przybylski adjust for such things as negative attitudes towards school and time spent with parents (among other things).

[452] Parry DA, Davidson BI, Sewall CJR, Fisher JT, Mieczkowski H, Quintana DS. A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour*. 2021/11/01 2021;5(11):1535-1547. doi:10.1038/s41562-021-01117-5

These could very plausibly be in the causal pathway between time on SM and wellbeing. In fact, Kelly et al, using one of the same databases that Orben used, the Millennial Cohort Study, looked at social media use and subsequent depression and found starkly different results. Their primary findings are presented in below extracted from their paper.[453]

Figure 58: Summary of Multivariable Regressions of Depressive Symptom Scores by Social Media Use[454]

Multivariable regressions, depressive symptom scores by social media use.

	Model 0 (M0)		Model 1: M0 + online harassment		Model 2: M0 + sleep		Model 3: M0 + self-esteem		Model 4: M0 + body image		
	Social media use in hours/weekday										
Panel A: girls (n = 5496)											
None	0.74***		(0.62 to 0.89)	0.84*	(0.71 to 0.99)	0.87	(0.74 to 1.02)	0.77**	(0.65 to 0.91)	0.88	(0.76 to 1.01)
<1 h	0.88**		(0.80 to 0.96)	0.94	(0.86 to 1.02)	0.93	(0.86 to 1.00)	0.87***	(0.80 to 0.95)	0.96	(0.89 to 1.03)
1 to <3 h (ref)											
3 to <5 h	1.26***		(1.15 to 1.37)	1.17***	(1.08 to 1.26)	1.18***	(1.09 to 1.28)	1.20***	(1.10 to 1.30)	1.17***	(1.08 to 1.26)
>5 h	1.50***		(1.39 to 1.62)	1.30***	(1.21 to 1.40)	1.28***	(1.19 to 1.38)	1.26***	(1.17 to 1.35)	1.30***	(1.21 to 1.40)
Wald test, F(4,387)	48		P < 0.00005	21	P < 0.00005	22	P < 0.00005	31	P < 0.00005	21	P < 0.00005
Panel B: boys (n = 5408)											
None	1.01	(0.91 to 1.11)		1.11*	(1.01 to 1.23)	1.06	(0.97 to 1.16)	0.98	(0.89 to 1.08)	1.10*	(1.01 to 1.20)
<1 h	0.99	(0.92 to 1.07)		1.03	(0.95 to 1.11)	1.01	(0.94 to 1.09)	0.99	(0.92 to 1.07)	1.01	(0.94 to 1.09)
1 to <3 h (ref)											
3 to <5 h	1.21***	(1.08 to 1.35)		1.16**	(1.04 to 1.30)	1.15*	(1.03 to 1.27)	1.18**	(1.06 to 1.32)	1.17**	(1.05 to 1.31)
>5 h	1.35***	(1.23 to 1.50)		1.27***	(1.15 to 1.39)	1.21**	(1.10 to 1.34)	1.31***	(1.18 to 1.44)	1.30***	(1.19 to 1.42)
Wald test, F(4,387)	13	P < 0.00005		8	P < 0.00005	5	P = 0007	11	P < 0.00005	10	P < 0.00005

Notes: All regressions adjust for covariates: family income and structure at age 14, internalising scores at age 11, and age and are weighted with sample weights. Confidence intervals are in parentheses. Sample sizes are unweighted. Regression coefficients have been exponentiated to aid interpretation.

* p < 0.05.
** p < 0.01.
*** p < 0.001.

In their analysis, using 1- 3 hours of usage at baseline as a comparator (Model 0 above), increased social media usage (3 to <5 and > 5 hours per day) was associated with a 21-50% increased risk of subsequent depression (red squares). Models 1-4 go on to explore the *mechanisms* (sleep, self-esteem, and body image) that might explain this association by adding *mediators* to

[453] Kelly Y, Zilanawala A, Booker C, Sacker A. Social Media Use and Adolescent Mental Health: Findings From the UK Millennium Cohort Study. *EClinicalMedicine*. Dec 2018;6:59-68. doi:10.1016/j.eclinm.2018.12.005

[454] Kelly Y, Zilanawala A, Booker C, Sacker A. Social Media Use and Adolescent Mental Health: Findings From the UK Millennium Cohort Study. EClinicalMedicine. 2019 Jan 4;6:59-68. doi: 10.1016/j.eclinm.2018.12.005. PMID: 31193561; PMCID: PMC6537508.

see if they are significant. They are; see the blue squares in the figure above. Adding "online harassment" (Model 1); "sleep" (Model 2); "self-esteem" (Model 3) and "body image" (Model 4) all attenuated the odds of increased media's association with depression. In statistical terms, as we explored in section earlier, this means they are in the causal pathway: social media use's association with depressive symptoms goes *through* each of them. Finally, the technology exposure variable was only measured as duration without respect to content (including SM in particular).

K. Ferguson (2024)[455]

This meta-analysis concluded that "*meta-analytic evidence for causal effects was statistically no different than zero."* This meta-analysis claimed to synthesize the existing experimental data linking (or failing to link) SMS usage and mental health. Several things stood out as I read that meta-analysis. First, it had a single author. While not in and of itself dispositive, single authorship is unusual in today's days of "team science" and especially unusual for systematic reviews and meta-analysis where subjective assessment of content is part of the adjudication process. In fact, most guidelines for how to conduct and publish systematic reviews discuss how consensus should be achieved and reported when authors disagree about relevance, findings etc. Indeed, the ROBIS criteria, widely accepted as one of the sources of best practices state: "To minimize the potential for bias and errors in these processes, titles and abstracts should be screened independently by at least two reviewers and full-text inclusion assessment should involve at least two reviewers (either independently or with one performing the assessment and

[455] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541

the second checking the decision)."[456] Second, the author simply reports that 27 studies were identified as meeting criteria but does not provide a diagram of how many studies the search strategy yielded and how many studies were excluded for what reasons as is customary or systematic review. Third, there was considerable heterogeneity both in terms of approaches, outcomes, and duration in the included studies. Following best practices, heterogeneity is assessed *prior* to any summary estimate, and where it is too great, either statistically or conceptually, summary estimates are not generated. This was not done here although the author notes in the discussion that the summary estimate "*masks considerable heterogeneity between studies."*

My concerns with this particular meta-analysis led me to conduct a deeper dive into it and unsurprisingly I found given its contentiousness that there was considerable conversation in the scientific "twitter sphere" especially since it ran counter to the prevailing scientific and public consensus about the role SM may play in mental health outcomes. Many scientists criticized its findings including David Stein whose substack on it begins:

> Ferguson published a 'review' that repeatedly but falsely implied that the experiments revealed there were no benecial [sic] impacts of SM time reductions on depression and anxiety. Ferguson misdirects the public in this manner persistently within his review, and even the title as well as the Keywords: social media, mental health, depression, anxiety information displayed at start of the review do mislead the public to think the review is about impacts on genuine MH disorders like depression and anxiety.[457]

Stein goes on to point out multiple errors of omission (missing studies) and commission (incorrect methodologies applied, wrong effect sizes with opposite signage used, inclusion of

---

[456] Whiting P, Savović J, Higgins JP, et al. ROBIS: A new tool to assess risk of bias in systematic reviews was developed. *J Clin Epidemiol*. Jan 2016;69:225-34. doi:10.1016/j.jclinepi.2015.06.005

[457] https://shoresofacademia.substack.com?utmsource=navbar&utmmedium=web

studies that do not measure mental health etc.) and concludes: “In short, Ferguson’s paper stands and falls on de facto censorship of evidence.”

Both Stein and Thrule go on to reanalyze the data and reach the *opposite* conclusion of Ferguson. I found a pre-print of Thrule’s analysis online and inquired it if it had been peer-reviewed and published yet. Here is the reply I received to an email I sent (Nov 13, 2024).

> *Hi Dimitri,*
>
> *Thanks for your note. The re-analysis is already in press at Psychology of Popular Media, the same journal that published the Ferguson meta-analysis in the first place. I submitted corrected proofs a couple of weeks ago, so hopefully it will be online soon. I think they are waiting to get a response from Chris Ferguson to publish the re-analysis and his response together.*
>
> *Thanks,*
> *Johannes*

report that: “Stratified analyses indicated that interventions of less than 1 week resulted in significantly worse mental health outcomes (d=-0.168, SE=0.058, p=.004), while interventions of 1 week or longer resulted in significant improvements (d=0.169, SE=0.065, p=.01).”[458] These findings are entirely consistent with what one would expect if studying abstention amongst people with an addiction. In effect then, this metanalysis, despite its conclusion, does more to *affirm* SM addiction than the *refute* it.

In spite of its many and considerable limitations — enough that it should not be taken seriously — Ferguson’s study results are summarized below.

[458] Thrul J, Devkota J, AlJuboori D, Regan T, Alomairah S, Vidal C. Social media reduction or abstinence interventions are providing mental health benefits – reanalysis of a published meta-analysis. *Psychology of Popular Media*. In press;

Figure 59:[459] Meta-Analytic Results of Social Media and Mental Health Outcomes

Table 1

Meta-Analytic Results of Social Media and Mental Health Outcomes

Random-effects model ($k = 27$)						
Estimate (d)	Z	p	CI lower bound		CI upper bound	
0.088	1.63	.104	−0.018		0.197	
Heterogeneity statistics						
Tau	Tau^2	I^2	H^2	df	Q	p
0.114	0.013 ($SE = 0.0053$)	75.2%	4.025	26.000	91.64	<.001

Note. Tau^2 estimator: maximum-likelihood. For the purposes of analysis in jamovi, values d were converted to r and then converted back again. CI = confidence interval.

His "flawed" summary estimate of the effect size .088 (small by accepted standards) and his p. value is .10 which is technically "statistically" insignificant. Recall two things we discussed earlier in this report. First, a p- value of .10 means that there is a 10% chance that the result is spurious (ie a 90% chance it is the truth). Second, even effect sizes of this magnitude can have large population effects at scale. Ferguson subsequently "amended" and corrected this meta-analysis allegedly in response to these critiques but did not redress them.

[459] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541

L. Ferguson, Kaye, Branley-Bell, Markey (2025)

Ferguson CJ, Kaye LK, Branley-Bell D, Markey P. There is no evidence that time spent on social media is correlated with adolescent mental health problems: Findings from a meta-analysis.[460] The considerable flaws, missteps, and overstatement in the metanalysis by Ferguson discussed in (b) above are enough to call into question the his credibility conduct them but he has done numerous of them, all of which have been heavily criticized.

I'll begin my critique of this paper by making a table of the 30 systematic reviews and metanalyses cited in this report. They were selected based on the criteria listed in section IV.B. I have highlighted the title of this Ferguson one in light blue below:

Do social media experiments prove a link with mental health: A methodological and meta-analytic review.[461]
Alcohol use and risk of suicide: a systematic review and Meta-analysis[462]
Exposure and Risks of Ischemic Heart Disease and Stroke Events: Review and Meta-Analysis[463]
Cyberbullying Perpetration and Victimization in Youth: A Meta-Analysis of Longitudinal Studies.[464]
Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies.[465]

[460] *Professional Psychology: Research and Practice*. 2025;56(1):73-83. doi:10.1037/pro0000589
[461] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541
[462] Amiri S, Behnezhad S. Alcohol use and risk of suicide: a systematic review and Meta-analysis. Journal of Addictive Diseases. 2020/02/17 2020;38(2):200-213. doi:10.1080/10550887.2020.1736757
[463] Alexeeff SE, Deosaransingh K, Van Den Eeden S, Schwartz J, Liao NS, Sidney S. Association of Long-term Exposure to Particulate Air Pollution With Cardiovascular Events in California. *JAMA Network Open*. 2023;6(2):e230561-e230561. doi:10.1001/jamanetworkopen.2023.0561
[464] Marciano L, Schulz PJ, Camerini A-L. Cyberbullying Perpetration and Victimization in Youth: A Meta-Analysis of Longitudinal Studies. Journal of Computer-Mediated Communication. 2020;25(2):163-181. doi:10.1093/jcmc/zmz031
[465] Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. *Journal of Computer-Mediated Communication*. 2024;29(1)doi:10.1093/jcmc/zmad055

Interplay between social media use, sleep quality, and mental health in youth: A systematic review.[466]
Association Between Daily Alcohol Intake and Risk of All-Cause Mortality: A Systematic Review and Meta-analyses[467]
Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values.[468]
Psychometric Properties of Screening Instruments for Social Network Use Disorder in Children and Adolescents: A Systematic Review[469]
Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-analysis[470]
Media and Depression Symptoms: a Meta-Analysis.[471]
Fear of missing out (FOMO) and internet use: A comprehensive systematic review and meta-analysis[472]
Fear of missing out and social networking sites use and abuse: A meta-analysis[473]
Prevalence of body dysmorphic disorder: A systematic review and meta-analysis.[474]
The Relationship Between SNS Usage and Disordered Eating Behaviors: A Meta-Analysis.[475]

[466] Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. *Sleep Medicine Reviews*. 2021/04/01/ 2021;56:101414. doi:https://doi.org/10.1016/j.smrv.2020.101414

[467] Zhao J, Stockwell T, Naimi T, Churchill S, Clay J, Sherk A. Association Between Daily Alcohol Intake and Risk of All-Cause Mortality: A Systematic Review and Meta-analyses. *JAMA Network Open*. 2023;6(3):e236185-e236185.

[468] Cheng C, Lau Y-c, Chan L, Luk JW. Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors*. 2021/06/01/ 2021;117:106845. doi:https://doi.org/10.1016/j.addbeh.2021.106845

[469] Schlossarek S, Schmidt H, Bischof A, et al. Psychometric Properties of Screening Instruments for Social Network Use Disorder in Children and Adolescents: A Systematic Review. *JAMA Pediatr*. Apr 1 2023;177(4):419-426. doi:10.1001/jamapediatrics.2022.5741

[470] Shannon H, Bush K, Villeneuve P, Hellemans K, Guimond S. Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-analysis. *JMIR Ment Health*. 2022;9(4)

[471] Cunningham S, Hudson CC, Harkness K. Social Media and Depression Symptoms: a Meta-Analysis. *Res Child Adolesc Psychopathol*. Feb 2021;49(2):241-253. doi:10.1007/s10802-020-00715-7

[472] Akbari M, Seydavi M, Palmieri S, Mansueto G, Caselli G, Spada MM. Fear of missing out (FOMO) and internet use: A comprehensive systematic review and meta-analysis. *Journal of Behavioral Addictions*. 31 Dec. 2021 2021;10(4):879-900. doi:https://doi.org/10.1556/2006.2021.00083

[473] Fioravanti G, Casale S, Benucci SB, et al. Fear of missing out and social networking sites use and abuse: A meta-analysis. *Computers in Human Behavior*. 2021/09/01/ 2021;122:106839. doi:https://doi.org/10.1016/j.chb.2021.106839

[474] Rief McGrath LR, Oey L, McDonald S, Berle D, Wootton BM. Prevalence of body dysmorphic disorder: A systematic review and meta-analysis. Body Image. 2023/09/01/ 2023;46:202-211. doi:https://doi.org/10.1016/j.bodyim.2023.06.008

[475] Zhang J, Wang Y, Li Q, Wu C. The Relationship Between SNS Usage and Disordered Eating Behaviors: A Meta-Analysis. Front Psychol. 2021;12:641919. doi:10.3389/fpsyg.2021.641919

The use of social networking sites, body image dissatisfaction, and body dysmorphic disorder: A systematic review of psychological research.[476]
A Meta-Analysis of the Effects of Social Media Exposure to Upward Comparison Targets on Self-Evaluations and Emotions.[477]
The role of the media in body image concerns among women: a meta-analysis of experimental and correlational studies.[478]
How the exposure to beauty ideals on social networking sites influences body image: A systematic review of experimental studies.[479]
A meta-analytic review of the relationship between social media use and body image disturbance[480]
The role of media literacy in body dissatisfaction and disordered eating: A systematic review.[481]
A scoping review to investigate the association between social media, body image and eating disorders amongst young people.[482]
Problematic usage of the internet and eating disorder and related psychopathology: A multifaceted, systematic review and meta-analysis[483]
"Using digital media or sleeping … that is the question". A meta-analysis on digital media use and unhealthy sleep in adolescence[484]

[476] Ryding FC, Kuss DJ. The use of social networking sites, body image dissatisfaction, and body dysmorphic disorder: A systematic review of psychological research. *Psychology of Popular Media*. 2020;9(4):412-435. doi:10.1037/ppm0000264

[477] McComb C, Vanman E, Tobin S. A Meta-Analysis of the Effects of Social Media Exposure to Upward Comparison Targets on Self-Evaluations and Emotions. *Media Psychology*. 2023;26(5)

[478] Grabe S, Ward LM, Hyde JS. The role of the media in body image concerns among women: a meta-analysis of experimental and correlational studies. *Psychol Bull*. May 2008;134(3):460-76. doi:10.1037/0033-2909.134.3.460

[479] Fioravanti G, Bocci Benucci S, Ceragioli G, Casale S. How the exposure to beauty ideals on social networking sites influences body image: A systematic review of experimental studies. *Adolescent Research Review*. 2022:No Pagination Specified-No Pagination Specified. doi:10.1007/s40894-022-00179-4

[480] Saiphoo AN, Vahedi Z. A meta-analytic review of the relationship between social media use and body image disturbance. *Comput Hum Behav*. 2019;101:259-275.

[481] McLean SA, Paxton SJ, Wertheim EH. The role of media literacy in body dissatisfaction and disordered eating: A systematic review. *Body Image*. Dec 2016;19:9-23. doi:10.1016/j.bodyim.2016.08.002

[482] Dane A, Bhatia K. The social media diet: A scoping review to investigate the association between social media, body image and eating disorders amongst young people. *PLOS Global Public Health*. 2023;3(3):e0001091. doi:10.1371/journal.pgph.0001091

[483] oannidis K, Taylor C, Holt L, et al. Problematic usage of the internet and eating disorder and related psychopathology: A multifaceted, systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*. 2021/06/01/ 2021;125:569-581. doi:https://doi.org/10.1016/j.neubiorev.2021.03.005

[484] Pagano M, Bacaro V, Crocetti E. "Using digital media or sleeping … that is the question". A meta-analysis on digital media use and unhealthy sleep in adolescence. *Computers in Human Behavior*. 2023/09/01/ 2023;146:107813. doi:https://doi.org/10.1016/j.chb.2023.107813

Interventions to control children's screen use and their effect on sleep: A systematic review and meta-analysis.[485]
School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature[486]
Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: a meta-analysis[487]
The use of wearable technology to measure and support abilities, disabilities and functional skills in autistic youth: a scoping review[488]
The relationship between screen time and mental health in young people: A systematic review of longitudinal studies[489]
Impacts of digital social media detox for mental health: A systematic review and meta-analysis[490]
Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies[491]
Association between suicide reporting in the media and suicide: systematic review and meta-analysis[492]
Social media use and self-injurious thoughts and behaviors: A systematic review and meta-analysis[493]

[485] Martin KB, Bednarz JM, Aromataris EC. Interventions to control children's screen use and their effect on sleep: A systematic review and meta-analysis. *Journal of Sleep Research*. 2021;30(3):e13130. doi:https://doi.org/10.1111/jsr.13130

[486] Wheaton AG, Chapman DP, Croft JB. School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. *J Sch Health*. May 2016;86(5):363-81. doi:10.1111/josh.12388

[487] Bowers JM, Moyer A. Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: a meta-analysis. *Sleep Health*. Dec 2017;3(6):423-431. doi:10.1016/j.sleh.2017.08.004

[488] Black MH, Milbourn B, Chen NTM, et al. The use of wearable technology to measure and support abilities, disabilities and functional skills in autistic youth: a scoping review. *Scandinavian Journal of Child and Adolescent Psychiatry and Psychology*. 2020;8(1):48-69. doi:doi:10.21307/sjcapp-2020-006

[489] Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clin Psychol Rev*. Jun 2021;86:102021. doi:10.1016/j.cpr.2021.102021

[490] Ramadhan RN, Rampengan DD, Yumnanisha DA, et al. Impacts of digital social media detox for mental health: A systematic review and meta-analysis. *Narra J*. Aug 2024;4(2):e786. doi:10.52225/narra.v4i2.786

[491] Ribeiro JD, Franklin JC, Fox KR, et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. *Psychol Med*. Jan 2016;46(2):225-36. doi:10.1017/S0033291715001804

[492] Niederkrotenthaler T, Braun M, Pirkis J, et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis. *BMJ*. 2020;368:m575. doi:10.1136/bmj.m575

[493] Nesi J, Burke TA, Bettis AH, et al. Social media use and self-injurious thoughts and behaviors: A systematic review and meta-analysis. *Clinical Psychology Review*. 2021/07/01/ 2021;87:102038. doi:https://doi.org/10.1016/j.cpr.2021.102038

Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis[494]
Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review[495]
A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use.[496]
There is no evidence that time spent on social media is correlated with adolescent mental health problems: Findings from a meta-analysis[497]

A casual read will notice a salient difference in the titles. Some pose questions; many are entirely descriptive; only one is definitively declarative, and negatively so at that. In scientific settings, proving a negative is exceedingly difficult to do as it requires ruling out all possibilities (viz "There are no black swans"). Even the reviews above that *do* find significant associations are more circumspect in their titles. Ferguson's title is definitive and polemical. Ironically in the introduction to his paper, he states, "Specifically concerning academic debate, the issue of social media use and mental health remains polarized." And later in the introduction he cites multiple methodological issues with the existing literature including reliance on self-report, absence of content etc. Yet he then goes on to summarize and synthesize those same studies and concludes that there is no evidence. As such, his title is incendiary and designed to draw attention, rather

[494] Fry D, Krzeczkowska A, Ren J, et al. Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis. *The Lancet Child & Adolescent Health*. doi:10.1016/S2352-4642(24)00329-8

[495] Thorell LB, Buren J, Strom Wiman J, Sandberg D, Nutley SB. Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. *Eur Child Adolesc Psychiatry*. Aug 2024;33(8):2503-2526. doi:10.1007/s00787-022-02130-3

[496] Parry DA, Davidson BI, Sewall CJR, Fisher JT, Mieczkowski H, Quintana DS. A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour*. 2021/11/01 2021;5(11):1535-1547. doi:10.1038/s41562-021-01117-5

[497] Ferguson CJ, Kaye LK, Branley-Bell D, Markey P. There is no evidence that time spent on social media is correlated with adolescent mental health problems: Findings from a meta-analysis. *Professional Psychology: Research and Practice*. 2025;56(1):73-83. doi:10.1037/pro0000589

than accurately convey the current state of science. What is more, his own results—using "flawed" and "limited" studies—report the following:

Figure 60: Meta-Analytic Results of Social Media and Mental Health Outcomes[498]

Meta-analytic Results of Social Media and Mental Health Outcomes

Effect size	*k*	β	95% CI	Homogeneity test	I^2	τ	Publication bias?
All studies	79	.061	[.047, .075]	$X^2(78) = 4404.45$, $p < .001$	98.8	.055	No
Biological sex							
Male	27	.044	[.025, .062]	$X^2(26) = 164.79$, $p < .001$	94.7	.040	No
Female	29	.075	[.050, .101]	$X^2(28) = 388.10$, $p < .001$	97.9	.063	No
Study type							
Correlational	48	.072	[.05, .090]	$X^2(47) = 4167.83$, $p < .001$	99.3	.057	No
Longitudinal	30	.044	[.023, .066]	$X^2(29) = 169.54$, $p < .001$	83.6	.049	No
Data set							
Bespoke	21	.044	[.012, .070]	$X^2(12) = 167.61$, $p < .001$	89.2	.046	No
National survey	53	.067	[.050, .084]	$X^2(52) = 99.21$, $p < .001$	99.2	.058	Yes
Dissertation	5	.045	[.016, .074]	$X^2(4) = 1.81$, $p = .770$	57.2	0	No

Note. *k* = number of studies; β = pooled effect size estimate; CI = confidence interval; I^2 = heterogeneity statistic.

As demonstrated in the red box above, all of his results do in fact show a significant, albeit small, correlation between social media and health outcomes. Given the imprecision of the data, those findings alone could be interpreted as positive. Perhaps mindful of that, in his discussion, Ferguson states, "Overall, our findings indicate that the current research literature is unable to provide *strong* evidence for a clinically relevant link between time spend on social media and mental health issues in youth." (*emphasis added*). Finally, it is odd that this meta review does not include some experimental and quasi-experimental studies that provide much stronger evidence of a causal linkage. These same studies were omitted from his prior metanalysis as well.[499]

[498] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541

[499] Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. *Psychology of Popular Media*. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541; Allcott H, Braghieri L, Eichmeyer S, Gentzkow M. The Welfare Effects of Social Media. *American Economic Review*. 2020;110(3):629–76. doi:10.1257/aer.20190658; Braghieri L, Levy Re, Makarin A. Social Media and Mental Health. *American Economic Review*. 2022;112(11):3660–93. doi:10.1257/aer.20211218

M. Hancock et al. (2022, last revised 2025)

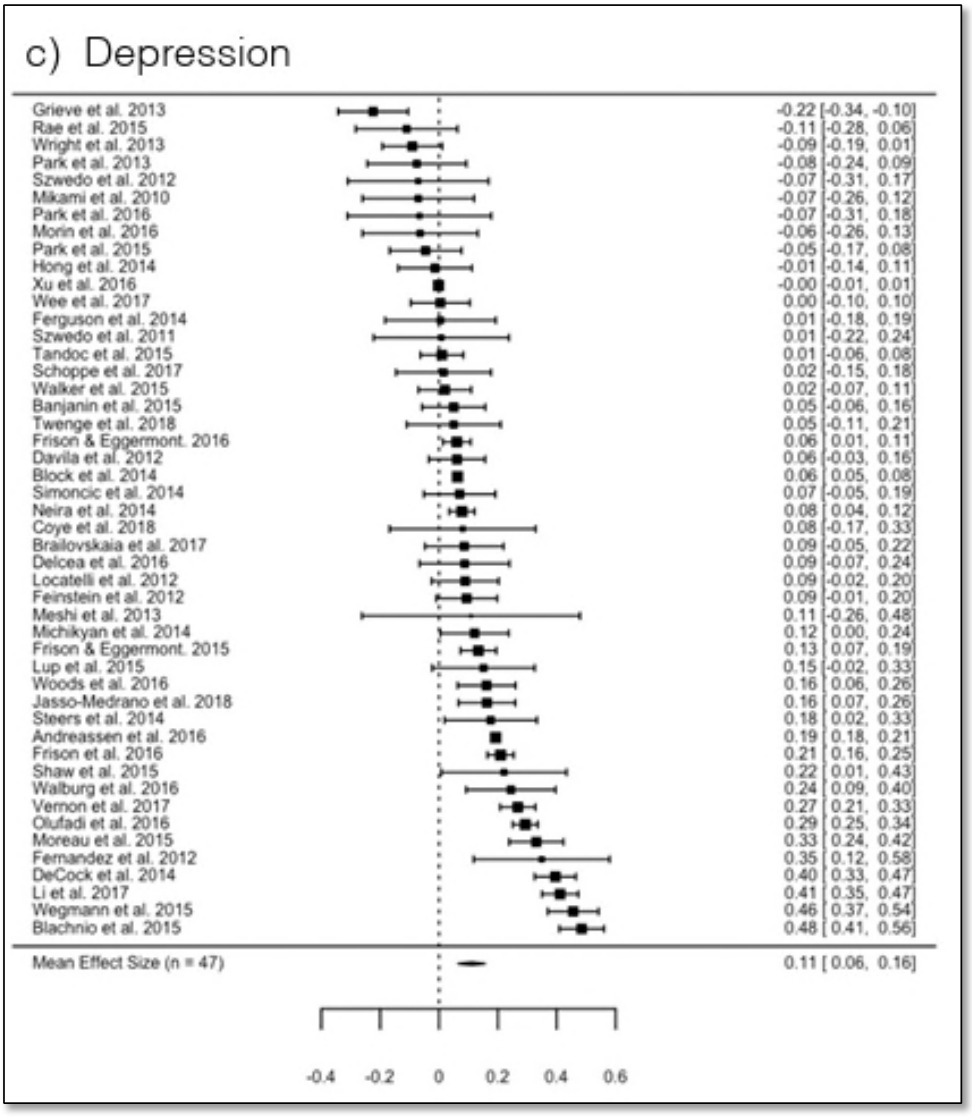
I was given this one by counsel to review.[500] I had not identified as one to consider including previously because the literature search in it was completed in 2018. Furthermore, it has only, to my knowledge, been "published" on a pre-print server (SSRN) and not in the peer-reviewed literature. Briefly, pre-print servers are a mechanism devised to provide rapid dissemination of findings in an open access platform that allows for commentary. Their intended purpose—and their biggest selling points—are the open and rapid dissemination of new knowledge with an opportunity to incorporate feedback and improve the science prior to peer review which remains the gold standard of quality in biomedical journals. Pre-print servers saw an explosion of submissions during COVID as rapidly proliferating scientific findings were uploaded often as fast as they were completed. Many papers uploaded to preprint servers are never published in peer reviewed journals at all but the theory is that the eventual submission will be improved by providing a period of open vetting. Experts urge caution in accepting the findings of pre-print servers for exactly this reason. This particular paper was first posted to the server in 2022 and updated in Jan of 2025. It has not, to my knowledge, been published in a journal yet. Nevertheless, I reviewed it.

There was considerable heterogeneity in the included studies and so the authors appropriately deployed a random effect model as discussed earlier. In their first analysis they included all 226 studies to look at the association of social media use with overall well-being and

[500] Hancock et al. "Psychological Well-Being and Social Media Use: A Meta-Analysis of Associations between Social Media Use and Depression, Anxiety, Loneliness, Eudaimonic, Hedonic and Social Well-Being"

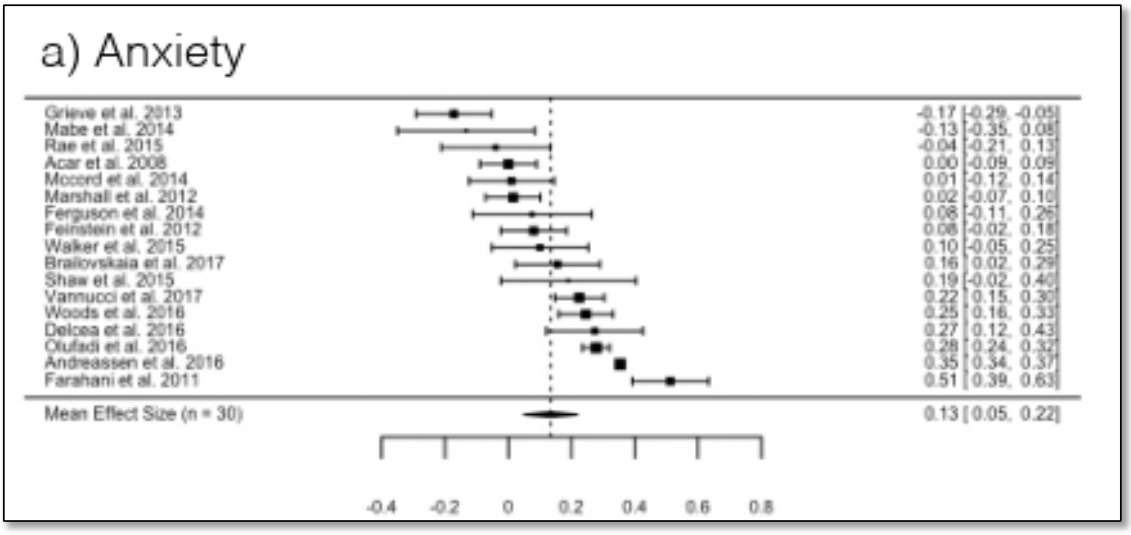
found no effect. Next, they looked at two outcomes relevant to this report: anxiety and depression. The forest plots for both are presented below. There are several notable findings. First, visually, if one scans from top to bottom, there is a notable temporal trend towards stronger associations over time and the authors note that for depression in particular, there was a statistically significant trend towards increased effect size. This is especially notable as the final included study was in 2015. There are many possible explanations for this including the evolution of SM algorithms and usage patterns over time. Second, the overall effect sizes, which the authors characterize as "small" are .13 and .12 for depression and anxiety respectively. Both effects were statistically significant and consistent with quasi-experimental and experimental studies referenced previously in this report.

Figure 61: Depression[501]



[501] Hancock et al. "Psychological Well-Being and Social Media Use: A Meta-Analysis of Associations between Social Media Use and Depression, Anxiety, Loneliness, Eudaimonic, Hedonic and Social Well-Being"

Figure 62: Anxiety[502]



e) **Orben A**. **Teenagers, screens and social media: a narrative review of reviews and key studies.** ***Social Psychiatry and Psychiatric Epidemiology*****. 2020/04/01 2020;55(4):407-414. doi:10.1007/s00127-019-01825-4**

Counsel also provided me a narrative review of existing systematic reviews.[503] This short review article by a noted skeptic of the association between SM and adverse effects concludes that the field is "dominated by many cross-sectional studies" and the overall effect sizes are negative "but very small." This review neglects that there are longitudinal studies and even some quasi-experimental studies that find significant effects that even when small, have significant public health implications at scale as well as the fact that there are subgroups for whom the effects are even larger.

[502] Hancock et al. "Psychological Well-Being and Social Media Use: A Meta-Analysis of Associations between Social Media Use and Depression, Anxiety, Loneliness, Eudaimonic, Hedonic and Social Well-Being"
[503]Orben A. Teenagers, screens and social media: a narrative review of reviews and key studies. Social Psychiatry and Psychiatric Epidemiology. 2020/04/01 2020;55(4):407-414. doi:10.1007/s00127-019-01825-4

N. NASEM Report

The National Academy of Medicine is a highly respected independent body of scientists which, among other things, commissions and publishes reports on important medical topics. I have served as a panelist on such reports, and for 6 years was a member of their Board of Children Youth and Families. In general, I have tremendous respect for the institution and the work they do. That said, there are several notable things that negatively impact the methodology and findings of this report.

1) Lack of relevant expertise on the committee. The National Academy Handbook on committee selection states, "Committee members are chosen based on their knowledge and experience in the various aspects of the topics to be investigated."[504] Of the 10 members of the panel, only 2 have actively researched social media and adolescent mental health. Others have researched related topics including AI and social media, bullying etc, and some appear to have no relevant research experience at all. There was only one member in a school of Public Health even though the report, and its implications, are squarely grounded in a public health issue.[505]
2) Conflict of Interest. At least two of the panelists have had their research supported by digital media companies. One received an unrestricted gift from Google and the other from Instagram. The NAM policy is that even *research* support from a relevant industry would be disqualifying from serving.

[504] National Academy of Sciences E, and Medicine. A Guide for Committee Members. Accessed April 2025
[505] Allem J-P. Social Media and Adolescent Health. *American Journal of Public Health*. 2024;114(10):980-982. doi:10.2105/ajph.2024.307784

3) The majority of expert reviewers of the report, while established and credible academic scientists, were likewise, by and large, not media researchers and at least one of them espouses a very clear contrarian position about the effects of media on adolescent health. The combination of a paucity of experts on the panel and reviewers with a firmly entrenched position critiquing their work can result in undue influence and effects.
4) When discussing the "positive" effects of social media on adolescent health, panelists relied on the same types of studies as those showing harm which is to say studies that were mostly observational, often cross-sectional, relied on self-reported usage etc. However, none of those limitations were mentioned as problems in that section in the same way they were in the chapter on harms. Furthermore, the section chose to call out one of the longitudinal studies of social media use by Coyne et al.[506] That study did in fact not find significant negative effects of social media usage on adolescent wellbeing. However, although the demographics and sampling frame are not reported in detail in the cited paper, they are from the Flourishing Families Study. Below is a description of how that panel was assembled.

[506] Kramer ADI, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. *Proceedings of the National Academy of Sciences*. 2014;111(24):8788-8790. doi:doi:10.1073/pnas.1320040111

Figure 63:Description of Sample from Coyne et. al[507]

The researchers chose a northern section of Seattle and the Provo area for their data collection. The Seattle sector includes unusual diversity within a relatively small area and also has a low crime rate, offering a safety factor for the students. The Provo area offers the possibility of comparing and contrasting Latter-day Saint families to others. To recruit families, they sent letters of invitation to every family in the area with one or two parents and at least one child in the 10- to 13-year-old age range. From those that responded, they chose a random sample, ending up with 500 families in Seattle and 200 in Provo. The Seattle group "mirrors the north Seattle census statistics," says Day, with a wide range of education levels and financial situations; about 20 percent are families of color. The Provo area families, as expected, are less diverse.

And here, from a separate paper using the same sample, is a description of the demographics.[508]

Figure 64: Description of Sample from Padilla-Walker et. al.

At Time 1, participants were 500 (163 single-parent and 337 two-parent) families, 96% of whom had complete data for Time 2 ($N = 478$, 154 single-parent and 324 two-parent families). Regarding ethnicity, 86% of fathers, 75% of mothers, and 69% of children were European American, 6% of fathers, 14% of mothers, and 13% of children were African American, and 8% of fathers, 11% of mothers, and 18% of children were from other ethnic groups or were multiethnic. Seventy percent of fathers and 59% of mothers reported having a bachelor's degree or higher. Average monthly income for fathers was US$6,572 ($SD = 5,316.46$) and for mothers was US$3,538 ($SD = 8,231.68$). Ninety-five percent of fathers and 66% of mothers reported being currently married (never divorced); 10% of mothers were single parents, never been married, 4% were separated, 15% were divorced, 3% were cohabiting, and 2% were widowed.

[507] *Families that Flourish*, BYU (2012), located at https://magazine.byu.edu/article/families-that-flourish/ (last accessed Apr. 16, 2025).

[508] Padilla-Walker LM, Christensen KJ. Empathy and Self-Regulation as Mediators Between Parenting and Adolescents' Prosocial Behavior Toward Strangers, Friends, and Family. *Journal of Research on Adolescence*. 2011;21(3):545-551. doi:https://doi.org/10.1111/j.1532-7795.2010.00695.x

As would be expected given the sampling frame, it is not remotely representative of the US population. Why they singled out that longitudinal study when there are several other larger and more representative ones as well as several experimental deprivation ones is unclear.[5095-10]

Further, the report goes on to say, "Social media can be valuable to adolescents who otherwise may feel excluded or lack offline support, including patients with rare diseases or disabilities, and those who struggle with obesity or mental illness, or come from marginalized groups such as LGBTQ+ young people." For this quote, they happen to cite an AAP guideline that I am an author on.[510] That particular statement was based on our opinion and not on any original science (which they fail to cite). Finally, the report states that "At its most extreme end, isolation and related mental health problems can manifest in suicidal thoughts and self-harm. Some evidence indicates that supportive online communities can decrease risks of suicidal ideation and improve wellbeing.[511] That study (authored by a member of the committee) did indeed find

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[509] Kramer ADI, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. *Proceedings of the National Academy of Sciences*. 2014;111(24):8788-8790. doi:doi:10.1073/pnas.1320040111
Allcott H, Braghieri L, Eichmeyer S, Gentzkow M. The Welfare Effects of Social Media. *American Economic Review*. 2020;110(3):629–76. doi:10.1257/aer.20190658
Hunt MG, Marx R, Lipson C, Young J. No More FOMO: Limiting Social Media Decreases Loneliness and Depression. *Journal of Social and Clinical Psychology*. 2018;37(10):751-768. doi:10.1521/jscp.2018.37.10.751
Braghieri L, Levy Re, Makarin A. Social Media and Mental Health. *American Economic Review*. 2022;112(11):3660–93. doi:10.1257/aer.20211218
Bridge JA, Greenhouse JB, Ruch D, et al. Association Between the Release of Netflix's 13 Reasons Why and Suicide Rates in the United States: An Interrupted Time Series Analysis. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2020/02/01/ 2020;59(2):236-243. doi:https://doi.org/10.1016/j.jaac.2019.04.020
Niederkrotenthaler T, Braun M, Pirkis J, et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis. *BMJ*. 2020;368:m575. doi:10.1136/bmj.m575
[510] Reid Chassiakos YL, Radesky J, Christakis D, Moreno MA, Cross C. Children and Adolescents and Digital Media. *Pediatrics*. Nov 2016;138(5)doi:10.1542/peds.2016-2593
[511] De Choudhury M, Kıcıman E. The Language of Social Support in Social Media and its Effect on Suicidal Ideation Risk. *Proc Int AAAI Conf Weblogs Soc Media*. May 2017;2017:32-41.

benefits… On Reddit. There are multiple salient differences between reddit and social media sites including the demography of users, the site's features (generally anonymous, organized by topics rather than individuals, no algorithmic display of content, pictures etc) and of course Reddit is not a defendant in this suit.

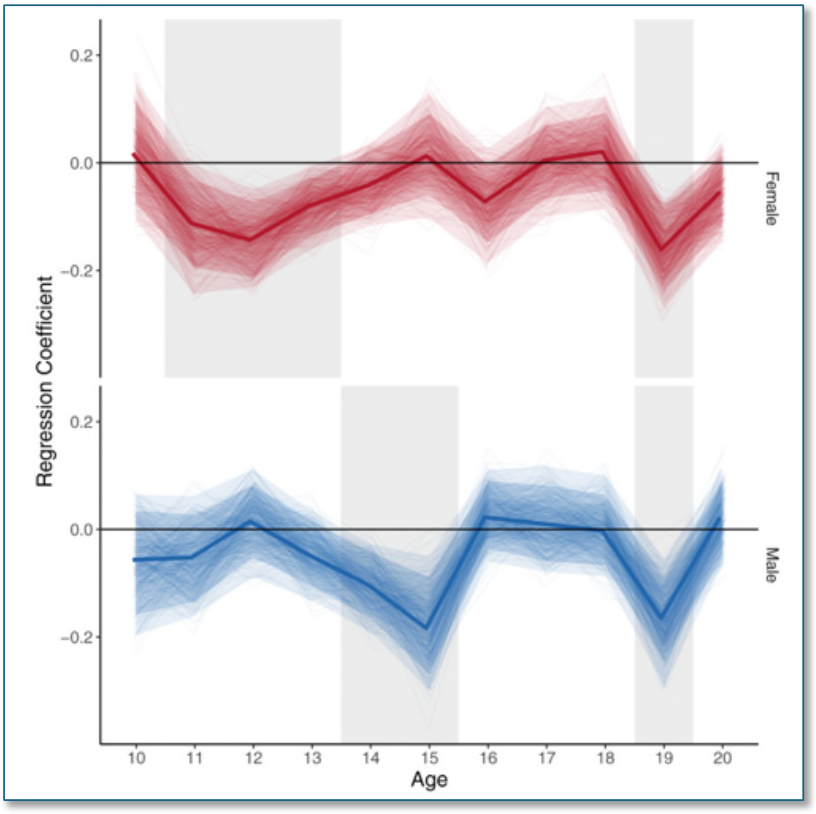
XII. Prevention Measures

Below, I will walk through specific prevention steps that could have been taken by Defendants to better protect child safety, recognizing the specific vulnerabilities of children. This includes evidence that age verification tools were inadequate, and parental controls were absent, limited, or ineffectively implemented. From a public health standpoint, allowing young users on social media platforms as they existed up to present puts these vulnerable children at risk of potentially severe harms. Because children are particularly vulnerable to social media harms, protections for them should have been anything but lackluster.

The variable developmental sensitivity to social media sites was illustrated in a study by Orben, Przybylski et al. They used the "Understanding Society" cohort study of 17,409 10-21 year olds to look at how self-reported social media use predicted life satisfaction one year later.[512] Some of their findings are summarized below.

[512] Orben A, Przybylski AK, Blakemore S-J, Kievit RA. Windows of developmental sensitivity to social media. *Nature Communications*. 2022/03/28 2022;13(1):1649. doi:10.1038/s41467-022-29296-3

Figure 65: How Social Media Use Predicts Life Satisfaction In Longitudinal Data[513]



The grey rectangles illustrate ages where the effects were significantly different from the null. For both females and males, younger ages are associated with increased likelihood of negative effects on life satisfaction. Females are more vulnerable between the ages of 10-13 and males between the ages 13 ½ to 15 ½.

To put the vulnerabilities of younger children into perspective, consider that according to a survey of over 4,500 U.S. parents who chose to delude their children about the existence of Santa

[513] Orben A, Przybylski AK, Blakemore S-J, Kievit RA. Windows of developmental sensitivity to social media. *Nature Communications*. 2022/03/28 2022;13(1):1649. doi:10.1038/s41467-022-29296-3

Claus, the average age at which children stop believing in him is 8.4 years.[514] And a subsequent study found that as many as 20% of 10-year-olds still believe in him.[515]

Parental involvement is essential to mitigating risks to children. Research shows that open communication and social support are critical in buffering teens from the harms of online abuse. Social support from trusted adults and peers can significantly blunt the psychological impact of exposure to things like cyberbullying or hate speech. A systematic review of effective strategies to combat and mitigate cyberbullying identified families as being a key component.[516] Trained parents can help their children prevent, identify, and cope with cyberbullying but doing so requires that they be alerted to warning signs either by the victim or the platform. Likewise, with respect to sexting, although schools emerge as critical intervention sites, parents and family involvement is essential.[517]

Finally, although research into sextortion is limited and in early stages, notification of parents or family members is an important and effective strategy to mitigate harms.[518] However, fewer than 50% of teens do so highlighting the essential role that the sites must play in prevention. Defendants could provide the ability to report inappropriate interactions or CEI/CSAM to a safety

[514] Helen Brown, *When Do Children Stop Believing in Santa?*, MADE FOR MUMS (Dec. 5, 2023), located at https://www.madeformums.com/news/when-do-children-stop-believing-in-santa/?utm_source=chatgpt.com
[515] Elisabeth Beauchamp, Lora Novak, *At What Age Did Americans Stop Believing in Santa?*, TODAY'S HOMEOWNER (Nov. 13, 2024), located at https://todayshomeowner.com/blog/guides/not-believing-in-santa-by-state/
[516] Tozzo P, Cuman O, Moratto E, Caenazzo L. Family and Educational Strategies for Cyberbullying Prevention: A Systematic Review. *International Journal of Environmental Research and Public Health*. 2022;19(16):10452.
[517] Ojeda M, Del Rey R. Lines of Action for Sexting Prevention and Intervention: A Systematic Review. *Archives of Sexual Behavior*. 2022/04/01 2022;51(3):1659-1687. doi:10.1007/s10508-021-02089-3
[518] Ray A, Henry N. Sextortion: A Scoping Review. *Trauma, Violence, & Abuse*. 2025;26(1):138-155. doi:10.1177/15248380241277271

support team that provides immediate feedback to the child. If a child reports such inappropriate interactions or illegal content, the Defendant could also notify the parent. I have not seen evidence that this happens effectively and have seen evidence to the contrary. For example, Jayakumar acknowledged at her deposition that, as of March 30, 2020, Instagram did not have a specific way for people to report CSAM on its platform.[519] Further, despite publicly claiming it was increasing staff to review reports of CSAM, Meta did the opposite and slashed the total workforce assigned to that job.[520]

In order for parents and guardians to provide the support that children require, they need adequate ability and access to control social media usage for their children. Parents also need to receive full and accurate information regarding the mental health harms that can be caused by social media so that they can make informed decisions for their children. As discussed below, Defendants could have, but failed to, provide adequate parental controls and information to parents. Relatedly, they failed to verify the ages of the users, a meaningful predicate to ensuring that any parental controls are effective.

O. At What Age Should Adolescents Use Social Media?

Because of the increased risk of harm to children and adolescents, in my opinion, defendants' social media platforms should restrict children under the age of 16 from using their platform or at a minimum, require informed parental consent and have extensive, effective parental controls. For teenagers age 16 and 17, I would recommend parental consent be required and effective parental controls be implemented for use of social media.

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[519] Jayakumar Dep. 274:6-11; *see also* Jayakumar Dep. Ex. 31 ("We don't have an in-app reporting option for CEI that I'm aware of."); Jayakumar Dep. 275:23-276:2 ("[R]eporting CEI is sort of baked into most platforms. It was a surprise to me, I was only two months into the company, it was a surprise to me that you couldn't report CEI within the app.").
[520] Jayakumar Dep. 352:9-356:15.

The legal "13-year-old minimum" age for creating social media accounts in the United States emanates from the Children's Online Privacy Protection Act (COPPA). Enacted in 1998 and implemented by the Federal Trade Commission (FTC) in 2000, COPPA was designed to give parents control over what data websites and online services can collect from children under 13 years of age. (It is not, in fact, a "legal limit," but rather just sets certain requirements for usage of platforms by minors under the age of 13.) COPPA was enacted prior to the creation of the social media companies I discuss in my report. Further, COPPA is not a scientific limit for what is appropriate, healthy, or beneficial for adolescents. Rather, COPPA is a legal, statutory minimum regarding data collection and restrictions on monetization of internet collected data. As Dr. Alison Lee, a senior UX researcher at Meta, testified: "There's also likely a lot of harm that may happen as a result of lack of support to those young people, especially in those digital spaces that were not designed for young people in the first place."[521]

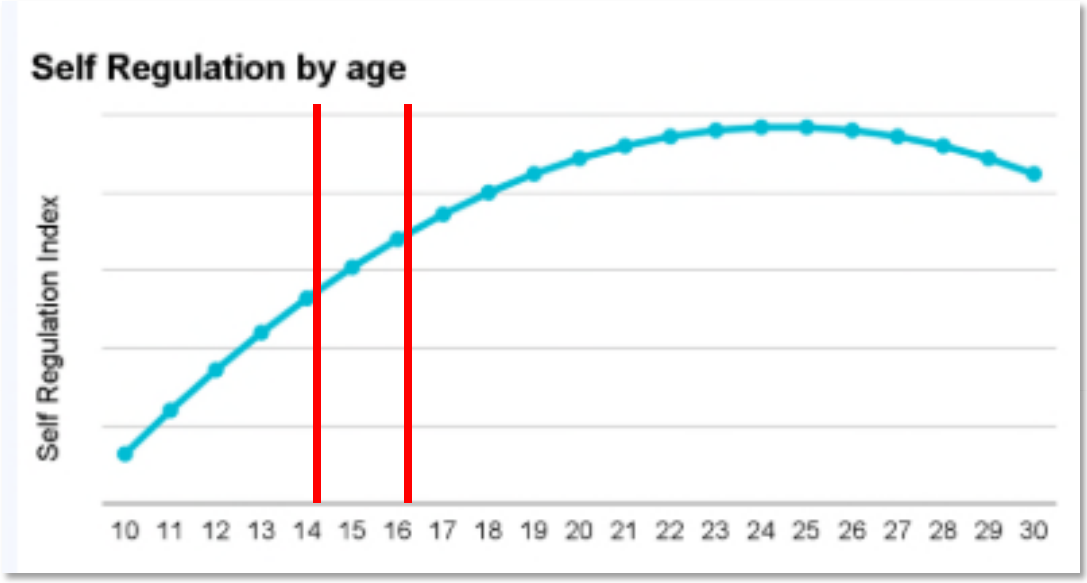
As discussed above, the white matter of the brain has not reached full maturity at age 13 and is decidedly less mature at age 10. Internally, Meta documents recognized that "[t]he teenage brain is usually about 80% mature… At this time teens are highly dependent on their temporal lobe where emotions, memory and learning, and the reward system reign supreme."[522]

Speaking as a pediatrician, an epidemiologist and a parent, age milestones must be viewed from a developmental perspective. I am not aware of any scientific support that 13 is the age at which children can safely engage with social media without supervision. My opinion is that much of the science actually demonstrates that social media causes mental health and other harms, especially to children. Meta's documents quote David Kleeman, Senior Vice President at Dubit,

[521] Alison Lee Deposition Transcript at 21:19-23
[522] Mark Zuckerberg Dep. Exhibit 30 at -5452

as saying, "While most platforms have set their minimum age for participation at 13, there's no on/off switch that makes someone ready to be a fully media-literate participant on that birthday."[523] And when asked in her deposition if there was any longitudinal data to support the 13 year and older age restriction. Dr. Moira Burke, a Meta user experience (UX) research scientist, responds, "I am not aware of longitudinal research on anything related to the ages that people start."[524]

Restricting social media use and providing effective parental controls for pre-teens and teens seems entirely justifiable if one looks at **Figure *12*** and **Figure *14***. By age 21, both brain development and executive function are by and large fully complete. There is still rapid growth of executive function at age 13 (see super imposed dotted red lines on figures). Internal documents from YouTube appear to recognize this:



Document 174: GOOG-3047MDL-01719787 at Slide 17 (emphasis added)

[523] Alison Lee Dep. Exhibit 29 at 2-3
[524] Moira Burke Deposition Transcript at 50:24-51:1

Indeed, the Handbook of Children and Screens recommends a minimum age for "social media use as 16 given the consistent links between social media use and depression of evidence of causality."[525] As part of these recommendations, we also note a need for effective age verification in order to consistently enforce age minimums.[526]

Some believe that denying children access to social media during early adolescence deprives them of the ability to connect with others and share insights, information, entertainment etc. Further, some believe that especially for vulnerable and potentially isolated populations (e.g. LGBTQ+ youth in rural areas) social media sites might enable them to connect with others with whom they identify in a safe space that might be affirming and even lifesaving. I am cognizant and sensitive to that position and it is discussed at length in the Handbook of Children and Screens. But scientific research indicates the data on the benefits versus harms for LGBTQ+ youth in particular are mixed[15] and the Thorn report (discussed above) revealed that LGBTQ youth are more likely to be bullied than their heterosexual peers. Moreover, there are other, safer ways to enable community-building without relying on extant social media sites.

P. Inadequate Age Verification

i) Meta

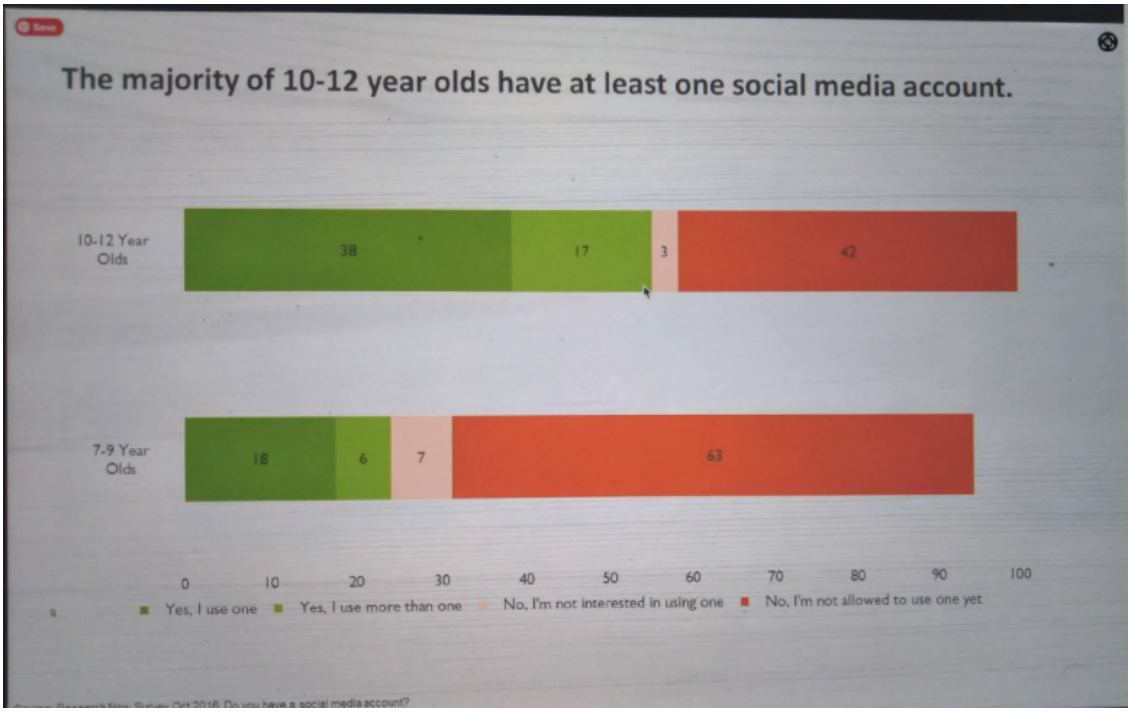
Despite COPPA requiring restrictions for users under 13-year-old, children under 13 are still able to (and do) access social media platforms and accounts, including those operated by Meta. Indeed, in 2018, Meta's own analysis reported that there were "4 million people under 13 in 2015 on IG. This represents around 30% of all 10–12-year-olds in the US."[527]

[525] Handbook of Children and Screens at 139
[526] Handbook of Children and Screens at 139
[527] META3047MDL-014-00133717, -3721

- Looking at people we predict to be 13 and 14 today, we can estimate that there were 4M people under 13 in 2015 on IG. This represents around 30% of all 10-12 years old in the US. Finally, assuming similar numbers today, 75% of US teens are MAP on IG.

Document 175: META3047MDL-014-00133717, -3721

Likewise, a 2017 study commissioned by one of Facebook's research managers, Anja Dinhopl, found that the majority of 10–12-year-olds and 24% of 7–9-year-olds have at least one social media account in spite of age "gating":



Document 176: Haugen_00023849, -3866

This "mixed methods" study is notable given it included focus groups of 10–12-year-olds, child parent interviews, and a survey of 1450 7–12-year-old children about their social media habits.[528]

[528] Haugen_00023849. Interestingly, the study cites the "sensitive nature of the subject" in explaining that "research findings, materials and raw data about tweens' social media usage are only available upon request." Haugen_00023849, -3855.

In 2020, Thorn (a not for profit dedicated to child online safety) issued a report that was circulated within Meta that discussed TikTok, Snap, and YouTube user ages. Among other findings, it reported:

Platform usage habits: At least once a day

Company	All minors	Ages 9-12	Ages 13-17
Discord	19%	12%	25%
Facebook	36%	45%	28%
Google Hangouts/Meet	33%	36%	30%
Instagram	50%	40%	59%
Messenger	32%	38%	27%
Pinterest	16%	13%	17%
Reddit	10%	8%	12%
Snapchat	47%	40%	52%
Telegram	6%	10%	3%
TikTok	45%	41%	49%
Tumblr	13%	18%	9%
Twitter	28%	30%	27%
WhatsApp	26%	39%	16%
YouTube	80%	78%	81%

Document 177: META3047MDL-031-00245501, -5503

This report is entirely consistent with Meta's own data from 2017, which found that 55% of 10–12-year-olds have at least one social media site and the very limited steps Meta took to mitigate it since then. In response, Pavni Diwanji (VP of UX Research) responded to the group via email, "This is a big WHOA, if these numbers are to be believed….. If we feel that these numbers are in the right ballpark, it's hard to justify bringing more kids onto our platform before we make it better,

afford better protections. And if the numbers are not in the right ballpark, can we make a case or refute these?[529]

Notably, Instagram did not even start *asking* users for their date of birth until December 2019, nine years after it was launched and it did not *require* it until March of 2021.[530] Merely "asking" for a birthdate is a minimal and easily circumventable safeguard which many of the defendants readily acknowledge in their internal communications. Children as young as 9 or 10 (possibly younger) were (and likely still are) on the platform.

Meta executives were aware that its age limits were not really working. In 2019, Nick Clegg, Meta President of Global Affairs, texted his team, "The fact that we have age limits that are unenforced (unenforceable?) and that there are, as I understand it, important differences in the stringency of our policies on IG vs Blue App [Facebook] makes it difficult to claim we are doing all we can."[531] Similarly, in a 2019 email chain, Monika Bickert (VP of Public Policy), informed others she was getting an error message when trying to report an underage account brought to her attention by someone at a child's school. She adds: "The reporting flow was pretty bad. I wondered if we should look into it. *It was obviously structured to deter any reports*."[532]

Troublingly, the "final word" in this email chain came from Tim Mathews (Product Manager) who stated, "Improving this is not currently in the plans for FRX and looking at these numbers seem quite small (*only* 15K completions per week)".[533] But 15,000 children is the equivalent of approximately 20 entire average sized US high schools per week. Moreover, Mr. Mathews' reply overlooks that the "bad reporting flow" may, in part, explain the "low" numbers.

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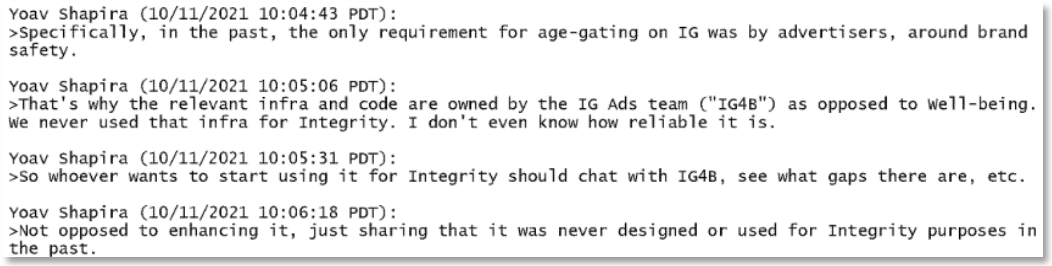
[529] META3047MDL-031-00245501, -5501
[530] Diego Castaneda Dep. Ex. 4; *See also* Diego Castaneda Dep. Tr. at 79:12-80:2.
[531] META3047MDL-003-00175144, -5153
[532] META3047MDL-014-00166515, -6517 (emphasis added)
[533] META3047MDL-014-00166515, -6515 (emphasis added)

Facilitating reporting to alleviate or prevent harm is an essential component of public health safety strategies. It is foundational to the institution of mandatory reporting.

The situation does not seem to have improved by 2021. In an internal chat that year, Meta employees indicated they did not even know the age of ~30% of Instagram users. Despite claiming externally that "we age gate," these employees privately acknowledged that "age-gating" was never designed nor used for Integrity purposes, but rather was implemented only by the Instagram advertising team:

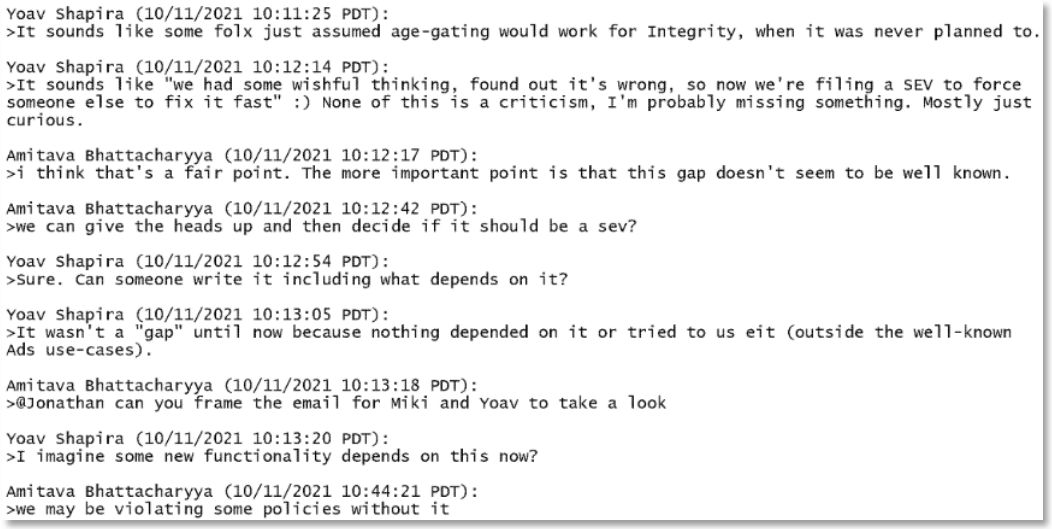


Yoav Shapira (10/11/2021 10:04:43 PDT):
>Specifically, in the past, the only requirement for age-gating on IG was by advertisers, around brand safety.

Yoav Shapira (10/11/2021 10:05:06 PDT):
>That's why the relevant infra and code are owned by the IG Ads team ("IG4B") as opposed to Well-being. We never used that infra for Integrity. I don't even know how reliable it is.

Yoav Shapira (10/11/2021 10:05:31 PDT):
>So whoever wants to start using it for Integrity should chat with IG4B, see what gaps there are, etc.

Yoav Shapira (10/11/2021 10:06:18 PDT):
>Not opposed to enhancing it, just sharing that it was never designed or used for Integrity purposes in the past.



Yoav Shapira (10/11/2021 10:11:25 PDT):
>It sounds like some folx just assumed age-gating would work for Integrity, when it was never planned to.

Yoav Shapira (10/11/2021 10:12:14 PDT):
>It sounds like "we had some wishful thinking, found out it's wrong, so now we're filing a SEV to force someone else to fix it fast" :) None of this is a criticism, I'm probably missing something. Mostly just curious.

Amitava Bhattacharyya (10/11/2021 10:12:17 PDT):
>i think that's a fair point. The more important point is that this gap doesn't seem to be well known.

Amitava Bhattacharyya (10/11/2021 10:12:42 PDT):
>we can give the heads up and then decide if it should be a sev?

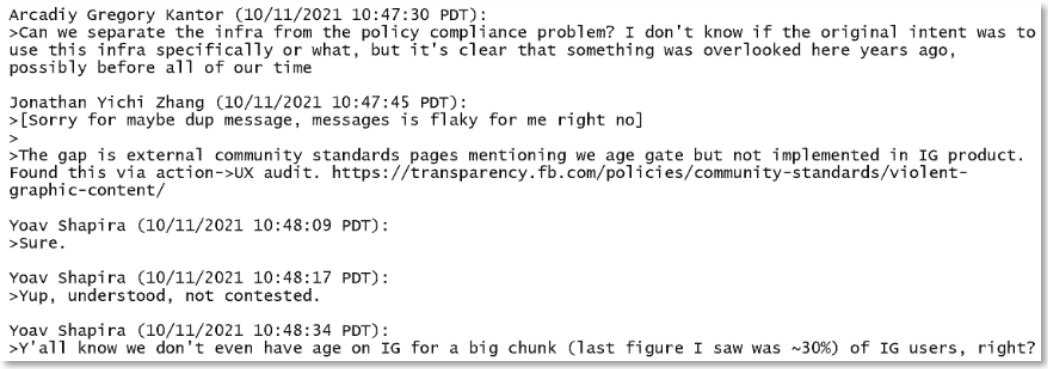
Yoav Shapira (10/11/2021 10:12:54 PDT):
>Sure. Can someone write it including what depends on it?

Yoav Shapira (10/11/2021 10:13:05 PDT):
>It wasn't a "gap" until now because nothing depended on it or tried to us eit (outside the well-known Ads use-cases).

Amitava Bhattacharyya (10/11/2021 10:13:18 PDT):
>@Jonathan can you frame the email for Miki and Yoav to take a look

Yoav Shapira (10/11/2021 10:13:20 PDT):
>I imagine some new functionality depends on this now?

Amitava Bhattacharyya (10/11/2021 10:44:21 PDT):
>we may be violating some policies without it



Arcadiy Gregory Kantor (10/11/2021 10:47:30 PDT):
>Can we separate the infra from the policy compliance problem? I don't know if the original intent was to use this infra specifically or what, but it's clear that something was overlooked here years ago, possibly before all of our time

Jonathan Yichi Zhang (10/11/2021 10:47:45 PDT):
>[Sorry for maybe dup message, messages is flaky for me right no]
>
>The gap is external community standards pages mentioning we age gate but not implemented in IG product. Found this via action->UX audit. https://transparency.fb.com/policies/community-standards/violent-graphic-content/

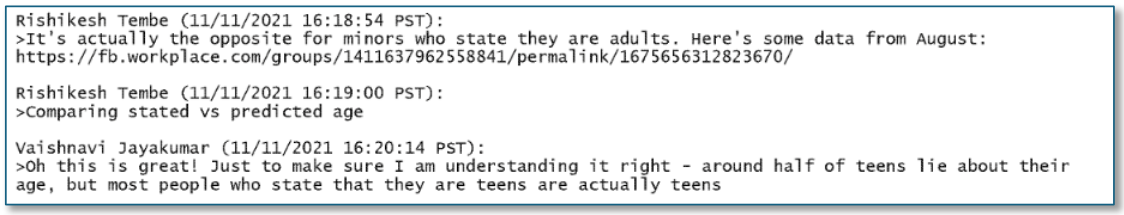
Yoav Shapira (10/11/2021 10:48:09 PDT):
>Sure.

Yoav Shapira (10/11/2021 10:48:17 PDT):
>Yup, understood, not contested.

Yoav Shapira (10/11/2021 10:48:34 PDT):
>Y'all know we don't even have age on IG for a big chunk (last figure I saw was ~30%) of IG users, right?

Document 178: META3047MDL-014-00355780, -5780-81

Jayakumar, child safety lead at Instagram, states in her deposition that "Insta didn't do enough to identify under 13's."[534] As of September of 2020, Instagram's own documents reveal that there "was a backlog of 450,000 reports or noted incidences of potential users under the age of 13 that need to be reviewed and addressed."[535] But later in the same text exchange, Sara Chang (Facebook child safety) states that there are over 2.5 million.[536] That considerably larger estimate is plausible given this exchange between Jayakumar and Rishikesh Tembe, an Insta programmer:



Rishikesh Tembe (11/11/2021 16:18:54 PST):
>It's actually the opposite for minors who state they are adults. Here's some data from August: https://fb.workplace.com/groups/1411637962558841/permalink/1675656312823670/

Rishikesh Tembe (11/11/2021 16:19:00 PST):
>Comparing stated vs predicted age

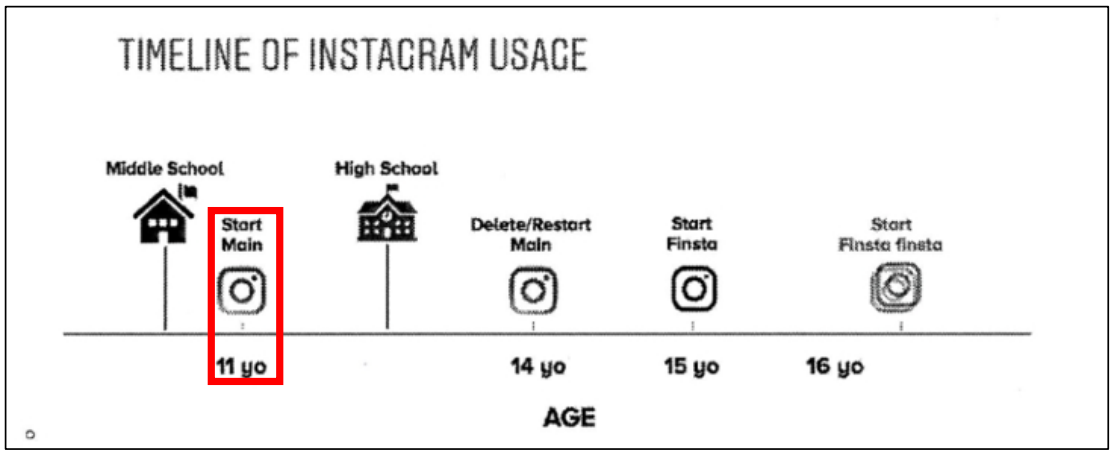
Vaishnavi Jayakumar (11/11/2021 16:20:14 PST):
>Oh this is great! Just to make sure I am understanding it right - around half of teens lie about their age, but most people who state that they are teens are actually teens

Document 179: META3047MDL-020-00298458, -8458

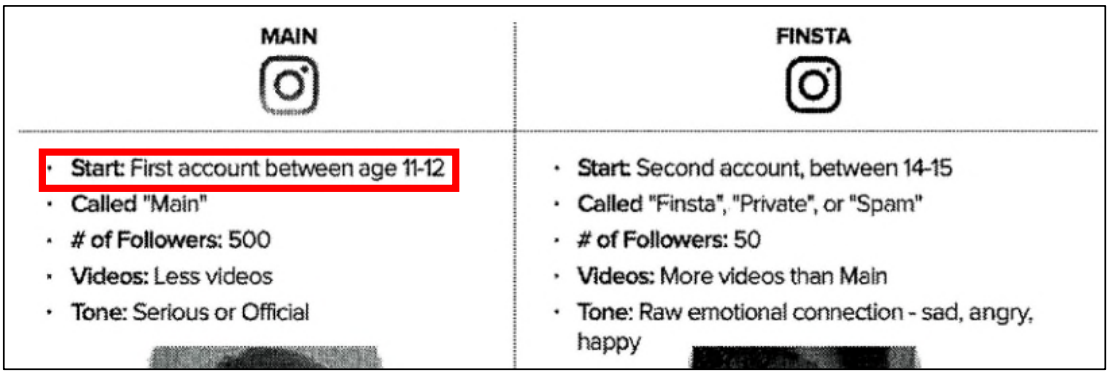
To call it out for emphasis, Insta was aware that "**around ½ of teens lie about their age**." It should be a surprise to no one that given the ready access to adult content teens will lie about their age especially if there are no consequences to doing so.

[534] Vaishnavi Jayakumar Dep. Tr. at 82:19-21
[535] Vaishnavi Jayakumar Dep. Tr. at 89:14-18; *See also* Vaishnavi Jayakumar Dep. Exhibit 8.
[536] Vaishnavi Jayakumar Dep. Tr. at 96:21

Meta's failure to understand the age of the children on its platform (or facilitate and act on reports of users under the age of 13) makes sense when paired with documents indicating that the company was actively looking to grow the number of young people who use its platforms. Indeed, while several Meta employees testified that under 13-year-old children were not a growth strategy, and when they were found using the site they were expediently removed, those claims are undermined by the following graphics, which were shown within the company during a presentation regarding sustaining and promoting growth of the app (in part through "Finstas," fake Instagram accounts).



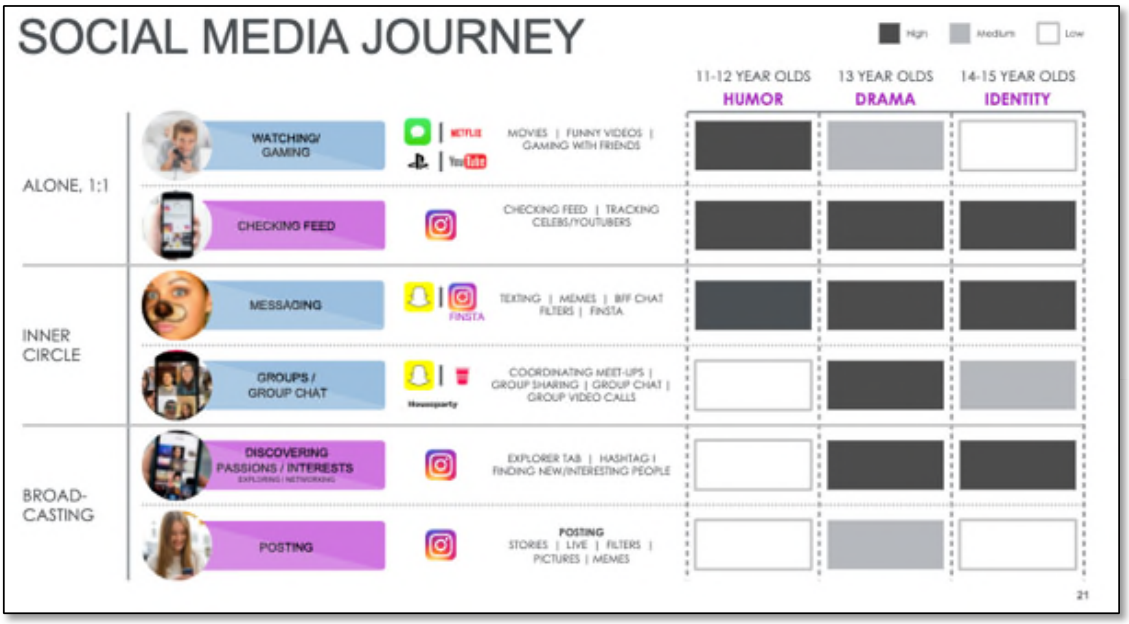
Document 180: META3047MDL-031-00086272, -6273



Document 181: META3047MDL-031-00086272, -6273

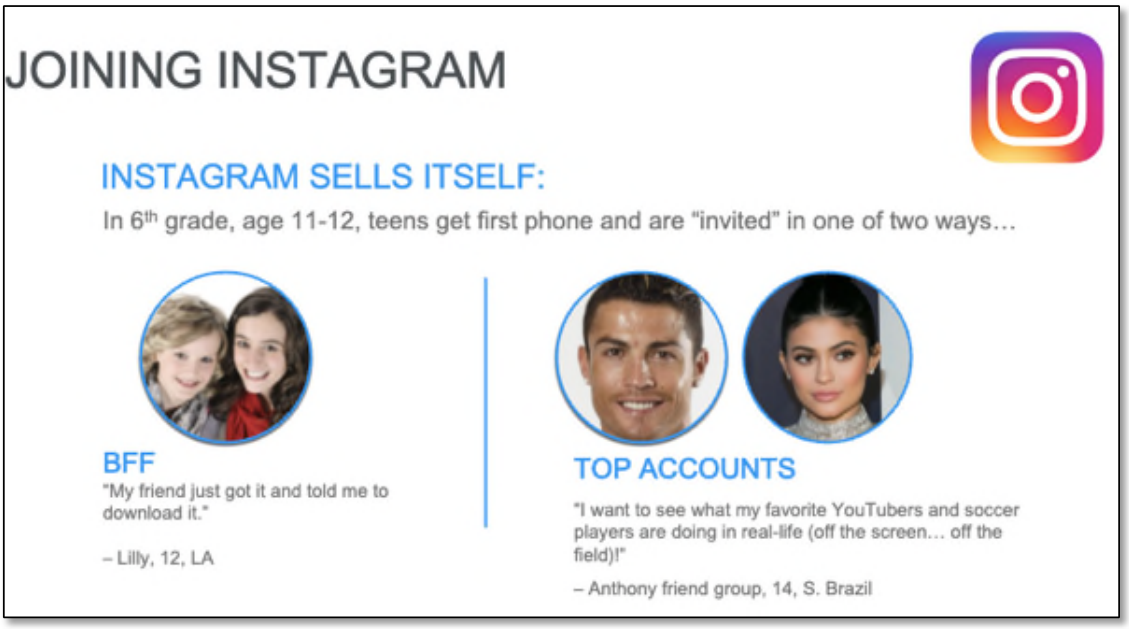
Both slides show that 11 years is the "age" at which, in Meta's timeline, the typical child starts using Instagram (red boxes added) and, for what it's worth, the age at which they typically create a "Finsta" account. "Finstas" are further addressed below in the context of parental controls.

Consider, too, an international qualitative study of 220 children that Meta conducted in 2017 (before Meta was collecting age data through Instagram). This study, entitled "Early Teen Illumination Research," used a sampling frame of children aged 11-15 and the reported objective was to "understand early teens and create illumination foundation. Foundation that will inspire high impact marketing messages and campaigns that drive Instagram platform production and engagement and bring in new users."[537]



Document 182: META3047MDL-019-00059532 at Slide 21

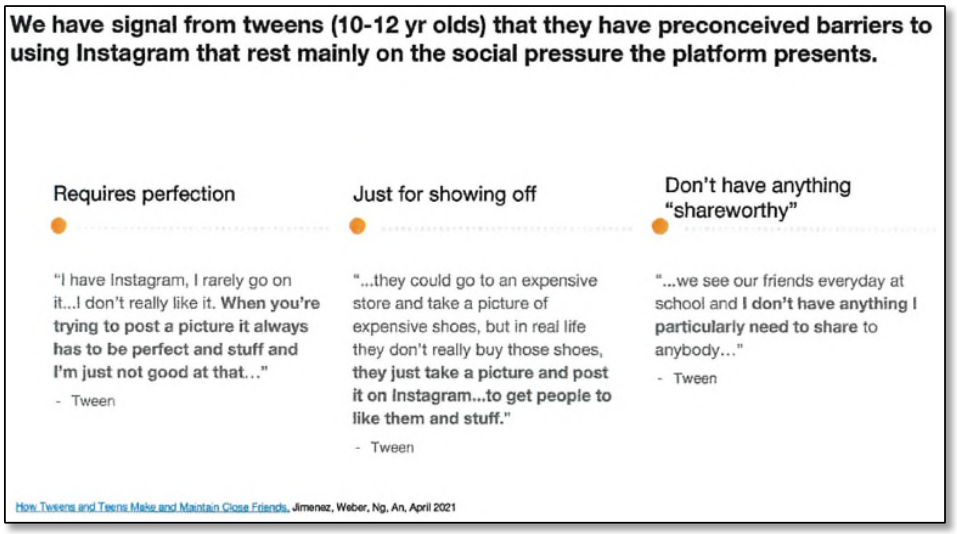
[537] META3047MDL-019-00059532 at Slide 7



Document 183: META3047MDL-019-00059532 at Slide 26

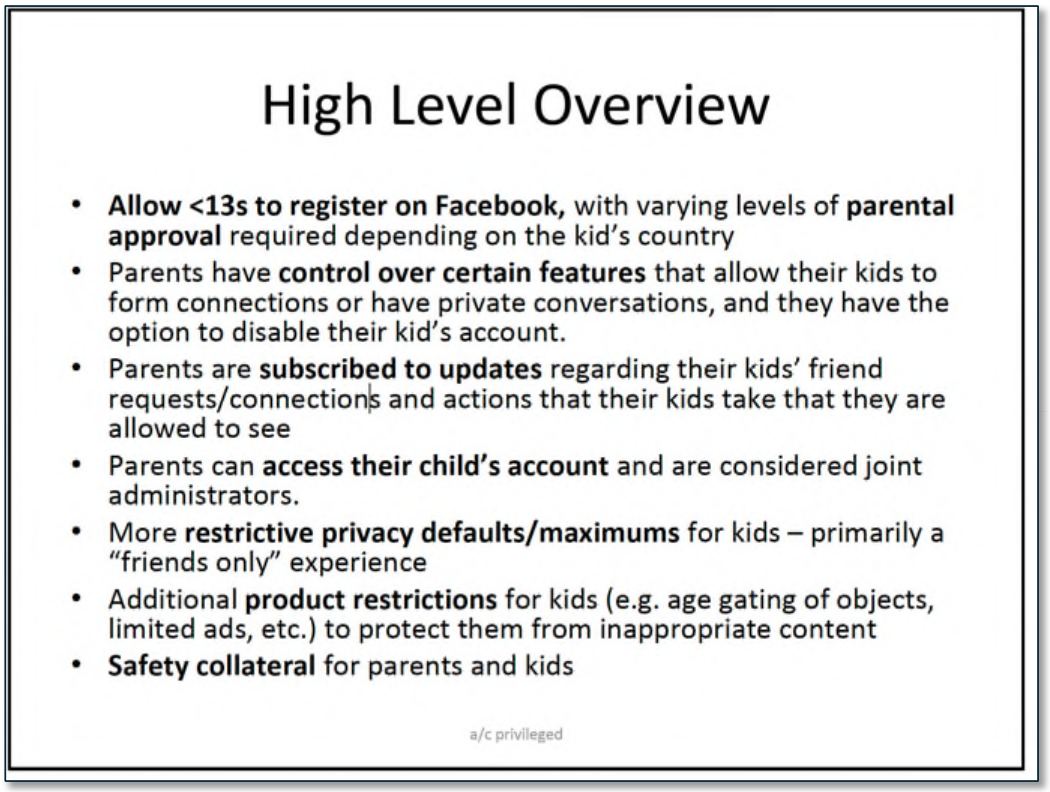
These slides demonstrate that Meta noted the age of initiation preceded 13 and in fact, "Instagram sells itself" to 6th grades ages 11-12.

Finally, in 2021, Meta conducted a study to ascertain "barriers" to using Instagram among 10–12-year-olds (see below).



Document 184: META3047MDL-020-00349969, -0038

I have seen documents indicating that discussed strategies to get younger teens on their platforms "safely." For instance, I have seen preparatory documentation motivating the launch of Facebook's "Project Kid" which was a site designed with additional controls specifically for children under the age of 13.

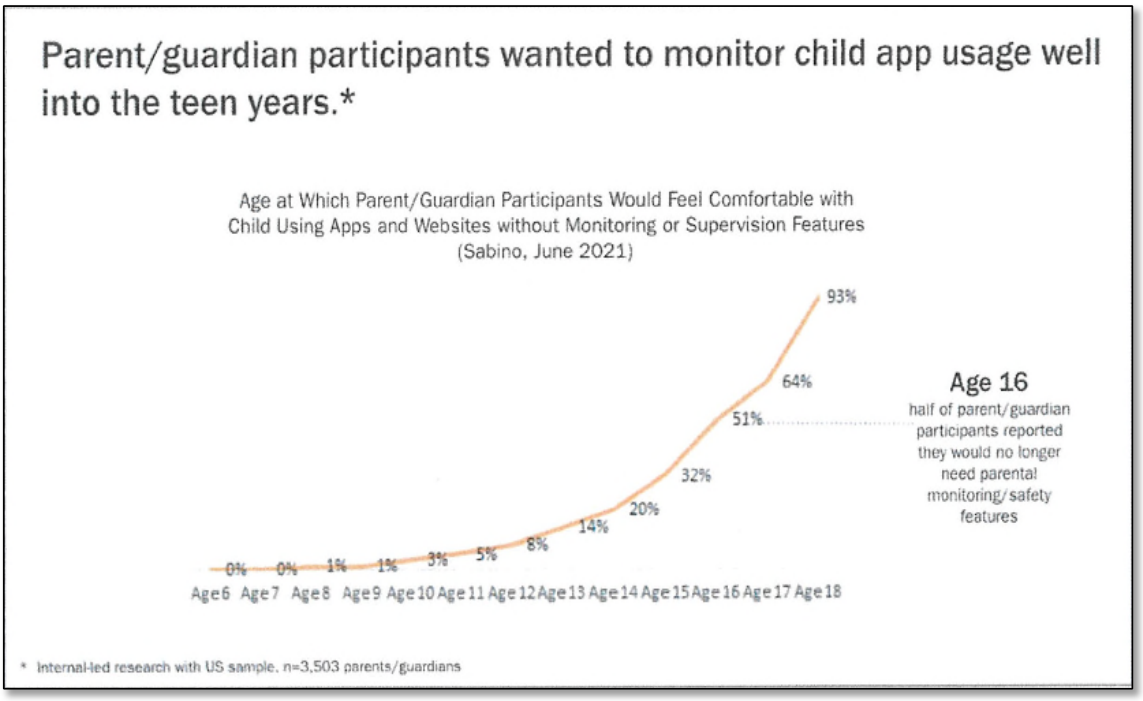


Document 185: META3047MDL-034-00385870 at Slide 2

Notably, although these controls were developed and deployable, when Meta scrapped the plans to roll out Facebook Kids because of public backlash, they neglected to offer some or all of those same safeguards to the parents of 13 year and older children.

That is particularly concerning given Meta's awareness that over 70% of parents reported concerns about the content their tweens might be exposed to and the people they might meet on Meta's platforms.[538] Those parental concerns were further validated by internal Meta research led by Kramer in 2020, which surveyed over 3500 parents/guardians:

[538] Haugen_00023849, -3870



Document 186: META3047MDL-020-00350316, -0360

In addition to demonstrating that parents "want[] to monitor child app usage well into the teen years," this study is notable because the lower limit Meta used to query parental interest in monitoring was 6 years. Again, that is considerably below the current 13-year-old COPPA limit, suggesting Meta was exploring parents' comfort levels for children well below the current COPPA age limit.

Meta's failure to age gate (and/or its perfunctory approach to doing so) are particularly concerning in light of Meta's understanding of the significant mental health harms that children on the platform can experience. In 2020, Thorn (a not for profit dedicated to child online safety) issued a report that was circulated within Meta. Among other findings, the report stated that "[c]hildren report having online sexual interactions at high rates…25 percent of kids 9-17 reported

having had a sexually explicit interaction with someone they thought was 18 or older."[539] Those numbers are consistent with Meta's own. Meta reports that 50% of Instagram direct messages (DMs) to children come from adults, which is concerning to say the least.[540] Indeed, in June of 2020, an internal Meta communication reported the results of an internal study showing that "**500,000 IG underage accounts receive IIC on a weekly basis**. The IG prevalence is 3x Messenger's."[541] "IIC" is Meta's acronym for "inappropriate interactions with children."

To put this in human terms, consider this example from a 2019 mixed-methods study commissioned by Meta of child users of Instagram in the Los Angeles area all of whom were over 13 when the research was conducted by Answer Lab, an independent contractor. One 14-year-old participant reported:

> *Fake robot accounts DM you and say 'watch my free sex videos' and the person sends it to 50 different kinds of people...This was kind of like 'hey get a $500 Visa gift card', I did that one time, it was the first time I ever saw it, I was really young, I thought, 'I am going to get some money!' It asked me for my address, plain old little me, I was kind of ditzy, and what it said to me after that was 'We have your address now, we will stalk you.' I was eleven, I freaked out...That's probably one of the reasons I got a private account. - P12, 14*

Document 187: Diego Castaneda Deposition Exhibit 9 at -6904

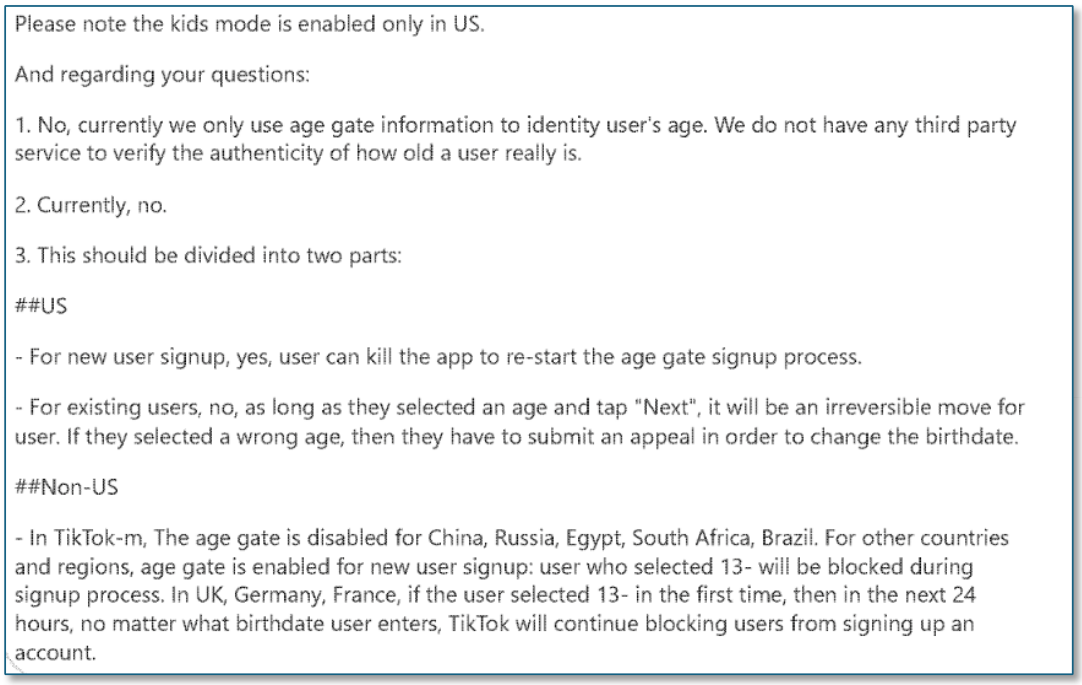
Notwithstanding their own understanding validating Thorn's findings, in their public (and internal) response, Meta "thanked" Thorn, then pointed out that Thorn excluded Apple's iMessage from their study though it is "bigger than Messenger and IG Direct Combined." While it might be true that iMessage is used more frequently than DMing on Meta, it is a texting platform that is not tied to any social media site. There is no built-in algorithm in iMessage that makes children's contact information available to potential predators. In this context, iMessage is closer to a

[539] META3047MDL-031-00245499, -5502
[540] Diego Castaneda Deposition Transcript at 280:9-12
[541] META3047MDL-014-00350154, -0159 (bold in original)

proverbial "landline" which was not a commonly deployed pedophiliac strategy. In any event, Meta's effort to divert attention to another platform is not persuasive, again given its own awareness of the problem.

ii) TikTok

On June 12, 2019, Rey Allie, Trust and Safety Strategy Expert at Tik Tok, asked Patrick Nommensen, Head of Global Public Policy for Bytedance, "if we are doing anything to verify that those who say there are over 13 actually are." Nommensen responded, "We do not verify age beyond user input."[542] Blake Chadlee, President for Global Business solution, provided further details in his response:



Please note the kids mode is enabled only in US.

And regarding your questions:

1. No, currently we only use age gate information to identity user's age. We do not have any third party service to verify the authenticity of how old a user really is.

2. Currently, no.

3. This should be divided into two parts:

##US

- For new user signup, yes, user can kill the app to re-start the age gate signup process.

- For existing users, no, as long as they selected an age and tap "Next", it will be an irreversible move for user. If they selected a wrong age, then they have to submit an appeal in order to change the birthdate.

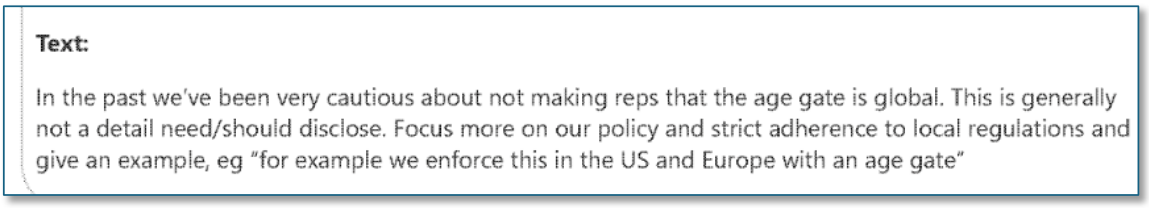
##Non-US

- In TikTok-m, The age gate is disabled for China, Russia, Egypt, South Africa, Brazil. For other countries and regions, age gate is enabled for new user signup: user who selected 13- will be blocked during signup process. In UK, Germany, France, if the user selected 13- in the first time, then in the next 24 hours, no matter what birthdate user enters, TikTok will continue blocking users from signing up an account.

Document 188: TIKTOK3047MDL-079-LARK-02017133, -7136

[542] TIKTOK3047MDL-079-LARK-02017133, -7133

There appears to be considerable variability in how (or if) age gating is present and or enforced but it is readily gameable in all contexts. Presumably recognizing that the problematic nature of misrepresenting age gating is universal, Nommensen adds:


Text:

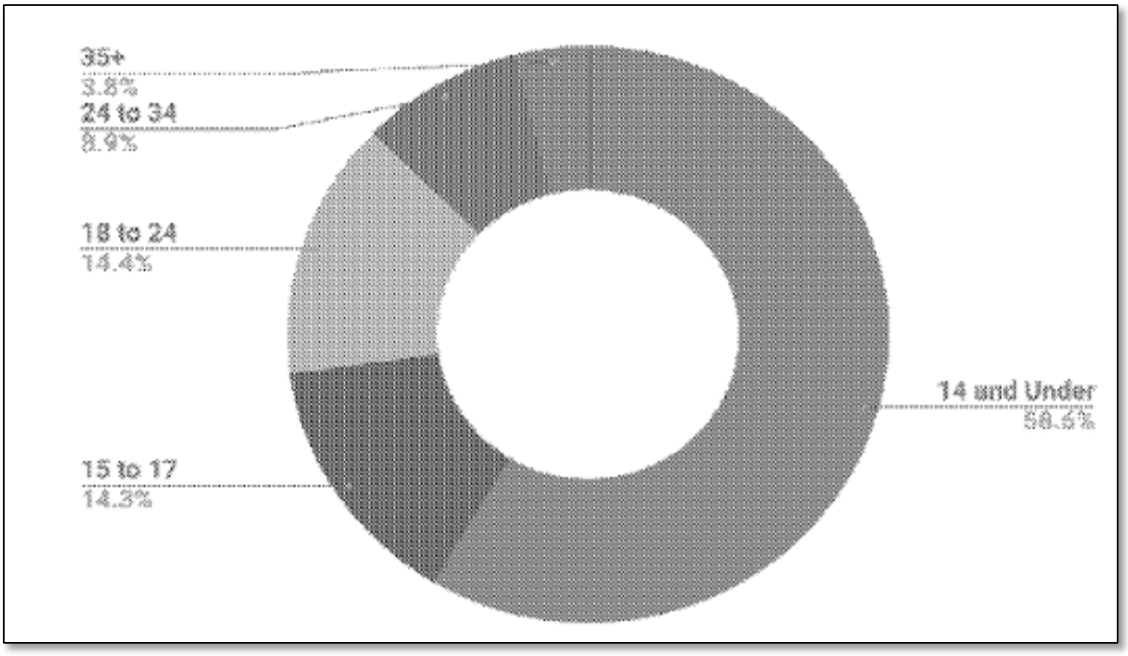
In the past we've been very cautious about not making reps that the age gate is global. This is generally not a detail need/should disclose. Focus more on our policy and strict adherence to local regulations and give an example, eg "for example we enforce this in the US and Europe with an age gate"

Document 189: TIKTOK3047MDL-079-LARK-02017133, -7138

The ineffectiveness of Tik Tok's age gating approach was acknowledged by Kristelle Collins, of the Youth Safety and Wellbeing team, in a text exchange on Aug 11, 2022. In her words, "I know I sound like a broken record on this, but I think we need to continually highlight that age gate is predicated on entering a birth date—this is a feeble safety precaution and needs to be understood for what it is."[543] In a chat exchange on August 26, 2021, Amy Classen, Global Issue Owner at TikTok, stated that "10% of users are underage" and "[she's] about to ban all of them."[544] But it appears that even when the age is known at TikTok, some users—at least very popular ones, were not immediately banned. In his deposition, Han was asked about a particular 11-year-old creator with 4.1 million followers.[545] The child, whose age was confirmed as accurate by TikTok, was blacklisted but still able to post for at least five months.[546]

The problem of underage users may be especially pronounced at TikTok which distinguishes itself from its competitors in its marketing materials as having a younger (and more female) demographic. Almost 59% of their users are in the "14 and Under" category.

[543] TIKTOK3047MDL-021-LARK-00005510, -5516
[544] TIKTOK3047MDL-038-LARK-00192063, -2064
[545] Eric Han Deposition Transcript at 365:9-12
[546] Eric Han Deposition Transcript at 369:7-14



Document 190: *TIKTOK3047MDL-004-00290586, -0586*

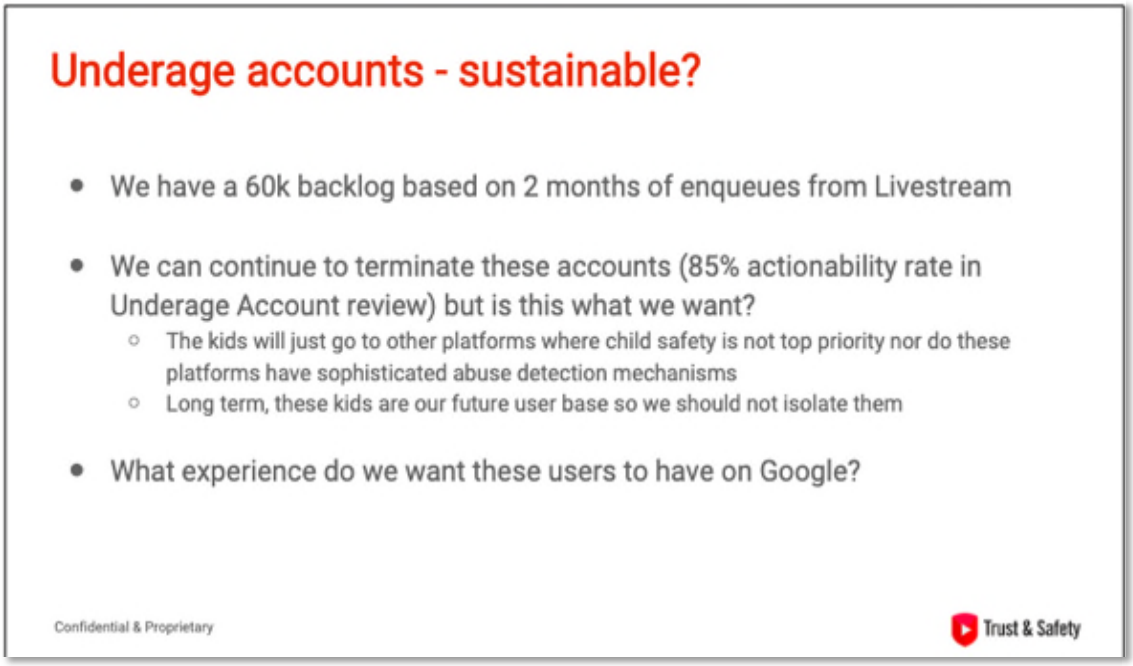
As an aside, it is notable that the "Under 14" category does not have a lower bound. Every other age band is bounded at both ends except 35+ which understandably doesn't have one since the upper age of human life expectancy is unknown. Given that being over 13 is "required" to have an account, one might expect it would have been labeled "13-14." Nevertheless, the "14 and Under" category consumes more videos per day (225 on average) than any other group. Younger users are also more likely to share, which also drives their usage.[547]

iii) YouTube

For its part, YouTube also had an "underage" problem with a considerable backlog of problem users to address as well: "Most actual YT Teens users did not declare themselves

[547] TIKTOK3047MDL-004-00290586, -0587

between 13-17. This partially explains why only around 3-4% of the YT DAU are Teens users based on the declared age."[548]



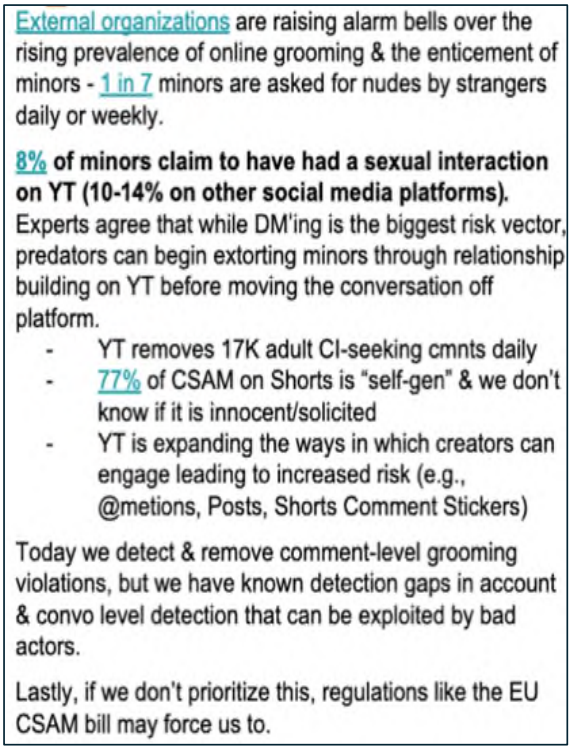
Document 191: GOOG-3047MDL-00246776 at Slide 17

While "[t]erminat[ion]" is one proposed option (bullet 2 above), that same bullet goes on to question, "is this what we want?" rationalizing that "kids will go on to other less safe platforms" and acknowledging they are YouTube's "future base"—a powerful motivation to minimize or ignore the problem.

As recently as February 2021, using its "Athena v3 classifier," "YouTube flag[ged] 300K accounts per week as being suspicious for underage." By this estimate YouTube scans only 0.3% of accounts daily.[549] As of 2021, Athena has allegedly "terminated over 35 million channels."[550]

[548] GOOG-3047MDL-01435767 at Slide 16
[549] GOOG-3047MDL-01342809, -2810
[550] GOOG-3047MDL-01342809, -2809

YouTube, too, recognizes the problem of "grooming" on its platform with 8% of minors claiming to have had a sexual interaction on it and 17K adult CI seeking comments removed daily (see below).



External organizations are raising alarm bells over the rising prevalence of online grooming & the enticement of minors - 1 in 7 minors are asked for nudes by strangers daily or weekly.

8% of minors claim to have had a sexual interaction on YT (10-14% on other social media platforms). Experts agree that while DM'ing is the biggest risk vector, predators can begin extorting minors through relationship building on YT before moving the conversation off platform.

- YT removes 17K adult CI-seeking cmnts daily
- 77% of CSAM on Shorts is "self-gen" & we don't know if it is innocent/solicited
- YT is expanding the ways in which creators can engage leading to increased risk (e.g., @metions, Posts, Shorts Comment Stickers)

Today we detect & remove comment-level grooming violations, but we have known detection gaps in account & convo level detection that can be exploited by bad actors.

Lastly, if we don't prioritize this, regulations like the EU CSAM bill may force us to.

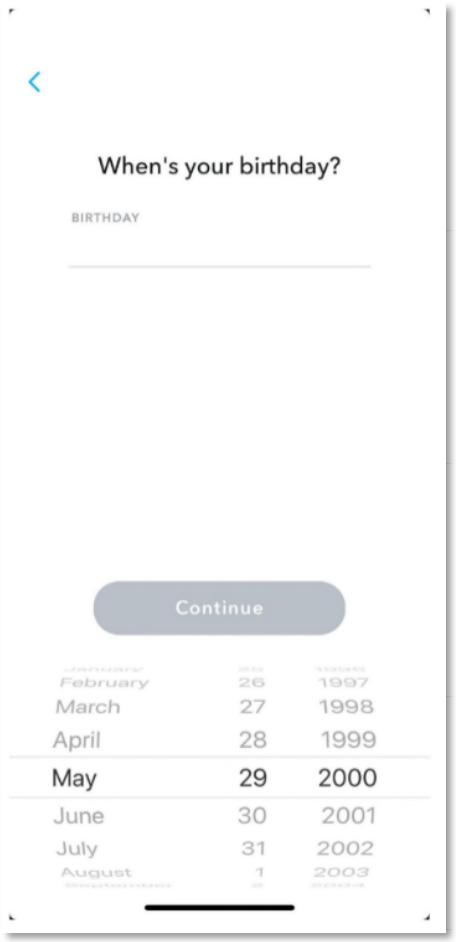
Document 192: GOOG-3047MDL-00864164 at Slide 26

The final sentence of this excerpt, which emphasizes that inappropriate interactions should be a high priority, goes on to say that failing to do so might result in increased regulation that might force them to.

iv) Snap

Snapchat's age gate is similarly lax. Until 2016, Snap did not collect birthday information from its users at all. Since then, when signing up for the app, Snapchat users have been required to enter a birthday, and if they enter a birthday under the age of 13, they are not allowed to create an account. However, since 2017, the birthday entry screen has defaulted to eighteen years before

that day's date—essentially providing children with a pre-loaded fake birthday. An example of this from May 29, 2018 is included below.[551]



Document 193: SNAP2367438, -67440

A prospective user can simply press "Continue" and be allowed to create a Snap account without ever having to affirmatively enter their birthday. Indeed, the eighteen-year-old default makes it easier to create an account and thereby increases Snap's engagement metrics, including time

[551] SNAP2367438, -67440

spent.[552] Snap trialed truly neutral age gates, where there is no pre-selected birthday, for other markets, but it has never adopted this design in the United States.[553]

Josh Siegel, a former manager at Snap, described this default as a "minor design change" but internal Snap correspondence reveals that it was anything but.[554] So many children took advantage of Snap's ready-made fake birthday that it created the appearance of a "dramatic drop" in the number of 13-17 year old users that was of "great concern" to Snap's leadership.[555]

Snap's ineffective age verification systems also mean that Snap is unable to prevent children under the age of 13 from using Snap.[556] At one point Snap tested a form of cookie that would lock new users out of the signup process if they entered an age below 13, but perversely, scrapped it because it was having too much of an effect on the number of user registrations and undercutting Snap's growth metrics.[557] And once children under 13 are on Snap, Snap will only remove them if they affirmatively identify themselves to Snap as being under 13 or if someone else reports them. In 2021, Jennifer Stout, Snap's Vice President of Global Public Policy, wrote that "we're often asked what we do proactively [to delete underage accounts] and our answer truthfully is nothing."[558]

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[552] SNAP3129214, -9214; *See also* Josh Siegel Dep. Tr. at 302:13-303:13:6-15
[553] SNAP6399042, -9042
[554] Josh Siegel Dep. Tr. at 288:20-22
[555] SNAP2367515, -7515 ("Nima foundthat our default birth year when a user signs up is 2000, which may explain a significant amount of what we're seeing."); SNAP2367438, -7438 ("I believe part ofthe problem is that default year in the registration flow is year 2000 and that's why top birthday year for us is 2000 by far.")
[556] SNAP2294924
[557] SNAP4833189, -3189 ("In the past, we've tested a session cookie that would lock out users from new sign ups
ups if they entered an age below 13. However, the impact this had on new user registrations was so significant that the product team scrapped it.")
[558] SNAP4833189, -3189

Q. Inadequate Parental Controls

Parental controls are an important tool through which parents can monitor their kids' usage of social media platforms and try to keep their kids safe. Importantly, parental controls, while important, should be complemented by increased industry safety standards. The limits of parental controls as an effective tool for safety are explained well by former Meta employee Ms. Jayakumar, who testified in her deposition: "I think parental controls are a complementary tool for child safety online. They cannot be the foundational tool. In addition to the vast impracticality of the suggestion, there is no evidence that every child has an engaged, knowledgeable parent with plenty of time to spare to monitor their child's activity. It also kind of ignores the widespread prevalence of online experiences. Most of us are online for much more of the day than we are offline, and having a parent monitor every single minute of that would essentially be more than a full-time job."[559]

Parental controls implemented by Defendants have been late in time, cumbersome, and minimally effective in their implementation.

i) Meta

Meta's top executives were put on notice about the importance of parental controls as early as February 2009. That month, Mr. Zuckerberg was sent an email from one of Meta's founding engineers, Jeff Rothschild, entitled "Let parents be parents on Facebook."[560] Mr. Rothschild wrote: "I suspect that this feature may be somewhat controversial, so to limit the distraction, I'll bounce this off the three of you first to get some feedback on whether this is worth exploring further. I would like to see us add an opt-in feature, which would allow a Facebook user (child) to designate

[559] Jayakumar Dep. 434:11-24
[560] Zuckerberg Dep. Ex. 91.

another user (the parent) to have certain auditing rights and limited controls over the child account."[561] He went on: "The dynamic that this creates is to give parents an opportunity to act as parents on Facebook as they would in other dimensions of their children's lives, shifting the primary responsibility for protecting and supervising children from Facebook to parents, which I believe is the only scalable and effective way to address the issues of minors on Facebook."[562]

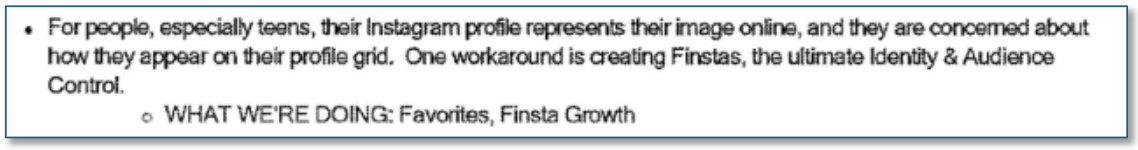
Despite this early warning, "parental controls, including tools developed for parental supervision of Teens, were first made available to users on Facebook in 2023"—fifteen years later.[563] And, despite acquiring Instagram in 2012, Meta did not make parental controls available on *that* platform until 2022, fully a decade later.[564]

While delay seems inexplicable, it makes sense when paired with documents indicating that Meta affirmatively sought to thwart parents' supervision of their children's use of its platforms—in order to ensure increased usage by young people. For example, Mr. Zuckerberg sent an email to other company executives in February 2016 discussing Facebook Live, a feature that allowed users to livestream video. After declaring his optimism for this product, he stated: "I'm worried that even if Live is a new raw format that young people enjoy, they may quickly migrate to a standalone product with a clean graph if we don't fix our graph issues for this audience. That is, they may like Live, **but still not want to live stream to their parents** and all their FB friends."[565] He then went on: "If we tell teens' parents and teachers about their live videos, that

[561] Zuckerberg Dep. Ex. 91.
[562] Zuckerberg Dep. Ex. 91.
[563] Meta's Amended Responses to Request for Admission No. 4.
[564] Meta's Amended Responses to Request for Admission No. 3.
[565] META3047MDL-014-00378779, -8779 (emphasis added)

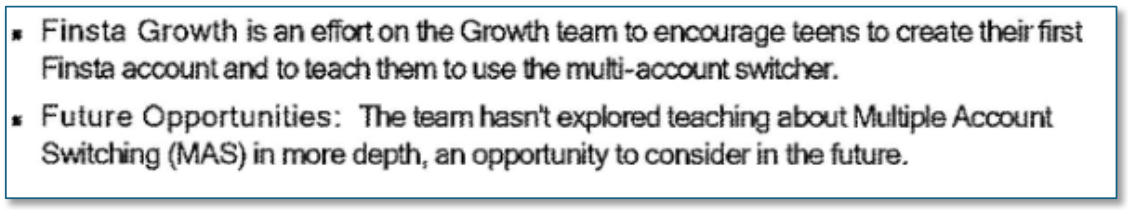
will probably ruin the product from the start."[566] Finally: "My guess is we'll need to be very good about **not notifying** parents / teachers."[567]

Parental controls also ran contrary to the objectives of Instagram's "Finsta growth team":


- For people, especially teens, their Instagram profile represents their image online, and they are concerned about how they appear on their profile grid. One workaround is creating Finstas, the ultimate Identity & Audience Control.
  - WHAT WE'RE DOING: Favorites, Finsta Growth

Document 194: META3047MDL-031-00086272, -6272

As the name "Finsta Growth" implies, Meta actively promoted usage of finstas by teenagers:


- Finsta Growth is an effort on the Growth team to encourage teens to create their first Finsta account and to teach them to use the multi-account switcher.
- Future Opportunities: The team hasn't explored teaching about Multiple Account Switching (MAS) in more depth, an opportunity to consider in the future.

Document 195: META3047MDL-031-00086272, -6274

Meta's promotion of Finstas ran counter to parental supervision, as a January 2020 memo made clear: most parents "did not become aware of teen finstas/spam accounts, until long after the teen had created it."[568] It is my opinion as a pediatrician and public health expert, that Meta's promotion of fake Instagram accounts to teenagers is akin to a liquor store getting into the fake ID business.

I have reviewed a recent interview by Mr. Zuckerberg on the Joe Rogan podcast, in which he makes the claim that, "from a values perspective, where we should be is just trying to, like, be

[566] META3047MDL-014-00378779, -8780
[567] META3047MDL-014-00378779, -8780
[568] META3047MDL-034-00078516, -8516

an ally of parents."[569] During this interview, Mr. Zuckerberg touted a suite of new parental supervision features called "Instagram Teen Accounts," which the company began rolling out in late 2024. Whether Meta's position as of 2025 is to be an ally of parents, it seems clear to me Meta did not take this approach earlier in its history, when I understand many of the children pursuing this litigation allege they were harmed.

ii) TikTok

TikTok's efforts to eliminate or mitigate the impact of harms on underage users were either insufficient or not implemented due to competing growth concerns. Despite creating tools like parental controls, the company's leadership acknowledge "we have awareness issues for multiple minor safety features, including restricted mode, parental controls, etc."[570] An internal study concluded that while users could often find information about these tools, "their paths to the correct information were often indirect [sic] which suggests that participants often expected to find information in alternative locations." The study further noted that "several items were relatively difficult for participants to find, including family paring, control who messages you and screen time management."[571]

The need for more restrictive safety features was echoed by the app's own users who reported that they "want[ed] restrictive solutions since permissive, ignorable, and unrestrictive tools are useless" to reduce harms they experienced on the platform.[572]

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[569] Joe Rogan Experience #2255 – Mark Zuckerberg, https://youtu.be/7k1ehaE0bdU (1:49:16 - 1:50:35)
[570] TIKTOK3047MDL-004-00147649, -7658; *See also* TIKTOK3047MDL-115-04366552, -6557-58 (Reporting that "teens lack awareness of our screen time management offering" with a mere 0.6% usage rate.).
[571] TIKTOK3047MDL-004-00311638, -1640.
[572] TIKTOK3047MDL-120-LARK-06208410, -8415-16.

These issues were exacerbated by TikTok's failure to prioritize these safety efforts compared to other growth-related initiatives. Its internal documents reported that while it would "need to address incentives and make tradeoffs in order to avoid common points of failure" to address user wellbeing, its efforts were being impaired by "1) the lack of cross-functional cohesion caused by no shared definition of wellbeing and unclear decision-making processes, roles and priorities, and 2) a lack of resources and visibility" that made wellbeing work "mostly one-off, reactive, and [an inconsistent] priority across teams."[573] These problems clearly persisted since as late as 2024, TikTok was relegating user wellbeing at the expense of engagement when it decided to launch "Streaks" despite "prior research on this feature on other platforms [finding] an association with anxiety, problematic overuse, and FOMO" and concluding that it "does not adhere to our current practice of promoting healthy digital habits for U18s."[574]

iii) YouTube

The history of parental controls on YouTube is confusing to say the least, and varies greatly depending on the level of parental control (device or app), the particular YouTube product (Main or Kids), and the operating system (Android or iOS). This constellation of measures would be very challenging for any parent to keep track of let alone deploy effectively.

Until 2017, there were no parental controls made available by Google or YouTube for YouTube Main. That year, Google introduced Family Link, which provided device level parental

[573] TIKTOK3047MDL-002-00077113, -7136.
[574] TIKTOK3047MDL-150-LARK-07285061, -5064; *See also* Ivan Mehta, *TikTok is Testing Snapchat-Like Streaks*, TECHDIRT (June 6, 2024), https://techcrunch.com/2024/06/06/tiktok-is-testing-snapchat-like-streaks/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAKEmu-yvF_SbcoCS5ipjNuvFSTOkk01TZX-v_C3mpK1rm4_B22dbW-UXTRFjEc0-77kDxjuR1baXCv4LDOxpNgl5C_E6Qq-NcJ5THxCkI3o8tH_338rKDUzyrwqcZWJKM-XWFaqDA-b3IWx2PguJ19juUkNXv19IKtWWWhs0TZfF.

controls for children under 13 using Android devices.[575] Parental controls via Family Link did not become available for Chromebook, and could not be used for children above the age of 13, until 2018.[576] Family Link did not allow for app-specific time limits until 2019.[577] Parental controls, via Family Link, were not available for iOS until 2018 (and the iOS version continues to suffer from reduced capabilities).[578] The ability for parents to restrict the use of particular applications, including YouTube, during school hours was not introduced to Family Link until 2024, despite internal discussions regarding app-specific time-of-day restrictions since at least 2018.[579]

YouTube did not introduce its *own* (app level) parental controls for YouTube Main until 2021 with the launch of a "supervised experience" for "tweens" under the age of 13, internally referred to as "SupeX."[580] Parental controls in SupeX are limited to: content settings, channel blocking, disabling autoplay, and the ability to disable or delete the child's search and watch history.[581] Notably, the introduction of SupeX created a loophole whereby Android and ChromeOS could bypass the SupeX onboarding process and access YouTube Main using their EDU accounts.[582] Despite YouTube's February 2021 announcement that it was introducing supervised

[575] GOOG-3047MDL-01621942, 1942-43; James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1.
[576] Helping more families set digital ground rules with Family Link, September 18, 2018, https://blog.google/technology/families/helping-more-families-set-digital-ground-rules-family-link/ (last visited April 11, 2025).
[577] The evolution of Family Link parental controls, May 7, 2019, https://blog.google/technology/families/evolution-of-family-link-parental-controls/ (last visited April 11, 2025).
[578] James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1; GOOG-3047MDL-05630293.ECM at 294.ECM; FAQ, https://families.google/familylink/faq/ (last visited April 13, 2025) ("Can children or teens be supervised by Family Link on iOS devices and web browsers?" "Children or teens signed into iOS, web browsers, or other unsupervised devices can only be partially supervised.")
[579] James Beser 30(b)(1) Dep. Vol II at, April 3, 2025, Exs. 40, 41, 42, 43, 44, 45.
[580] James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1; GOOG-3047MDL-00000280.
[581] James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1; GOOG-3047MDL-00000280.
[582] GOOG-3047MDL-01693424; *see also* James Beser 30(b)(6) Dep., April 8, 2025, Ex. 2.

experiences for "tweens ***and*** teens," YouTube did not introduce parental controls for teens until 2024.[583] Parental controls for teens are limited to reviewing channel activity and information for teen users who post content.[584]

YouTube knew that parental controls in Family Link and YouTube didn't provide parents an easy way to monitor and control their children's screen time on YouTube.[585] For instance, Family Link Screen Time controls only applied to Android and Chromebook devices, despite YouTube's knowledge that approximately 65% of U.S. users were on iOS.[586] Similarly, Family Link accounts and enforcement of YouTube app settings was limited to signed-in users on Android and ChromeOS devices.[587] Therefore, children accessing YouTube in a logged-out state (i.e. not signed into an account) on iOS could "circumvent policy restrictions and parental controls."[588] And, of course, YouTube knew that child users could also input a false age, which would similarly allow them to view anything an adult accessing YouTube in this way could view. [589]

It wasn't until 2022 that concerns about regulation and competition caused YouTube to reevaluate its "inadequate" offerings, acknowledging that parents could not "access their child's screen time controls" in YouTube.[590] This included SupeX.[591]

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[583] *Compare* GOOG-3047MDL-00000280 *with* James Beser 30(b)(6) Dep., April 8, 2025, Exs. 1, 4.
[584] James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1.
[585] GOOG-3047MDL-05214601, -4601.
[586] GOOG-3047MDL-05214601, -4601.
[587] James Beser 30(b)(6) Dep., April 8, 2025, Ex. 1.
[588] GOOG-3047MDL-05630293.ECM at 294.ECM.
[589] Woojin Kim Dep. March 11, 2025, 229:22-230:32 (Kim testified that he was not aware of an age being assigned to a YouTube user accessing YouTube Main in a logged-out state); Matt Halprin Dep., February 22, 2025 169:5-25 (Matt Halprin was aware from discussions at meetings at YouTube that people were not honest about their ages when creating an account); James Beser Dep., April 3, 2025, 491:23-492:1 ("So YouTube signed out is very easy to access, and it's very likely that some of those users are under 13.").
[590] GOOG-3047MDL-05214601, -4604.
[591] GOOG-3047MDL-05214601, -4604; GOOG-3047MDL-01195859.

Parental controls on YouTube Kids have taken a different, though equally circuitous and incomplete path. YouTube Kids launched on February 23, 2015, but parents were not given the ability to block channels on YouTube Kids until the following year.[592] Two years later, in September 2018, parental controls were "added to the YouTube Kids app – allowing parents to handpick videos and channels in the app."[593] However, at this point, members of the YouTube Parent Panel had been "encouraging the YouTube Kids team to put more control in the hands of parents" for nearly the entire time YouTube Kids had been in existence.[594]

YouTube did not allow parental control of the Autoplay feature in YouTube Kids until 2021 when it was defaulted to "off" and parents given the option to deploy it.[595] Prior iterations of YouTube Kids did not include an Autoplay toggle option.[596] The rationale for not putting this decision in parents' hands for over six years was that if a parent wanted a child to "watch 15 minutes of YouTube, but then every two minutes…had to go and play the next movie for them, then that would not be the experience that parents wanted."[597] However, this meant that, if a child's guardian did not set a timer on YouTube Kids, videos would continue to play forever without intervention.[598]

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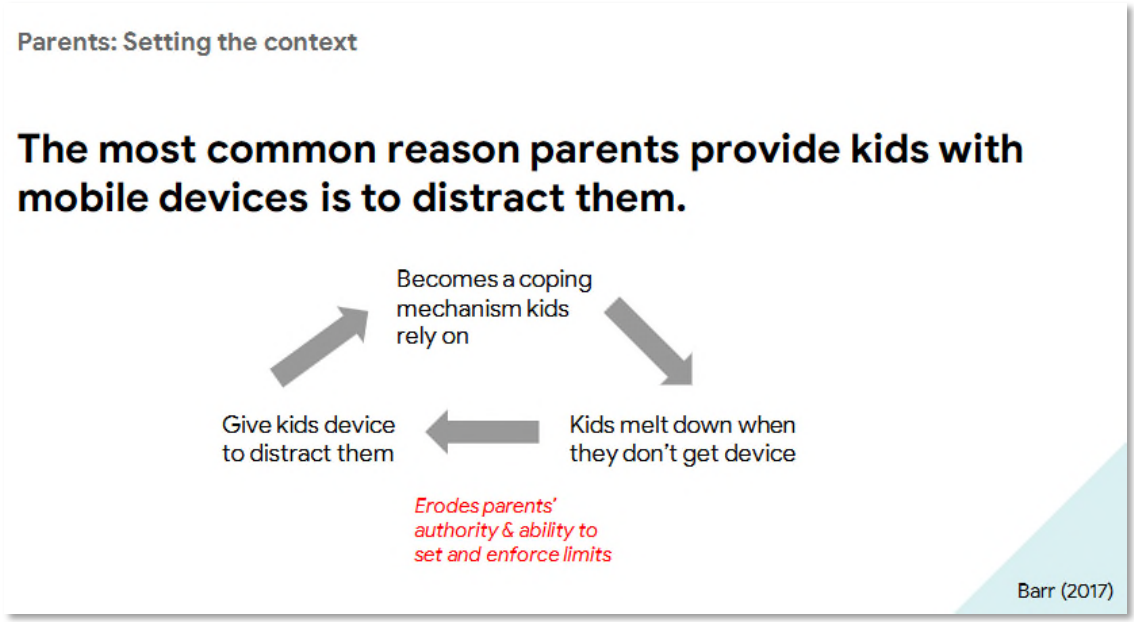
[592] History of YouTube's Responsibility Efforts. www.youtube.com/howyoutubeworks/progress-impact/timelines (Retrieved April 26, 2024); GOOG-3047MDL-00000048; *see* GOOG-3047MDL-01625570, -5570 (There was concern, at launch, that "[p]arental controls security in the app was very weak" and something kids could "easily work around"; however, the suggested response to this concern was simply to state that YouTube would listen to user feedback and continue to improve the experience).
[593] GOOG-3047MDL-00000922, -0928
[594] GOOG-3047MDL-00080597, -0599.
[595] GOOG-3047MDL-04922012, p. 14.
[596] GOOG-3047MDL-04922012, p. 14.
[597] Shimrit Ben Yair Dep., March 20, 2025, 91:5-12.
[598] Shimrit Ben Yair Dep., March 20, 2025, 93:17-21 (Videos would continue to play "[f]or as long as the parent allowed their kids to use the product.")

Years before YouTube granted parents the ability to control the Autoplay feature on YouTube Kids, internal documents acknowledged a study concluding the "most common reason parents provide kids with mobile devices is to distract them" and depicting the resulting cycle in which kids relied on this distraction as a coping mechanism and melted down when not given the device, ultimately eroding "parents authority [and] ability to set and enforce limits[.]" [599]



Document 196: GOOG-3047MDL-00408442 at Slide 15

Other internal documents evidence findings that "young kids are often the ones holding the tablet" and a preference by parents and children for larger screens.[600] In contrast, Shimrit Ben Yair, Product Manager Lead for YouTube Kids at its inception, testified that YouTube Kids was slated to begin on tablet devices because they "heard from parents that…iPads and tablets is typically

[599] GOOG-3047MDL-00408442 at Slide 15.
[600] Shimrit Ben Yair Dep., March 20, 2025, Ex. 12 at Slide 43; *see also* Ben Yair Ex. 12 at Slide 6 ("TV is still THE 'device' most often used by kids [5-7 years old]" and Slide 19 ("Some parents prefer TV because: - Kids have better posture and sit further from the device – It's easier to monitor")

where they watch content as a family."[601] When asked whether this research regarding families gathered around tablets to watch video were provided to her in written form, Ben Yair cited her "own experience as a parent" as the guiding force for making YouTube Kids available on tablets first, ahead of other devices.[602] Eighteen months after its launch, YouTube Kids remained a smartphone and tablet only product, touted in advertising-related materials as "optimized for tablets."[603]

iv) Snap

Snap's only parental controls are a feature called "Family Center." Family Center was only implemented in August, 2022, making Snap among the last of Defendants to implement parental controls.[604] Furthermore, the controls that Snap implemented through Family Center were extremely limited and barely used. The initial version of Family Center only permitted parents to view kids' friends and recent conversations, without the ability to limit use or control account settings. Other designs considered would have allowed greater visibility into account settings and allowed parents to actually change kids' settings, but that capability was removed at the direction of Snap's CEO, Evan Speigel.

[601] Shimrit Ben Yair Dep., March 20, 2025, 76:16-24.
[602] Shimrit Ben Yair Dep., March 20, 2025, 106:3-21.
[603] Shimrit Ben Yair Dep., March 20, 2025, 131:14-132:13; *see* Ben Yair Dep Ex. 14 at Slide 24.
[604] SNAP0017949

Document 197: SNAP2619258, -9264

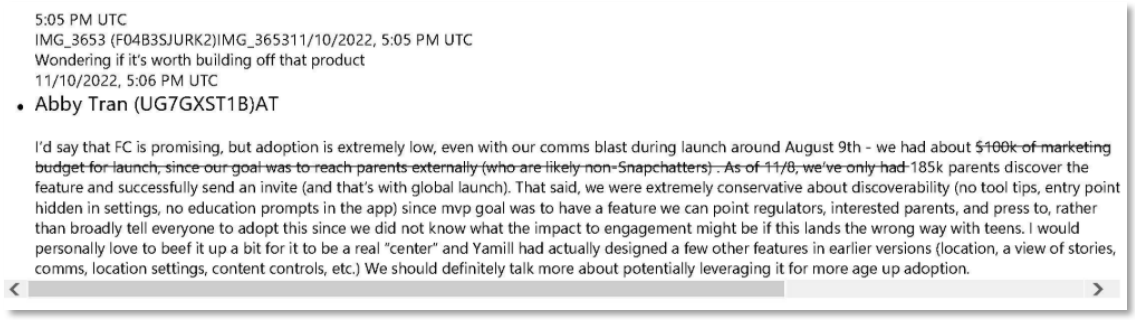
While additional features were added to Family Center in 2023, allowing parents to see more parts of users' profiles, Family Center still does not allow parents to actually place guardrails on their children's use of Snapchat.

Additionally, the number of families actually using Family Center is miniscule. Ten months after it launched, only 0.33% of kids actually used Family Center.[605] Perhaps driving this very low adoption of Family Cener is the fact that it's only available when a child's reported age is under 18.[606] But Snap is not only aware that a significant number of children lie about their age and say that they are older in order to get on Snap, it actively facilitates that lying by making the default age at sign-up 18—a default that makes users ineligible for Family Center.[607] Snap doubles

[605] SNAP0017949, -7952
[606] SNAP0010984, -0985, *Why Can't I Access Family Center*, SNAP, located at https://help.snapchat.com/hc/en-us/articles/8132746171796-Why-can-t-I-access-Family-Center#:~:text=And%20as%20a%20reminder%2C%20it's,to%20accept%20Family%20Center%20invites (last accessed Apr. 14, 2025).
[607] SNAP0010984, 0984, *Why Can't I Access Family Center*, SNAP, located at https://help.snapchat.com/hc/en-us/articles/8132746171796-Why-can-t-I-access-Family-Center#:~:text=And%20as%20a%20reminder%2C%20it's,to%20accept%20Family%20Center%20invites (last accessed Apr. 14, 2025).

down on this policy by not notifying parents if the reason their Family Center request has been rejected is that their child's reported age is over 18. As a Snap employee pointed out in 2022, this creates the impression that Snap is "prioritizing a users right to essentially falsify their age (something we ostensibly don't support) over a parent's ability to utilize the Family Center functionality."[608]

Overall, as Abby Tran, the Snap product manager responsible for launching Family Center, wrote in 2022, "if we are asking the question of 'does this feature give parents everything they need to improve safety for their teen' - obviously not."[609] In internal communications, Tran was forthright about the fact that this limited utility was by design. The point of Family Center was to provide just enough features to create a public talking point, without actually doing anything that might affect kids' use of Snap. Snap's image, not children's safety, was paramount.


5:05 PM UTC
IMG_3653 (F04B3SJURK2)IMG_365311/10/2022, 5:05 PM UTC
Wondering if it's worth building off that product
11/10/2022, 5:06 PM UTC

- Abby Tran (UG7GXST1B)AT

I'd say that FC is promising, but adoption is extremely low, even with our comms blast during launch around August 9th - we had about ~~$100k of marketing budget for launch, since our goal was to reach parents externally (who are likely non-Snapchatters) . As of 11/8, we've only had~~ 185k parents discover the feature and successfully send an invite (and that's with global launch). That said, we were extremely conservative about discoverability (no tool tips, entry point hidden in settings, no education prompts in the app) since mvp goal was to have a feature we can point regulators, interested parents, and press to, rather than broadly tell everyone to adopt this since we did not know what the impact to engagement might be if this lands the wrong way with teens. I would personally love to beef it up a bit for it to be a real "center" and Yamill had actually designed a few other features in earlier versions (location, a view of stories, comms, location settings, content controls, etc.) We should definitely talk more about potentially leveraging it for more age up adoption.

Document 198: SNAP1186209, -6211

v) Exogenous Parental Controls Efforts

Teen's desire for autonomy coupled with their emerging curiosity about "adult" content makes restricting their access to digital spaces challenging. As discussed above, extant parental control features of social media platforms demonstrate minimal uptake in large part because of

[608] SNAP0010984, -0984
[609] SNAP1837692, -0984

design features that make them cumbersome or hard to understand. Given the shortcomings in the parental controls made available by Defendants themselves, and in light of the fact that the vast majority of US parents have concerns about their pre-teen and teenagers' screen use,[610] experts (including myself) generally recommend providing additional, effective parental controls to mitigate the risks to children and teenagers.

I define "exogenous" filters as those that are not app specific and commercially available as third-party, stand-alone solutions for parents to deploy whereas "endogenous" filters are ones that apps deploy or make available for parents. Endogenous filters and their limitations are discussed in the immediately preceding sections. As for exogenous ones, a SmithMicro random digit dial survey of 2000 US parents of children 5-18 years of age revealed that 90% of parents use digital parenting technology to manage their children's internet activity and 86% of parents report they have regular talks with their children about online safety.[611]

In spite of parents' efforts, teens have proven adept at using a variety of techniques to bypass common controls, including VPNs to redirect web traffic, incognito or private browsing windows, altering device or app time settings, or creating "fake" accounts altogether to evade detection or monitoring (e.g. finstas discussed in Section XI.C.(i) above). Almost ½ (45%) of parents reported that their child had attempted to disable or bypass parental controls.[612] That percentage is especially worrisome given the ease with which children can disable many existing SM controls. A 2015 study of over 15,000 parents found filters to be essentially of no utility in

[610] *META3047MDL-020-00350013*
[611] Software S. *Understanding Digital Parenting*. 2021. https://info.smithmicro.com/hubfs/Surveys/eBook_Smith-Micro-Digital-Parenting-Survey.pdf?hsLang=en-us
[612] Przybylski AK, Nash V. Internet Filtering and Adolescent Exposure to Online Sexual Material. *Cyberpsychology, Behavior, and Social Networking*. 2018/07/01 2018;21(7):405-410. doi:10.1089/cyber.2017.0466

screening content.[2] Further, a systematic review of 40 studies examining the effectiveness of existing digital technologies to moderate children's screen use showed minimal to no effect.[613]

One major limitation of exogenous filters is their imprecision in identifying inappropriate content within apps themselves. These tools are primarily designed to block access to entire websites (e.g., pornographic sites) or prevent the installation of or limit access to specific apps. However, they offer minimal—if any—visibility into what teens are actually exposed to inside those platforms, such as sexually explicit direct messages, grooming attempts, inappropriate images, or sextortion schemes. This is why platform-level controls, starting with reliable and enforceable age verification mechanisms, are so critical to teen safety.

In conclusion, while parents play a vital role in monitoring and guiding their children's use of digital technology, tech companies have an essential—and in many cases, indispensable—responsibility to support these efforts. This is especially true for parents who lack the technical know-how or financial means to access and manage third-party software solutions effectively.

R. Other safety features

A review of Defendants' documents demonstrates multiple missed opportunities to deploy effective safety features. For example, self-limiting tools, such as Meta's "Take a Break" feature, were tested to ensure they did not reduce engagement too much. Likewise, failure to provide parents and teenagers the ability to select default limits on the length and frequency of sessions, or to block time of usage during the day, such as nighttime or school facilitated over usage. As discussed above, distracted learning and disrupted sleep are particularly harmful for developing adolescents. In my opinion, based upon my clinical experience, medical training, and the academic

[613] Stoilova M, Monica B, and Livingstone S. Do parental control tools fulfil family expectations for child protection? A rapid evidence review of the contexts and outcomes of use. *Journal of Children and Media*. 2024/01/02 2024;18(1):29-49. doi:10.1080/17482798.2023.2265512

literature, tools that help reduce time on the apps will decrease the risk of harm. This is particularly true for any tool that decreases usage of social media platforms during the school day or at nighttime.

i) Lack of default limits on the length and frequency of sessions

The absence of default time limitations on these social media platforms creates an environment where pre-teens and teens, whose prefrontal cortex and self-regulatory capacities are still developing, can engage in prolonged and frequent usage patterns that significantly increase their vulnerability to addiction-like behaviors and associated mental health harms. Without built-in constraints, these platforms effectively rely on the external regulation that children and teens have not fully developed. It's analogous to expecting the proverbial kid set loose in a candy shop to volitionally limit what they eat. It is an unreasonable and ineffective expectation.

ii) Defective opt-in restrictions to the length and frequency of sessions, FTW

To the extent they exist, current opt-in restriction models for social media usage represent a fundamentally flawed approach to protecting vulnerable pre-teens and teens. By defaulting to unlimited engagement and requiring active self-limitation, platforms effectively place the burden of protection on the very individuals whose developmental stage makes them least equipped to exercise such judgment. Unlike other products with known risks to developing minds, these platforms provide minimal transparent communication about potential psychological harms, leaving adolescents and their caregivers inadequately informed about documented risks. The defective nature of opt-in time restrictions becomes evident when examined through a developmental lens. These mechanisms incorrectly assume teens and pre-teens possess the same risk assessment capabilities and impulse control as fully developed adults. This misalignment between platform safety design and neurobiological reality disproportionately impacts teens and

pre-teens. Platforms deliberately selected opt in (vs opt out) because they knew uptake would be less and the overall impact on the number of daily average users and time online would be minimally impacted.

iii) Defective self-limiting tools

Inadequate self-limiting tools on social media platforms represents a critical failure point in protecting adolescent mental health. When these tools are difficult to access, unintuitive to operate, or inconsistently implemented across features, they fail to provide the protection necessary for developing minds—contributing to increased anxiety, depression, and diminished psychological well-being. From a clinical perspective, the defective nature of existing self-limiting mechanisms directly undermines pre-teens and teens developing capacity for healthy self-regulation. These poorly designed tools create a false sense of protection while simultaneously exposing teens and pre-teens to algorithmic engagement strategies engineered to override impulse control, thereby exacerbating vulnerability to mental health harms, including compulsive usage patterns. The current implementation of self-limiting features on major social media platforms demonstrates a concerning disregard for developmental science. By designing ostensible protective measures that are easily circumvented, frequently reset, or buried within complex settings menus, platforms effectively nullify their utility for the population most in need of protection—contributing to documented increases in social comparison, sleep disruption, and attention difficulties among adolescent users.

iv) No blocks to usage during certain times of day

The absence of default time-of-day restrictions on social media platforms creates significant vulnerability during critical developmental periods. Without automated evening limitations, adolescents—who already experience biologically-driven delayed sleep onset—

frequently engage with stimulating content during pre-sleep hours, potentially disrupting circadian rhythms and reducing both sleep quality and quantity, which research has consistently linked to compromised emotional regulation, cognitive performance, and mood stability. From an educational perspective, the unrestricted availability of social media during school hours and designated study periods represents a substantial barrier to academic engagement and cognitive development. The constant accessibility of highly stimulating, dopamine-rewarding content creates an attention competition that developing brains are neurobiologically disadvantaged to resist, potentially contributing to documented decreases in sustained attention, comprehension, and academic performance.

Without time-specific usage limitations, platforms effectively undermine parental and educational boundary-setting efforts, creating digital environments that can disrupt essential activities including family interactions, academic engagement, and the consolidated sleep necessary for optimal psychological functioning.

v) Defective barriers to deactivation/deletion of accounts

The implementation of complex, multi-step account deactivation and deletion processes creates significant obstacles for adolescents attempting to disengage from potentially harmful social media use. These convoluted exit pathways exploit developing executive function capabilities, potentially prolonging exposure to platforms that clinical evidence suggests may be contributing to psychological distress for vulnerable pre-teens and teens. From a developmental perspective, the deployment of emotional tactics during account deletion attempts—including messages about friends who will 'miss' the user—exploits adolescents' heightened sensitivity to social evaluation.

By designing systems that capitalize on pre-teens and teens' powerful biological desire to "fit in," platforms effectively undermine genuine attempts at self-regulation, potentially extending exposure to psychological harms including social comparison, anxiety, and addiction-like usage patterns. The implementation of easy entry paired with high-friction exit disproportionately impacts developing users. This imbalance effectively traps adolescents in digital environments increasingly associated with negative mental health outcomes while simultaneously undermining their developing sense of digital autonomy and self-efficacy.

In that regard, limits on length and frequency of social media sessions, blocks on usage during critical hours of the day, and making it easier for children and parents to delete and deactivate accounts would help reduce harm to children. It is incumbent upon the social media companies to make these safety features default; requiring children or their parents to identify and maneuver a complicated "opt-in" process will decrease the number of adolescents who use these safety features. Former Meta employee Volichenko recognized this phenomenon at his deposition when he testified that opt-in features are implemented by fewer users than opt-out features.[614] Mr. Zuckerberg said the same thing.[615]

There are some examples of Defendants offering such tools, albeit in a fashion that prioritized continued engagement over real reduction in harm. For example, Meta noted in the "Teen Mental Health Deep Dive" that teens found time spent tools "easy to ignore."[616]

TikTok was no different. TikTok also introduced screen time management tools, as noted below:

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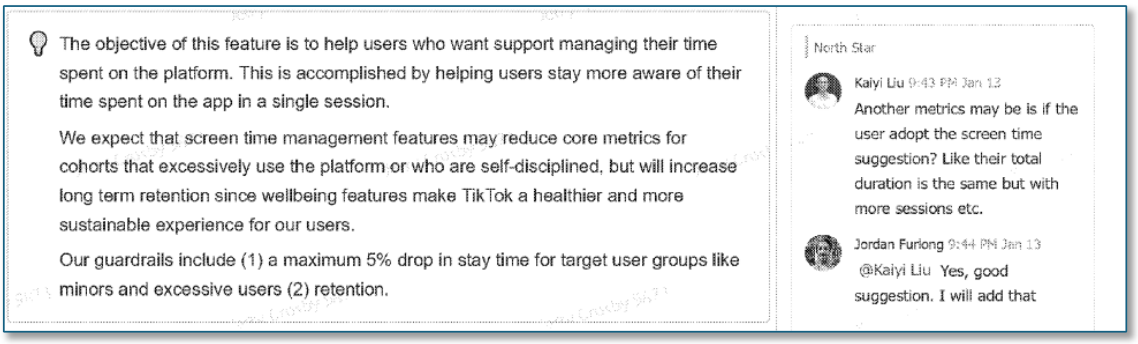
[614] Volichenko Dep. 106:6-107:1237.
[615] Zuckerberg Dep. 237:21-23 ("Stats show us that most people just use whatever the default setting or filter is").
[616] Gross Dep. Ex. 12 at -1773.



Document 199: TIKTOK3047MDL-001-00060515, -0520

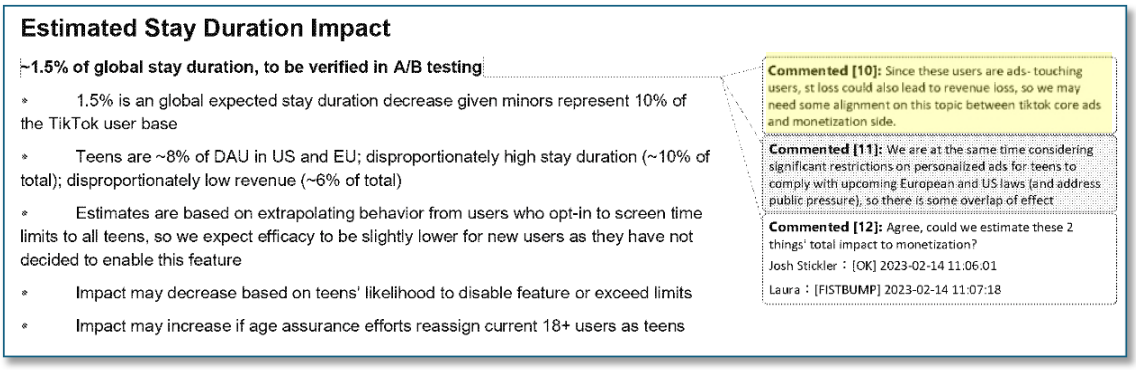
However, even as they introduced what was deemed a "safety" feature, the communication here (and elsewhere) references "guard rails" related to a potential reduction in the amount of time spent and the overall retention of users. The term "guard rails" in this context is a bit ironic. One normally associates them with safety features on highways that are erected to prevent drivers from going off a cliff or crossing a lane into oncoming traffic: money spent to reduce risk to lives. At TikTok they are intended to preserve revenue: lives put at risk to make money.

As it turns, out, uptake of the initial screen time management system was exceedingly poor (0.29%) although the percentage of TikTok's users who said they would use them was high (20-43%) leading TikTok to explore building out their offerings to make them more appealing.[617] True to form, those changes were subjected to A/B testing prior to being introduced with the following "guardrails" set:

[617] *TIKTOK3047MDL-001-00060515,* -0518

Guardrail	Observe potential trade-offs and impacts	StayDuration/U	Fluctuate
		Last 30-day ActiveDays/U	Fluctuate
		Publish/U	No effect
		Average session duration from 10pm-6am	Small decrease
		App uninstall rate	Small decrease

Document 200: TIKTOK3047MDL-001-00060515, -0520



Estimated Stay Duration Impact

~1.5% of global stay duration, to be verified in A/B testing

- 1.5% is an global expected stay duration decrease given minors represent 10% of the TikTok user base
- Teens are ~8% of DAU in US and EU; disproportionately high stay duration (~10% of total); disproportionately low revenue (~6% of total)
- Estimates are based on extrapolating behavior from users who opt-in to screen time limits to all teens, so we expect efficacy to be slightly lower for new users as they have not decided to enable this feature
- Impact may decrease based on teens' likelihood to disable feature or exceed limits
- Impact may increase if age assurance efforts reassign current 18+ users as teens

Commented [10]: Since these users are ads- touching users, st loss could also lead to revenue loss, so we may need some alignment on this topic between tiktok core ads and monetization side.

Commented [11]: We are at the same time considering significant restrictions on personalized ads for teens to comply with upcoming European and US laws (and address public pressure), so there is some overlap of effect

Commented [12]: Agree, could we estimate these 2 things' total impact to monetization?

Josh Stickler：[OK] 2023-02-14 11:06:01

Laura：[FISTBUMP] 2023-02-14 11:07:18

Document 201: TIKTOK3047MDL-010-00329585, -9596 (emphasis added)

Comment 10 above (yellow highlighting added) immediately cites the need for alignment with the "monetization" side since these are "ad-touching users."

The results of the A/B testing regression analysis indicated that the revamped Screen Time Management tools are estimated to reduce the daily average stay for minors by about 10 minutes on weekdays and 15 minutes on weekends which immediately begs the question "if that effect size is "acceptable."[618] It is honestly unclear in this context if acceptable means big enough or too big.

[618] TIKTOK3047MDL-004-00151111, -1111

Even after the initial testing was completed, the plan was to run a "holdout test to measure the effect that Screen Time Management features have on long term retention."[619]

Tik Tok's internal assessment of the uptake of all of their control features reveals just how ineffective they all are.

Feature	DAU / Penetration	Problems to Address
Screen Time Management	1.6m / .29%	1. Revamp change pin code/forget pin code process (Jordan doing in 7-8 bimonth) 2. There is little transparency into how much time users spend on the platform and therefore how they should self-regulate usage 3. Restrictions are not enforced on all platforms. Need to sync on uid level instead of uid+did (Jordan doing in 7-8 bimonth) 4. People don't know about this feature
Restricted Mode	600k / .11%	1. Restricted Mode controls for inappropriate content based on Risk labels, Warning Tags, and three rounds of moderation, but not labeling for specific age appropriateness. (Lufan working on this) 2. Content filtering only applies to FYP. Users can still search for and follow links that are shared to content that would be filtered out of the FYP by Restricted Mode 3. Content filtering is not enforced on all platforms, so users of Restricted Mode can continue to see unrestricted content 4. People don't know about this feature
Family Pairing	180k (parent) 278k (teen) / .08% (total)	1. Families do not use Family Pairing. Based on user research, it appears that a lack of awareness may be suppressing usage and perception. 2. Family Pairing doesn't address parents' top concerns like inappropriate content, offensive interactions, and lack of privacy 3. Teen users can disable Family Pairing without PIN, so it's less restrictive than activating either Restricted Mode or Screen Time Management individually.

Document 202: TIKTOK3047MDL-006-00325873, -5885

Daily active user penetration ranged from 0.08% to 0.29%. From a developmental perspective, relying on teens as young as 13 to self-regulate their usage, or "opt in" to more controls runs counter to what every pediatrician, psychologist, neuroscientist or even parent

[619] TIKTOK3047MDL-001-00060515, -0526

knows. They lack the foresight, the discipline, the cognitive capacity, to exert self-control like adults do (recall the brain development reviewed above). As Lee's presentation to Facebook leaders from 2020 states, "Teens don't think deeply about safety risks until something bad happens."[620]

In summary, SM platforms simultaneously created and deployed sophisticated engagement mechanisms and rudimentary, often tokenistic self-limiting features. This unbalanced digital environment for developing minds is exceedingly and unnecessarily hazardous especially for some children.

XIII. Conclusion

As a leading expert on the effects of digital media on children—with more than 25 years of experience as a pediatrician, researcher, public health scientist, chief science officer, and journal editor—it is my considered judgment that social media platforms are both contributing to and intensifying harm in millions of children in the United States and globally. Specifically, they are partially responsible for the alarming rise in depression, anxiety, sleep disturbances, body dysmorphia, eating disorders, suicide and self-harm, and school-related difficulties. These effects are widespread, though not evenly distributed. Certain subgroups—those already vulnerable—are disproportionately affected. Tragically, social media algorithms have amplified this inequity, often identifying and targeting children based on their susceptibility. As a result, children who engage with harmful content—knowingly or not—are frequently shown more of it, due to platform design elements operating without their or their parents' knowledge or consent.

It is no surprise—at least not to me—that platforms engineered by some of the brightest computer scientists and behavioral experts in the world, under business models focused on

[620] Alison Lee Deposition Exhibit 4 at Slide 12

maximizing user engagement, have proven especially addictive to young users. While some external experts dispute the conclusiveness of the research, in my view—and in that of many scientists in the field—the available evidence, combined with well-established psychological theory, supports a causal link between social media use and adverse outcomes in youth. Critics often highlight that many studies are cross-sectional and that effect sizes are modest. Both points are true. Yet there is also a growing body of longitudinal and experimental research demonstrating harm. Moreover, the principle of differential susceptibility tells us that population averages obscure significant impacts on the most vulnerable—and even small effect sizes, when applied at scale, translate into harm for millions of children.

Despite this, the pace of scientific discovery has been slowed—deliberately so—by social media companies' refusal to cooperate with independent researchers. Their own internal documents and analyses, many now public, acknowledge the harms their platforms pose to children. Yet time and again, they have failed to act in the best interest of their youngest users. Instead, they have rolled out superficial safety features and minor algorithmic tweaks, often admitted to be more about public relations positionings than meaningful protection. Even the most basic tools, such as parental controls, have been poorly designed and implemented, resulting in minimal uptake and no attempts to rectify them. Engaging children and adolescents was not a side effect—it was a growth strategy, pursued aggressively and competitively across the industry.

In sum, these platforms were consciously and systematically engineered to maximize engagement and growth—at the direct expense of children's well-being.

Exhibit A

CURRICULUM VITAE

Dimitri A. Christakis, MD, MPH

1. CONTACT INFORMATION

Dimitri A. Christakis, MD, MPH
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Seattle Children's Research Institute, Center for Child Health, Behavior and Development
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Seattle, WA 98121
206-884-8237
dachris@u.washington.edu

2. PERSONAL DATA

Place of Birth: New Haven, Connecticut, USA

3. EDUCATION

1982-1986	BA, English Literature, *cum laude,* Yale University; New Haven, CT
1988-1993	MD, University of Pennsylvania, School of Medicine: Philadelphia, PA
1996-1998	MPH, University of Washington, School of Public Health; Seattle, WA

4. POSTGRADUATE TRAINING

1993-1996	Resident, Pediatrics, University of Washington/Seattle Children's Hospital; Seattle, WA
1996-1998	Fellow, Pediatric, Robert Wood Johnson Clinical Scholars Program, University of Washington; Seattle, WA

5. FACULTY POSITIONS HELD

1996-1998	Acting Instructor, Department of Pediatrics, University of Washington; Seattle, WA
1998-1999	Acting Assistant Professor, Department of Pediatrics, University of Washington; Seattle, WA
2000-2003	Adjunct Assistant Professor, Department of Health Services, School of Public Health, University of Washington; Seattle, WA
2000-2003	Assistant Professor, Department of Pediatrics, University of Washington; Seattle, WA
2003-2006	Associate Director, Robert Wood Johnson Clinical Scholars Program
2003-2007	Adjunct Associate Professor, Department of Health Services, School of Public Health, University of Washington; Seattle, WA
2003-2007	Associate Professor, Department of Pediatrics, University of Washington; Seattle, WA
2003-2007	Director, Child Health Institute, Associate Professor, Department of Pediatrics, University of Washington; Seattle, WA

2007-Present	Adjunct Professor, Department of Health Services, School of Public Health, University of Washington; Seattle, WA
2007-Present	Professor, Department of Pediatrics, University of Washington; Seattle, WA
2007-Present	Director, Center for Child Health, Behavior and Development, Seattle Children's Research Institute; Seattle, WA
2008-Present	George Adkins Professor of Pediatrics University of Washington
2013-Present	Adjunct Professor, Department of Psychiatry, University of Washington; Seattle, WA

6. HOSPITAL POSITIONS HELD

1998-present	Attending Physician Pediatrics, University of Washington, Seattle Children's Hospital; Seattle, WA

7. HONORS

1986	Graduated with distinction in major field of study, Yale University
1986	Cum Laude, Yale University
1992	Nicholas Padis Memorial Prize for graduate academic excellence, University of Pennsylvania
2010	Academic Pediatric Association, Research Award for Lifetime Contribution
2018	Elected Member Washington State Academy of Sciences

8. BOARD CERTIFICATION

1994-present	Diplomate, American Board of Pediatrics, (MOC cycle
1994-present	Diplomate, National Board of Medical Examiners, Number 412061

9. CURRENT STATE LICENSE

1993-Present	State of Washington Medical License: Number MD00032924

10. PROFESSIONAL ORGANIZATIONS

1993-present	American Academy of Pediatrics
1995-present	Ambulatory Pediatrics Association
2002-2015	Society for Pediatric Research
2006-2015	American Pediatric Society

11. EDITORIAL RESPONSIBILITIES

1999-2000	Editorial Board, Effective Clinical Practice
2000-2015	Associate Editor, Archives of Pediatrics and Adolescent Medicine
2015-2018	Associate Editor, JAMA Pediatrics
2018-present	Editor in Chief, JAMA Pediatrics

12. SPECIAL NATIONAL RESPONSIBILITIES

1999-2002	Editorial board, Effective Clinical Practice
2000-2018	Associate Editor, Archives of Pediatrics and Adolescent Medicine
2001-2004	Associate Member, American Board of Pediatrics
2004-2017	Member, American Board of Pediatrics
2006-2008	Member NHLBI expert panel on Cardiovascular Disease Guidelines
2004-2010	Member HSOD study section
2008-2014	Member AAP Executive Committee on Children and Media
2014-present	Advisory Board, Children and Screens: Institute for Digital Media
2017-present	Member, National Academy of Medicine Board of Children, Youth, & Families
2018-present	Editor in Chief, *JAMA Pediatrics*

13. SPECIAL LOCAL RESPONSIBILITIES

1994-1998	Member, Children's Hospital Ethics Committee
200-2008	Director, Child Health Institute, University of Washington

14. RESEARCH FUNDING

Active Funding

1R01MH115913-01 04/01/2018 – 03/31/2023
NIH/NIMH annual direct costs: $469,434
Complex versus Essential Autism: A Developmental Study of Risk
This is a prospective, longitudinal study that tracks very low birthweight (VLBW, n=100) infants, high-risk infant siblings of children with ASD (HR-Sibs, n=100), and low-risk typically developing children (LR, n=100), from 6- to 36-months of age in order to understand how different risk factors for autism spectrum disorders (ASD) unfold over early development.
Role: Co-Investigator

5R21CA218592-02 08/01/2017 – 07/31/2020
NIH/NCI annual direct costs: $144,602
Preschoolers Learning & Active in Play (PLAY)
We propose research that uses wearable technology to monitor physical activity in children and motivate parents and educators to help create those active play opportunities, particularly for children from more vulnerable backgrounds who suffer from disparities in both health and educational outcomes.
Role: Co-Investigator

1R61AT009859-01A1 09/01/2018-03/31/2023
NIH/NCCIH annual direct costs: $308,401
Mind-Body Interventions to Mitigate Effects of Media Use on Sleep in Early Adolescents
Eliminating media use is neither feasible at a public health level nor perhaps even desirable given the role it plays in the lives of youth and adults, but mind-body interventions have the potential to mitigate state arousal effects and thus reduce negative impacts on sleep. Given emerging literature on links between intensive media use, sensory and interoceptive awareness, and self-regulation, we

propose to study two related mind-body approaches: mindfulness sensory awareness exercises to increase sensory and interoceptive awareness, and mindful body awareness check-ins to guide media use choices. In order to optimize this approach, we will examine the effects of these mind-body strategies independently, jointly, and in combination with other strategies to mitigate the effects of media use on sleep, including amber glasses to block short wavelength light during evening media use, avoiding content with high vigilance demands or violence, and external controls to time-out media access.
Role: Co-Investigator

20038913 CDRN-1306-0556 10/15/2015-9/30/2020
PCORI annual direct costs: $155,015
PEDSNet: A National Pediatric Learning Health System (Phase 3)155015
The main goal of this second phase of the PEDSnet project is to test and strengthen the infrastructure of PEDSnet with several research projects and PEDSnet-PPRN collaborations.
Role: Site PI

1R21HD099300-01A1 04/01/2020-03/31/2022
NIH/NICHD annual direct costs: $125,000
Attentional attributes of early child media usage
We propose to look at joint attention and cardiophyiological response to tablet based media use in toddlers. Role: Principal Investigator

Pending Funding

1R21HD103880-01 09/01/2020 – 08/31/2022
NIH annual direct costs: $125,000
Developing a shared decision making supplement to the family media plan/ Engaging adolescents in planning and implementation of limits on screen-based media use
We will use a participant engaged approach to create a shared decision making supplement to the Family Media Plan that elevates the voice of adolescents. We will then conduct a pilot evaluation to understand how it is impacting family media use planning, and to provide the foundation for a future fully powered longitudinal study to evaluate its impact on health behaviors including screen use.

Completed Funding

1991-1993
National Research Service Award/Measey Foundation Grant $14,500
PTSD in long term Cancer Survivors
Role: PI

1998-1999
University of Washington Royalty Research Fund $40,000
Continuity of care in children
Role: Co-PI

1998-2001
Packard Family Foundation $750,000

Pediatric Evidence based Medicine
Role: Co-PI

1999-2003
RWJ Generalist Faculty Award $237,000
Continuity of Care and Health Outcomes in Children
Role: PI

R01 2000-2003
Agency for Health Care Research and Quality $920,264
Getting Evidence to the Point of Care
Role: Co-PI

2001-2004
Nesholm Family Foundation $150,000
Infrastructure support for the Child Health Institute
Role: PI

R01 2001-2004
National Heart Lung and Blood Institute $920,000
Quality of Care for Children with Complex Chronic Disease
Role: Co-PI

R01 2001-2004
Agency for Health Care Research and Quality $1.5 million
Computer Asthma Management System
Role: Co-PI

2002-2004
Robert Wood Johnson $304,293
Childhood Antecedents of Adult Disease
Role: Co-PI

2002-2003
WA State Department of Health and Human Services $125,000
Disease Management Evaluation
Role: PI

R03 2002-2003
Agency for Health Care Research and Quality $100,000
Medical Homes for Children
Role: Co-PI

R03 2002-2003
Agency for Health Care Research and Quality $100,000

Diagnostic Decision Aid for Pediatric Sinusitis
Role: PI

2003-2004
Seattle Children's Hospital Fund for Excellence $20,000
Rotavirus and afebrile seizures in children
Role: PI

2003-2004
University of Washington, Royalty Research Fund $39,000
Community Health Kiosks
Role: PI

R01 2004-2009
NIH/NICHD $3 million
Promoting Prevention via the internet
Role: PI

2005-2006
Mega Bloks, Private funding $49,846
A randomized controlled trial of block distribution
Role: PI

2005-2006
Children's Hospital Outcomes Steering Award $27,246
Pilot study of television reduction in young children
Role: PI

2005-2007
FDA $150,000
Post marketing safety of Pharmaceuticals in a Medicaid Population
Role: PI

R01 2006-2011
National Heart Lung and Blood Institute $2.5 million
AsthmaNet: An internet based asthma management program
Role: PI

R21 2009-2011
National Institute on Drug Abuse $52,212
Facebook: A Screening Tool to Identify Alcohol Use Among Female College Freshmen
Role: Co-PI

R21 2009-2010
National Institute on Alcohol Abuse and Alcoholism $418,235

Use of Social Networking Web sites For Problem Drinking Screening in Adolescents
Role: Co-PI

R01 2008-2013
National Institute for Child Health and Development $2.6 million
Media Impact on Preschool Behavior
Role: PI

R01 2010-2015
National Institute on Aging $1.8 million
Using Media to Explore Mechanisms of Behavior Change Among College Students
Role: Co-PI

2015-2016
Catherine Meyer Foundation $100,000
Building a relax App for children
Role: PI

5R01HD068478-02 02/01/2012 – 01/31/2018
NIH/NICHD
Promoting Optimal Parenting
The first few years of a child's life are important to their long term cognitive and emotional development. Children's cognitive development during this time frame, especially around language and reciprocal communication, has a profound impact on later ability to succeed in school. We will study the effects of parent education and the provision of specific tools and recommendations for appropriate developmental stimulation over the first 3 years of life.
Role: PI

2R01DA021307-06A1 04/01/2013 – 03/31/2018
Oregon Research Institute/NIH
Evaluating an online parenting support system disseminated by pediatric practices
This study explores the impact of the Triple P Online System (TPOS), a 3-level online parenting support system, which delivers evidence-based video-driven parenting content in an innovative interactive format and at flexible dosage levels. TPOS will be compared against usual community services for effects on parenting practices and children's behavior. We will also examine the impact of training pediatric practitioners to promote TPOS among their patients on their protocol for handling children's behavior problems.
Role: Co-Investigator

Hearst Family Foundation 05/01/2016 – 04/30/2018
Promoting parental child interactions in primary care
This project is a randomized controlled trial that tests an intervention aimed to prompt pediatricians to discuss the importance of talking with infants. Using trained teachers in waiting rooms and educational DVDs, it will test whether we can narrow the 30 million word gap in a high risk population. It also includes LENA reports on how many words are being spoken at home.

Role: PI

1 R01 HD071937-01A1 12/10/2013 – 11/30/2018
NIH/NIMH
Healthy Sleep Intervention for Preschool Children
This study is a randomized controlled trial of an intervention for preschool children with sleep problems, in which we aim to give parents the knowledge, motivation, and skills necessary to set goals, problem-solve, and improve their child's sleep. In collecting three years of follow-up data, we will be able to determine the impact of early childhood sleep intervention on childhood sleep problems, obesity, poor academic achievement, and emotional and behavioral problems, as well as parental stress and daytime tiredness. This study has the dual potential to expand treatment resources for young children with behavioral sleep problems and to increase our scientific understanding of the long-term consequences of early childhood sleep problems.
Role: Co-Investigator

Seattle Children's Innovation Award 08/01/2016 – 07/31/2018
Cricket Crate
Cricket Crate is evidence based developmentally appropriate monthly tool kit that combine tangible objects (e.g. mobiles, swaddling blankets, etc.) with age based recommendations in an informative newsletter. It aims to help new parents optimize children's cognitive, social, and emotional development by applying the latest science related to early learning.
Role: PI
1 R34 AA025159-01 09/30/2016 – 08/31/2019
NIH/NIAAA
SM BASICS: Development and testing of a social media enhanced intervention
This two-phase study will refine a successful web-based alcohol intervention for use with community college students and incorporating social media tools, and test this intervention with a randomized controlled trial.
Role: Consultant

1 R21 CA218592-01 08/01/2017 – 07/31/2019
NIH/NCI
Preschoolers Learning & Active in Play (PLAY)
Preschoolers are thought to be very active but many are not getting adequate opportunities for active play and the recommended amounts of physical activity needed for their health and cognitive development. Experts have recommended strategies to promote physical activity in early learning settings and to involve parents in efforts to promote active living from a young age. We propose research that uses wearable technology to monitor physical activity in children and motivate parents and educators to help create those active play opportunities, particularly for children from more vulnerable backgrounds who suffer from disparities in both health and educational outcomes.
Role: Co-Investigator

15. BIBLIOGRAPHY

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(a) Peer-reviewed publications

1. Whittingham TS, Lust WD, **Christakis DA**, Passoneau JV. Metabolic stability of hippocampal slice preparations during prolonged incubations. *J Neurochem.* 1984; 43:689-96.

2. Hershenson MB, O'Rourke PP, **Christakis DA**, Coopes BJ, Crone RK. Oxygen extraction in lamb skeletal muscle. *Pediatr Res.* 1990 Aug; 28(2):101-5. PMID: 2395598.

3. **Christakis DA**, Feudtner C. Ethics in a short white coat: Medical student ethical dilemmas. *Methods Inf Med.* 1993; 68:249-54.

4. Kazak A, **Christakis D**, Alderfer M, Lawrence M. Young adolescent cancer survivors and their parents: Adjustment, learning problems, and gender. *Journal of Family Psychology.* 1994; 8:74-84.

5. Feudtner C, **Christakis D**. Making the rounds: The ethical development of medical students in the context of clinical rotations. *Hasting Cen Rep.* 1994; Jan-Feb; 24(1): 6-12. PMID: 8045775.

6. Feudtner C, **Christakis D**, Christakis N. Do clinical clerks suffer ethical erosion? Students' perceptions of their ethical environment and personal development. *Acad Med.*1994; 69: 670-9.

7. Stuber ML, **Christakis DA**, Houskamp B, Kazak AE. Post trauma symptoms in childhood leukemia survivors and their parents. *Psychosomatics.* 1996; 37: 254-61.

8. Feudtner C, **Christakis D**, Schwartz P. Ethics and the art of confrontation. *JAMA*. 1996 Sep; 276(9): 755-6. PMID: 8769561.

9. Hundert EM, Hafferty F, **Christakis DA**. Characteristics of the informal curriculum and trainees' ethical choices. *Acad Med.* 1996; 71: 631-2.

10. **Christakis DA**, Feudtner C. Temporary matters: The ethical consequences of transient social relationships in medical training. *JAMA*, 1997 Sep; 278(9): 739-43. PMID: 9286834.

11. Kazak AE, Barakat LP, Meeske K, **Christakis D**, Meadows AT, Casey R, Penati B, Stuber ML. Post traumatic stress, family functioning and social support in survivors of childhood leukemia and their mothers and fathers. *J Consult Clin Psychol.* 1997 Feb; 65(1): 120-9. PMID: 9103741.

12. **Christakis DA**, Wright JA, Rivara FP. Promethazine use in pediatric gastroenteritis: Towards a better understanding of use, risk, and benefit. *Ambulatory Child Health.* 1998; (4): 181-7.

13. **Christakis DA**, Rivara FP. Pediatricians' awareness of and attitudes about four clinical practice guidelines. *Pediatrics.* 1998 May; 101(5): 825-30. PMID: 9565409.

14. **Christakis DA**, Wright JA, Koepsell TD, Emerson S, Connell FA. Is greater continuity of care associated with less Emergency Department utilization? *Pediatrics*. 1999 Apr; 103(4): 738-42. PMID: 10103295.

15. Saha S, **Christakis DA**, Saint S, Whooley MA, Simon SR. A survival guide for generalist physicians in academic fellowships part 1: getting started. *J Gen Intern Med.* 1999 Dec; 14(12): 745-49. PMID: 10632819; PMC: 1496867.

16. Saha S, Saint S, **Christakis DA**, Simon SR, Fihn SD. A survival guide for generalist physicians in academic fellowships part 2: preparing for the transition to junior faculty. *J Gen Intern Med.* 1999 Dec; 14(12):750-5. PMID: 10632820; PMC: 1496859.

17. **Christakis DA**, Stewart L, Bibus D, Stout JW, Zerr DM, MacDonald JK, Gale JL. *Am J Prev Med.* 1999 Aug; 17(2): 147-50. PMID: 10490059.

18. **Christakis DA**, Harvey E, Zerr DM, Feudtner C, Wright J, Connell FA. A trade-off analysis of routine newborn circumcision. *Pediatrics.* 2000 Jan; 105(1): 246-9. PMID: 10617731.

19. **Christakis DA**, Davis R, Rivara FP. Pediatric evidence-based medicine: Past, present and future. *J Pediatr*. 2000 Mar; 136(3): 383-9. PMID: 10700697.

20. **Christakis DA**, Saint S, Saha S, Elmore J, Welsh DE, Baker P, Koepsell TD. Do physicians judge studies by their covers? An investigation of journal bias. *J Clin Epidemiol.* 2000 Aug; 53(8): 773-8. PMID: 10942858.

21. *Garrison MM, **Christakis DA**, Harvey E, Cummings P, Davis R. A meta-analysis of systemic steroids in the treatment of bronchiolitis in children. *Pediatrics.* 2000; 105(4): e44.

22. Saint S, **Christakis DA**, Baldwin LM, Rosenblatt R. Is hospitalism new? An analysis of Medicare Data from Washington State in 1994. *Eff Clin Pract.* 2000J Jan-Feb; 3(1): 35-9. PMID: 10788035.

23. **Christakis DA**, Mell L, Wright JA, Davis RL, Connell FA. The Association Between Greater Continuity of Care and Timely Measles-Mumps-Rubella Vaccination*. Am J Public Health.* 2000 Jun; 90(6): 926-5. PMID: 10846516.

24. Feudtner C, **Christakis DA**, Connell FA. Pediatric deaths attributable to complex chronic conditions: a population-based study of Washington State, 1980-1997.*Pediatrics.* 2000 Jul; 106(1): 205-9. PMID: 10888693.

25. Garrison MM, **Christakis DA**. A systematic review of therapies for infantile colic. *Pediatrics.* 2000 Jul; 106(1): 184-90. PMID: 10888690.

26. Saint S, **Christakis DA**, Saha S, Elmore JG, Welsh DE, Baker P, Koepsell TD. Journal reading habits of internists. *J Gen Intern Med.* 2000 Dec; 15(12): 881-4. PMID: 11119185

27. **Christakis DA**, Feudtner C. Informational Errors. *Eff Clin Pract.* 2000 Nov-Dec; 3(6): 301-4. PMID: 11151531.

28. Valentine JM, Neff J, Park AN, Maynard C, **Christakis DA**, Hicks-Thomson JH, Sharp V. Pediatric hospitalization patterns for selected chronic health conditions using hospital abstract reporting systems data: Methods and findings. *Health Services and Outcomes Research Methodology.* 2000; (1)3-4: 335-50.
29. **Christakis DA**, Johnston BD, Connell FA. Methodologic Issues in Pediatric Outcomes Research. *Ambul Pediatr*. 2001 Jan-Feb; 1(1): 59-62. PMID: 11888373.

30. **Christakis DA**, Zimmerman FJ, Wright JA, Garrison MM, Rivara FP, Davis RL. A randomized controlled trial of point of care evidence to improve antibiotic use for otitis media. *Pediatrics.* 2001 Feb; 107(2): E15. PMID: 11158489.

31. **Christakis DA**, Mell L, Koepsell TD, Zimmerman FJ, Connell FA. Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. *Pediatrics.* 2001 Mar; 103(3): 524-9. PMID: 11230593.

32. **Christakis DA**, Feudtner C, Pihoker C, Connell FA. Continuity and Quality of Care for Children With Diabetes Who Are Covered by Medicaid. *Ambul Pediatr*. 2001 Mar-Apr; 1(2): 99-103. PMID: 11888380.

33. Barlow WE, Davis RL, Glasser JW, Rhodes PH, Thompson RS, Mullooly JP, Black SB, Shinefield HR, Ward JI, Marcy SM, Destefano FD, Chen RT, Immanuel V, Pearson JA, Vadheim CM, Rebolledo V, **Christakis D**, Benson PJ, Lewis E, and the Centers for Disease Control Vaccine Safety Datalink Working Group. The risk of seizures after receipt of whole-cell pertussis or measles, mumps and rubella vaccine. *N Engl J Med.* 2001 Aug; 345(9): 656-61. PMID: 11547719.

34. Garrison MM, **Christakis DA**. Infant colic. *Pediatr Case Rev.* 2001 Oct; 1(1):19-24. PMID: 12865700.

35. Carroll A, Garrison MM, **Christakis DA**. A systematic review of non-surgical, non-pharmacologic treatment for gastroesophageal reflux. *Arch Pediatr Adolesc Med*. 2002; 156(2): 109-13.

36. Gallaher MM, **Christakis DA**, Connell FA. Health care use by children diagnosed as having developmental delay. *Arch Pediatr Adolesc Med.* 2002 Mar; 156(3): 246-51. PMID: 11876668.

37. **Christakis DA**, Wright JA, Zimmerman FJ, Bassett AL, Connell FA. Continuity of care is associated with high quality care by parental report. *Pediatrics.* 2002 Apr; 109(4): e54. PMID: 11927727.

38. Van Neil C, Feudtner C, Garrison MM, **Christakis DA**. Lactobacillus therapy for acute infectious diarrhea in children: A Meta-analysis. *Pediatrics*. 2002 Apr; 109(4): 678-84. PMID: 11927715.

39. Feudtner C, Silveira MJ, **Christakis DA**. Where do children with complex chronic conditions die? Patterns in Washington State, 1980-1998. *Pediatrics*. 2002 Apr; 109(4): 656-60. PMID: 11927711.

40. Zerr DM, Garrison MM, Marr K, **Christakis DA**. Fluconazole versus amphotericin for candidemia: A meta-analysis. *Journal of Clinical Outcomes Management.* 2002 9(4): 191-6.

41. Feudtner C, **Christakis DA,** Zimmerman FJ, Muldoon JH, Neff JM, Koepsell TD. Characteristics of deaths occurring in children's hospitals: implications for supportive care services. *Pediatrics*. 2002 May; 109(5):887-93. PMID: 11986451.

42. Neff JM, Valentine J, Park A, Hicks-Thomson J, **Christakis DA**, Muldoon J, Churchill S. Trends in pediatric hospitalizations of children in Washington State by insurance and chronic condition status 1991-1998. *Arch Pediatr Adolesc Med.* 2002 Jul; 156(7): 703-9. PMID: 12090839.
43. Saha S, Saint S, **Christakis, DA.** Impact factor: A valid measure of journal quality. *J Med Libr Assoc.* 2003 Jan; 91(1): 42-6. PMID: 12572533.

44. **Christakis DA**, Wright JA, Zimmerman FJ, Bassett AL, Connell FA. Continuity of care is associated with well-coordinated care. *Ambul Pediatr*. 2003 Mar-Apr; 3(2): 82-6. PMID: 12643780.

45. DiGiuseppe DL, **Christakis DA**. Continuity of care for children in foster care. *Pediatrics*. 2003 Mar; 111: e208-213. PMID: 12612273.

46. Carroll AE, Tarczy-Hornoch PT, O'Reilly E, **Christakis DA**. Resident documentation discrepancies in a neonatal intensive care unit. *Pediatrics.* 2003 May; 111(5 Pt 1): 976-80. PMID: 12728074.

47. **Christakis DA**, Lozano P. Continuity of care is associated with early and sustained treatment for ADHD. *J Clin Outcomes Manage* 2003; 10(7): 371-375.

48. Sox CM, Cooper WO, DiGiuseppe DL, Koepsell TD, **Christakis DA**. Provision of pneumococcal prophylaxis for publicly insured children with sickle cell disease. *JAMA.* 2003 Aug; 290(8): 1057-61. PMID: 12941678.

49. Li ST, DiGiuseppe DL, **Christakis DA**. Antiemetic use for acute gastroenteritis in children. *Arch Pediatr Adolesc Med.* 2003 May; 157(5): 475-9. PMID: 12742884.

50. Richardson LP, DiGiuseppe DL, Garrison MM, **Christakis DA**. Depression in Medicaid-covered youth: differences by race and ethnicity. *Arch Pediatr Adolesc Med.* 2003 Oct; 157(10): 984-9. PMID: 14557159.

51. Garrison MM, **Christakis DA**, Ebel B, Wiehe S, Rivara FP. Smoking cessation interventions for adolescents: a systematic review. *Am J Prev Med.* 2003 Nov; 25(4): 363-7. PMID: 14580641.

52. **Christakis DA**, Garrison MM, Ebel BE, Wiehe SE, Rivara FP. Pediatric smoking prevention interventions delivered by care providers: a systematic review. *Am J Prev Med.* 2003 Nov; 25(4): 358-62. PMID: 14580640.

53. Carroll AE, Sox CM, Tarini BA, Rhingold S, **Christakis DA**. Does presentation format at the Pediatric Academic Societies' annual meeting predict subsequent publication? *Pediatrics.* 2003 Dec; 112(6): 1238-41. PMID: 14654591.

54. Carroll AE, **Christakis DA**. Pediatricians and Personal Digital Assistants: What Type Are They Using? *Proc AMIA Symp.* 2003: 130-4. PMID: 14728148.

55. **Christakis DA**, Kazak A, Wright JA, Zimmerman FJ, Bassett AL, Connell FA. What factors are associated with achieving high continuity of care? *Fam Med.* 2004 Jan; 36(1): 55-60. PMID: 14710331.

56. Carroll AE, **Christakis DA**. Pediatricians' use of and attitudes about personal digital assistants. *Pediatrics*. 2004 Feb; 113(2): 238-42. PMID: 14754932.

57. Carroll AE, Tarczy-Hornoch PT, O'Reilly E, **Christakis DA**. The effect of point-of-care personal digital assistant use on resident documentation discrepancies. *Pediatrics.* 2004 Mar; 113 (3 Pt 1): 450-4. PMID: 14993533.

58. Zimmerman FJ, **Christakis DA**, Vander Stoep A. Tinker, tailor, soldier, patient: work attributes and depression disparities among young adults. *Soc Sci Med.* 2004 May; 58(10): 1889-901. PMID: 15020006.

59. **Christakis DA**, Zimmerman FJ, DiGiuseppe DL, McCarty CA. Early Television Exposure and Subsequent Attentional Problems in Children. *Pediatrics.* 2004 Apr; 113(4): 708-713. PMID: 15060216.

60. Richardson LP, DiGiuseppe D, **Christakis DA**, McCauley E, Katon W. Quality of care for medicaid-covered youth treated with antidepressant therapy. *Arch Gen Psychiatry*. 2004 May: 61(5): 475-80. PMID: 15123492.

61. Garrison MM, Richardson LP, **Christakis DA**, Connell FA. Mental illness hospitalizations of youth in Washington State. *Arch Pediatr Adolesc Med*. 2004 Aug; 158(8): 781-5. PMID: 15289251.

62. McCarty CA, Ebel BE, Garrison MM, DiGiuseppe DL, **Christakis DA**, Rivara FP. Continuity of Binge and Harmful Drinking From Late Adolescence to Early Adulthood. *Pediatrics*. 2004 Sep; 114(3): 714-9. PMID: 15342844.

63. Rivara FP, Ebel BE, Garrison MM, **Christakis DA**, Wiehe SE, Levy DT. Prevention of smoking related deaths in the United States. *Am J Prev Med.* 2004 Aug; 27(2): 118-25. PMID: 15261898.

64. **Christakis DA**, Wright JA. Can continuity of care be improved? Results from a randomized pilot study. *Ambul Pediatr*. 2004 Jul-Aug; 4(4): 336-9. PMID: 15264940.

65. Taylor JA, Brownstein D, **Christakis DA**, Blackburn S, Strandjord TP, Klein EJ, Shafii J. Use of incident reports by physicians and nurses to document medical errors in pediatric patients. *Pediatrics*. 2004 Sep; 114(3): 729-35. PMID: 15342846.

66. Rivara FP, **Christakis DA,** Cummings P. Duplicate publication. *Arch Pediatr Adolesc Med*. 2004 Sep;158(9): 926. PMID: 15351761.

67. Rivara FP, Garrison MM, Ebel B, McCarty CA, **Christakis DA**. Mortality attributable to harmful drinking in the United States, 2000. *J Stud Alcohol*. 2004 Jul; 65(4): 530-6. PMID: 15376828.

68. **Christakis DA**, Ebel BE, Rivara FP, Zimmerman FJ. Television, video, and computer game usage in children under 11 years of age. *J Pediatr*. 2004 Nov; 145(5): 652-6. PMID: 15520768.

69. Galbraith AA, Semura J, McAninch-Dake B, Anderson N, **Christakis DA**. Emergency department use and perceived delay in accessing illness care among children with Medicaid. *Ambul Pediatr*. 2004 Nov; 4(6): 509-513. PMID: 15548103.

70. Wiehe SE, Garrison MM, **Christakis DA**, Ebel BE, Rivara FP. A systematic review of school-based smoking prevention trials with long-term follow-up. *J Adolesc Health*. 2005 Mar; 36(3): 162-9. PMID: 15737770.

71. Carroll AE, Zimmerman FJ, Rivara FP, Ebel BE, **Christakis DA.** Perceptions about computers and the internet in a pediatric clinic population. *Ambul Pediatr.* 2005 March-April; 5(2): 122-126. PMID: 15780015.

72. Zerr DM, Garrison MM, Allpress AL, Heath J, **Christakis DA**. Infection control policies and hospital- associated infections among surgical patients: variability and associations in a multicenter pediatric setting. *Pediatrics*. 2005 Apr; 115(4): e387-92. PMID: 15805339.

73. **Christakis DA**, Cowan CA, Garrison MM, Molteni R, Marcuse E, Zerr DM. Variation in inpatient diagnostic testing and management of bronchiolitis. *Pediatrics*. 2005 Apr; 115(4): 878-84. PMID: 15805359.

74. Zimmerman FJ, Glew GM, **Christakis DA**, Katon W. Early cognitive stimulation, emotional support, and television watching as predictors of subsequent bullying among grade-school children. *Arch Pediatr Adolesc Med*. 2005 Apr; 159(4): 384-8. PMID: 15809395.

75. Cohen AL, Rivara FP, Davis R, **Christakis DA**. Compliance with guidelines for the medical care of first urinary tract infections in infants: a population-based study. *Pediatrics*. 2005 Jun; 115(6): 1474. PMID: 15930206.

76. Zerr DM, Blume HK, Berg AT, Del Beccaro MA, Gospe SM Jr., Allpress AL, **Christakis DA**. Nonfebrile illness seizures: a unique seizure category? *Epilepsia*. 2005 Jun; 46(6): 952-5. PMID: 15946338.

77. Zimmerman FJ, **Christakis DA.** Children's television viewing and cognitive outcomes: a longitudinal analysis of national data. *Arch Pediatr Adolesc Med*. 2005 Jul; 159(7): 619-25. PMID: 15996993.

78. Fishman PA, Ebel BE, Garrison MM, **Christakis DA**, Wiehe SE, Rivara FP. Cigarette tax increase and media campaign cost of reducing smoking-related deaths. *Am J Prev Med*. 2005 Jul; 29(1): 19-26. PMID: 15958247.

79. Robertson AS, Rivara FP, Ebel BE, Lymp JF, **Christakis DA**. Validation of parent self-reported home safety practices. *Inj Prev*. 2005 Aug; 11(4): 209-12. PMID: 16081748.

80. McCarty CA, Zimmerman FJ, Digiuseppe DL, **Christakis DA**. Parental Emotional Support and Subsequent Internalizing and Externalizing Problems Among Children. *J Dev Behav Pediatr.* 2005 Aug; 26(4):267-275. PMID: 16100499.

81. **Christakis DA**, Wright JA, Taylor JA, Zimmerman FJ. Association Between Parental Satisfaction and Antibiotic Prescription for Children with Cough and Cold Symptoms. *Pediatr Infect Dis J*. 2005 Sep; 24(9): 774-777. PMID: 16148842.

82. Sox CM, **Christakis DA**. Pediatricians' Screening Urinalysis Practices. *J Pediatr*. 2005 Sep; 147(3): 362-365. PMID: 16182676.

83. Thompson DA, **Christakis DA**. The association between television viewing and irregular sleep schedules among children less than 3 years of age. *Pediatrics*. 2005 Oct; 116(4): 851-6. PMID: 16199693.

84. Galbraith A, Koepsell TD, Grossman D, **Christakis DA**. Medicaid acceptance and availability of timely follow-up for newborns with Medicaid. *Pediatrics*. 2005 Nov; 116(5): 1148-54. PMID: 16264002.

85. Bowman SM, Zimmerman FJ, **Christakis DA**, Sharar SR, Martin DP. Hospital characteristics associated with the management of pediatric splenic injuries. *JAMA*. 2005 Nov 23; 294 (20):2611-7. PMID: 16304075.

86. Garrison MM, Jeffries H, **Christakis DA**. Risk of death for children with Down syndrome and sepsis. *J Pediatr.* 2005 Dec; 147(6):748-52. PMID: 16356424.

87. Cohen AL, **Christakis DA**. Primary language of parent is associated with disparities in pediatric preventive care. *J Pediatr*. 2006 Feb;148(2):254-258. PMID: 16492438.

88. Hollingworth W, Ebel BE, McCarty CA, Garrison MM, **Christakis DA**, Rivara FP. Prevention of deaths from harmful drinking in the United States: the potential effects of tax increases and advertising bans on young drinkers. *J Stud Alcohol.* 2006 Mar;67(2):300-8. PMID: 16562413.

89. **Christakis DA**, Zimmerman FJ. Media as a public health issue. *Arch Pediatr Adolesc Med*. 2006 Apr;160(4):445-6. PMID: 16585492.

90. Mendoza JA, Drewnowski A, Cheadle A, **Christakis DA**. Dietary energy density is associated with selected predictors of obesity in U.S. Children. *J Nutr.* 2006 May;136(5):1318-22. PMID: 16614423.

91. **Christakis DA**. The hidden and potent effects of television advertising. *JAMA*. 2006 Apr 12;295(14): 1698-9. PMID: 16615175.

92. Sox CM, Koepsell TD, Doctor JN, **Christakis DA**. Pediatricians' clinical decision making: results of 2 randomized controlled trials of test performance characteristics. *Arch Pediatr Adolesc Med*. 2006 May;160(5):487-92. PMID: 16651490.

93. Tarini BA, Carroll AE, Sox CM, **Christakis DA**. Systematic review of the relationship between early introduction of solid foods to infants and the development of allergic disease. *Arch Pediatr Adolesc Med*. 2006 May;160(5):502-7. PMID: 16651493.

94. Carroll AE, Rivara FP, Ebel BE, Zimmerman FJ, **Christakis DA**. Household computer and Internet access: The digital divide in a pediatric clinic population. *AMIA Annu Symp Proc*. 2005:111-5. PMID: 16779012.

95. **Christakis DA**, Zimmerman FJ. Early television viewing is associated with protesting turning off the television at age 6. *MedGenMed.* 2006 Jun 1;8(2):63. PMID: 16926802.

96. **Christakis DA**, Rivara FP. Publication ethics: Editors' perspectives. *J Pediatr*. 2006 Jul;149(1S): S39- S42. PMID: 16829242.

97. Tarini BA, **Christakis DA**, Welch HG. State newborn screening in the tandem mass spectrometry era: more tests, more false-positive results. *Pediatrics*. 2006 Aug;118(2):448-56. PMID: 16882794.

98. **Christakis DA**, Zimmerman FJ, Rivara FP, Ebel B. Improving Pediatric Prevention via the Internet: A Randomized, Controlled Trial. *Pediatrics*. 2006 Sep;118(3):1157-1166. PMID: 16951011.

99. Thakkar RR, Garrison MM, **Christakis DA**. A systematic review for the effects of television viewing by infants and preschoolers. *Pediatrics*. 2006 Nov;118(5):2025-31. PMID: 17079575.

100. **Christakis DA**, Garrison MM, Zimmerman FJ. Television viewing in US day care settings. *Communication Reports*. 2006 19(2) 111-120.

101. Mendoza JA, Drewnowski A, **Christakis DA**. Dietary Energy Density is Associated with Obesity and the Metabolic Syndrome in US Adults. *Diabetes Care*. 2007 Jan 17.

102. Thompson DA, **Christakis DA**. The association of maternal mental distress with television viewing in children under 3 years old. *Ambul Pediatr*. 2007 Jan-Feb;7(1):32-7. PMID: 17261480.

103. Thompson DA, Lozano P, **Christakis DA**. Parent use of touchscreen computer kiosks for child health promotion in community settings. *Pediatrics*. 2007 Mar;119(3):427-34. PMID: 17332194.

104. Tarini BA, Garrison MM, **Christakis DA**. Institutional variation in ordering complete blood counts for children hospitalized with bronchiolitis. *J Hosp Med*. 2007 Apr 10;2(2):69-73. PMID: 17427246.

105. **Christakis DA**, Zimmerman FJ. TV and Kids. A primer for pediatricians. *Contemporary Pediatrics*. April 2007.

106. Goldin A, Sawin R, Garrison MM, Zerr DM, **Christakis DA**. Aminoglycoside-based triple-antibiotic therapy versus monotherapy for children with ruptured appendicitis. *Pediatrics*. 2007 May;119(5):905-11. PMID: 17473090.

107. Zimmerman, FJ, **Christakis DA**, Meltzoff AN. Television and DVD/Video Viewing in Children Younger Than 2 Years. *Arch Pediatr Adolesc Med*. 2007 May;161(5):473-9. PMID: 17485624.

108. Davis RL, Wright J, Chalmers F, Levenson L, Brown JC, Lozano P, **Christakis DA**. A cluster randomized clinical trial to improve prescribing patterns in ambulatory pediatrics. *PLoS Clin Trials*. 2007 May 18;2(5):e25. PMID: 17525793.

109. Rivara FP, Cummings P, Ringold S, Bergman A, Joffe A, **Christakis DA**. A comparison of reviewers selected by editors and reviewers suggested by authors. *J Pediatr*. 2007 Aug;151(2):202-5. PMID: 17643779.

110. Zimmerman FJ, **Christakis DA**, Meltzoff A. Associations between media viewing and language development in children under age 2 years. *J Pediatr*. 2007 Oct;151(4):364-8. PMID: 17889070.

111. Mendoza JA, Zimmerman FJ, **Christakis DA**. Television viewing, computer use, obesity, and adiposity in US preschool children. *Int J Behav Nutr Phys Act*. 2007 Sep 25;4(1):44. PMID: 17894878.

112. **Christakis DA**, Zimmerman FJ, Garrison MM. Effect of block play on language acquisition and attention in toddlers: a pilot randomized controlled trial. *Arch Pediatr Adolesc Med*. 2007 Oct;161(10):967-71. PMID: 17909140.

113. Zimmerman FJ, **Christakis DA**. Associations Between Content Types of Early Media Exposure and Subsequent Attentional Problems. *Pediatrics*. 2007 Nov;120(5):986-992. PMID: 17974735.

114. **Christakis DA**, Zimmerman FJ. Violent Television Viewing During Preschool Is Associated With Antisocial Behavior During School Age. *Pediatrics*. 2007 Nov;120(5):993-999. PMID: 17974736.

115. Tarini BA, **Christakis DA**, Lozano P**.** Toward family-centered inpatient medical care: the role of parents as participants in medical decisions. *J Pediatr*. 2007 Dec;151(6):690-695. PMID: 18035155.

116. Rivara FP, **Christakis DA**. The march of science. *Arch Pediatr Adolesc Med*. 2007 Dec; 161(12):1214-1215. PMID: 18056569.

117. Moreno MA, Fost NC, **Christakis DA.** Research ethics in the MySpace era. *Pediatrics*. 2008 Jan;121(1):157-61. PMID: 18166570.

118. Zerr DM, Englund JA, Robertson AS, Marcuse EK, Garrison MM, **Christakis DA**. Hospital-based influenza vaccination of children: an opportunity to prevent subsequent hospitalization. *Pediatrics*. 2008 Feb;121(2):345-8. PMID: 18245426.

119. Cooper WO, Ray WA, Arbogast PG, Garrison M, Dudley JA, **Christakis DA.** Health Plan Notification and Feedback to Providers is Associated with Increased Filling of Preventer Medications for Children with Asthma Enrolled in Medicaid. *J Pediatr*. 2008 Apr;152(4):481-8. PMID: 18346500.

120. Thompson DA, Flores G, Ebel B, **Christakis DA.** Comida en venta: after-school advertising on Spanish-language television in the United States. *J Pediatr*. 2008 Apr;152(4):576-81. PMID: 18346518.

121. Bowman SM, Zimmerman FJ, **Christakis DA**, Sharar SR. The Role of Hospital Profit Status in Pediatric Spleen Injury Management. *Med Care*. 2008 Mar;46(3):331-338. PMID: 18388849.

122. Tieder JS, Cowan CA, Garrison MM, **Christakis DA**. Variation in inpatient resource utilization and management of apparent life-threatening events. *J Pediatr*. 2008 May;152(5):629-35. PMID: 18410764.

123. Galbraith AA, Semura JI, McAninch-Dake RJ, Anderson N, **Christakis DA**. Language disparities and timely care for children in managed care Medicaid. *American Journal of Managed Care* 2008 14(7):417-426. PMID: 18611093.

124. **Christakis DA**. The effects of infant media usage: what do we know and what should we learn? *Acta Paediatr.* 2009 Jan;98(1):8-16. PMID: 18793294.

125. Moreno MA, Vander Stoep A, Parks MR, Zimmerman FJ, Kurth A, **Christakis DA**. Reducing at-risk adolescents' display of risk behavior on a social networking web site: a randomized controlled pilot intervention trial. *Archives of Pediatrics and Adolescent Medicine*. 2009 Jan;163(1):35-41. PMID: 19124701.

126. Moreno MA, Parks MR, Zimmerman FJ, Brito TE, **Christakis DA**. Display of Health Risk Behaviors on MySpace by Adolescents: Prevalence and Associations. *Archives of Pediatrics and Adolescent Medicine*. 2009 Jan;163(1):27-34. PMID: 19124700.

127. Sox CM, Doctor JN, Koepsell TD, **Christakis DA.** The influence of types of decision support on physicians' decision making. *Arch Dis Child*. 2009 Jan 8. PMID: 19131417.

128. Blume HK, Garrison MM, **Christakis DA.** Neonatal seizures: treatment and treatment variability in 31 United States pediatric hospitals. *J Child Neurol*. 1 Feb 2009 24(2): 148-54. PMID: 19182150.

129. **Christakis DA**, Gilkerson J, Richards JA, Zimmerman FJ, Garrison MM, XuD, Gray S, Yapanel U. Audible television and decreased adult words, infant vocalizations, and conversational turns: a population based study. *Arch Pediatr Adolesc Med*. 2009 Jun;163(6):554-8. PMID: 19487612.

130. Moreno MA, Briner LR, Williams A, Walker L, **Christakis DA**. Real Use or "Real Cool": Adolescents Speak Out About Displayed Alcohol References on Social Networking Websites. *J Adolesc Health.* Epub 2009 June 16. PMID: 19766949.

131. Zimmerman FJ, Gilkerson J, Richards JA, **Christakis DA**, Xu D, Gray S, Yapanel U. Teaching by Listening: The Importance of Adult-Child Conversations to Language Development. *Pediatrics*. 2009 Jul; 124(1):342-49. PMID: 19564318.

132. Goldin AB, Garrison M, **Christakis D**. Variations between hospitals in antireflux procedures in Children. *Arch Pediatr Adolesc Med*. 2009 Jul;163(7):658-63. PMID: 21683205.

133. Tarini BA, Lozano P, **Christakis DA**. Afraid in the hospital: Parental concern for errors during a child's hospitalization. *J Hosp Med.* 2009 Aug 3. PMID: 19653281.

134. Perkins JA, Oliaei S, Garrison MM, Manning SC, **Christakis DA.** Airway procedures and hemangiomas: treatment patterns and outcome in U.S. pediatric hospitals. *Int J Pediatr Otorhinolaryngol*. 2009 Sep;73(9):1302-7. PMID: 19592117.

135. **Christakis DA**, Moreno MA. Trapped in the net: will internet addiction become a 21st-century epidemic? *Arch Pediatr Adolesc Med*. 2009 Oct; 163(10):959-60. PMID: 19805719.

136. **(Christakis DA)** Council on Communications and Media. From the American Academy of Pediatrics: Policy statement--Media violence. *Pediatrics*. 2009 Nov;124(5):1495-503. PMID: 19841118.

137. **Christakis DA**, Garrison MM. Preschool-aged children's television viewing in child care settings. *Pediatrics.* 2009 Dec;124(6):1627-32. PMID: 19933733.

138. **Christakis DA**, Zimmerman FJ. Young children and media: Limitations of current knowledge and future directions for research. *American Behavioral Scientist,* April 2009; vol. 52, 8: pp. 1177-1185.

139. Thompson DA, Sibinga E, Jennings J, Bair-Merritt MH, **Christakis DA** Television viewing by young Latino children: Evidence of heterogeneity. *Arch Pediatr Adolesc Med* 2010;164 174-179. PMCID: PMC2828343.

140. **Christakis DA**, Rivara FP. Influence of experiences from birth to 5 years of age on emotional and psychological health. *Arch Pediatr Adolesc Med*. 2010 May;164(5):491-2. PMID: 20439803.

141. Moreno MA, Briner LR, Williams A, Brockman L, Walker L, **Christakis DA.** A content analysis of displayed alcohol references on a social networking web site. *J Adolesc Health.* 2010 Aug;47 (2):168-75. Epub 2010 Mar 20. PMCID: PMC2907358.

142. Tandon PS, Wright J, Zhou C, Rogers CB, **Christakis DA**. Nutrition Menu Labeling May Lead to Lower-Calorie Restaurant Meal Choices for Children. *Pediatrics*. Feb 2010; 125: 244 - 248. PMID: 19933733.

143. **Christakis DA.** PAS Research Award: Making Research Matter: Promoting Dissemination and Sustainability. *Acad Pediatr*. 2010 Aug 3. PMID: 20685191.

144. **Christakis DA.** Internet addiction: a 21st century epidemic? *BMC Med* 2010 Oct 18; 8(1): p. 61. PMID: 20955578.

145. Moreno MA, Brockman L, Rogers CB, **Christakis DA**. An evaluation of the distribution of sexual references among "Top 8" MySpace friends. *J Adolesc Health.* 2010 Oct;47(4):418-20. PMCID: PMC2946400.

146. Tandon PS, Zhou C, Lozano P, Christakis **DA**. Preschoolers' Total Daily Screen Time at Home and by Type of Child Care. *J Pediatrics*. 2010 Oct 26. PMID: 20980020.

147. Martin ET, Kerin T, **Christakis DA**, Blume HK, Gospe SM Jr, Vinje J, Bowen MD, Gentsch J, Zerr DM. Redefining Outcome of First Seizures by Acute Illness. *Pediatrics*. Dec 2010: 126:(6). PMCID: PMC3040576.

148. O'Keeffe GS, Clarke-Pearson K; (**Christakis DA**). Council on Communications and Media. The impact of social media on children, adolescents, and families. *Pediatrics*. 2011 Apr;127(4) PMID: 21444588.

149. Moreno MA, Jelenchick L, Cox E, Young H, **Christakis DA**. Problematic Internet Use Among US Youth: A Systematic Review. *Arch Pediatr Adolesc Med*. 2011 May 2. PMCID: PMC3215336.

150. Myaing MT, Garrison MM, Rivara FP, **Christakis DA.** Differences between opt-in and actively recruited participants in a research study. *Journal of Clinical Medicine and Research.* 2011 May; vol 3(5);68-72.

151. **Christakis DA**, Moreno MM, Jelenchick L, Myaing MT, Zhou C. Problematic internet usage in US college students: a pilot study. *BMC Med.* 2011 Jun 22,9:77. PMCID: PMC3141542.

152. Garrison MM, Liekweg K, **Christakis DA**. Media use and child sleep: the impact of content, timing, and environment. *Pediatrics.* 2011 Jul;128(1):29-35. PMCID: PMC3124101.

153. Strasburger VC, (**Christakis DA**) Council on Communications and Media. Children, adolescents, obesity and the media. *Pediatrics*. 2011 Jul;128(1):201-8. PMID:21708800.

154. Moreno MA, **Christakis DA**, Egan KG, Jelenchick LA, Cox E, Young H, Villiard H, Becker T. A Pilot Evaluation of Associations Between Displayed Depression References on Facebook and Self reported Depression Using a Clinical Scale. *J Behav Health Serv Res*. 2011 Aug 24. PMCID: PMC3266445.

155. Garrison MM, Lozano P, **Christakis DA**. Controller medication use and sleep problems in pediatric asthma: a longitudinal case-crossover analysis. *Arch Pediatr Adolesc Med.* 2011 Sep;165(9):826-30 PMID:21893649.

156. **Christakis DA**. The Effects of Fast-Paced Cartoons. *Pediatrics*. 2011 Sep 12. PMID: 21911351.

157. Van Cleve WC, **Christakis DA**. Unnecessary Care for Bronchiolitis Decreases With Increasing Inpatient Prevalence of Bronchiolitis. *Pediatrics*. 2011 Oct 10. PMID: 21987704.
158. Meischke H, Lozano P, Zhou C, Garrison MM, **Christakis D**. Engagement in "My Child's Asthma", an interactive web-based pediatric asthma management intervention. *Int J Med Inform*. 2011 Nov;80(11):765-74. PMCID: PMC3255480.

159. Moreno MM, Brockman LN, Wasserheit JN, **Christakis DA**. A pilot evaluation of older adolescents' sexual reference displays on Facebook. *J Sex Res*. 2012 Jan 12. PMCID: PMC3501730.

160. Brown A (**Christakis DA**). Media use by children younger than 2 years. Council on Communications and Media. *Pediatrics*. 2011 Nov; 128(5):1040-5.PMID:22007002.

161. Milteer RM, Ginsburg KR, (**Christakis DA**). Council On Communications And Media Committee On Psychosocial Aspects Of Child And Family Health. The importance of play in promoting healthy child development and maintaining strong parent-child bond: focus on children in poverty. *Pediatrics*. 2012 Jan;129(1):e204-13. PMID: 22201149.

162. Moreno MA, **Christakis DA**, Egan KG, Brockman LN, Becker T. Associations Between Displayed Alcohol References on Facebook and Problem Drinking Among College Students. *Arch Pediatr Adolesc Med*. 2012 Jan 31. PMCID: PMC3266463.

163. Zimmerman FJ, Ortiz SE, **Christakis DA**, Elkun D. The value of social-cognitive theory to reducing preschool TV viewing. A pilot randomized trial. *Prev Med*. 2012 Feb 14. PMID: 22349644.

164. Tandon PS, Zhou C, **Christakis DA.** Frequency of Parent-Supervised Outdoor Play of US Preschool- Aged Children. *Arch Pediatr Adolesc Med*. 2012 Apr 2. PMID: 22473885.

165. Bjornson KF, Yung D, Jacques K, Burr RL, **Christakis D.** Step-Watch Stride counting: Accuracy, precision and prediction of energy expenditure in children. *J Pediatr Rehabil Med*. 2012 Jan 1;5(1):7-14. PMID:22543888.

166. Moreno MA, Jelenchick LA, Koff R, Eickhoff J, Diermyer C, **Christakis DA**. Internet use and multitasking among older adolescents: An experience sampling approach. *Computers in Human Behavior*. 28 (2012) 1097-1102.

167. Tandon PS, Garrison MM, **Christakis DA.** Physical Activity and Beverages in Home and Center-based Child Care Programs. *J Nutr Educ Behav.* 2012 May 5. PMID: 22564855.

168. **Christakis DA**, Garrison MM, Lozano P, Meischke H, Zhou C, Zimmerman FJ. Improving Parental Adherence with Asthma Treatment Guidelines: a Randomized Controlled Trial of an Interactive Website. *Acad Pediatr*. 2012 May 31. PMID:22694878.

169. **Christakis DA**, Joffe A, Keren R, Davis MM, Shah SS, Rivara FP. Introducing JAMA Pediatrics. *Arch Pediatr Adolesc Med*. 2012 Jul 1; 166(7):663. PMID: 22751885.

170. Garrison MM, **Christakis DA**. The Impact of a Healthy Media Use Intervention on Sleep in Preschool Children. *Pediatrics*. 2012 Aug 6. PMID: 22869826.

171. **Christakis DA**, Ramirez JS, Ramirez JM. Overstimulation of newborn mice leads to behavioral differences and deficits in cognitive performance. *Sci Rep*. 2012;2:546. 2012 Jul 31. PMCID: PMC3409385.

172. Moreno MA, **Christakis DA**, Egan KG, *Jelenchick LA, Cox E, Young H, Villiard H, Becker T. A pilot Evaluation of Associations Between Displayed Depression References on Facebook and Self-reported Depression Using a Clinical Scale. *J Behav Health Serv Res*. 2012 Jul;39(3):295-304. PMCID: PMC3266445.

173. Tandon PS, Zhou C, **Christakis DA.** The frequency of outdoor play for preschool age children cared for at home-based child care settings. *Acad Pediatr.* 2012 Sep 12. PMID: 22980727.

174. Brockman LN, Pumper MA, **Christakis DA**, *Moreno MA. Hookah's new popularity among US college students: a pilot study of the characteristics of hookah smokers and their Facebook displays. *BMJ Open.* 12 Dec 2012. PMID: 23242241.

175. Tandon PS, Saelens BE, Zhou C, Kerr J, **Christakis DA.** Indoor versus outdoor time in preschoolers at child care. *AM J Prev Med.* 2013 Jan; 44(1):85-8. PMID: 23253655.

176. **Christakis DA,** Frintner MP, Mulligan DA, Fuld GL, Olson LM. Media Education in Pediatric Residencies: A National Survey. *Academic Pediatrics.* Vol 13; 1. January 2013. PMID: 23312857.

177. **Christakis DA**, *Garrison MM, Herrenkohl T, Haggerty K, Rivara FP, Zhou C, *Liekweg K. Modifying Media Content for Preschool Children: A Randomized Controlled Trial. *Pediatrics*. 2013 Feb 18. PMID: 23420911.

178. **Christakis DA**, *Liekweg K, *Garrison MM, Wright JA. Infant video viewing and salivary cortisol responses: A Randomized Experiment. *J Pediatr*. 2013 May; 162(5):1035-40. PMID: 23164310.

179. Njoroge WF, Elenbaas LM, Garrison MM, Myaing M, **Christakis DA.** Parental Cultural Attitudes and Beliefs Regarding Young Children and Television. *JAMA Pediatr*. 2013 Aug 1; 167(8):739-45. PMID: 23778788..

180. **Christakis DA.** Breastfeeding and Cognition: Can IQ Tip the Scale? *JAMA Pediatr.* 2013 Sep. PMID: 23896823..

181. Bjornson KF, Zhou C, Stevenson R, **Christakis DA**, Song K**.** Walking activity patterns in youth with cerebral palsy and youth developing typically. *Disabil Rehabil.* 2013 Oct 25. PMID: 24160855.

182. Bjornson KF, Zhou C, Stevenson R, **Christakis DA**. Capacity to Participation in Cerebral Palsy: Evidence of an Indirect Path via Performance. *Arch Phys Med Rehabil*. 2013 Dec. PMID: 23835350.

183. **Christakis DA,** Zimmerman FJ. Rethinking Reanalysis. *JAMA.* 2013 Dec 18. PMID: 24326985.

184. Ameenuddin N, **Christakis DA**, Clarke-Pearson K, et al. Media: Wired Kids and Your Practice [online course]. *PediaLink. American Academy of Pediatrics.* 2014 March 26.

185. Radesky JS, Silverstein M, Zuckerman B, **Christakis DA.** Infant Self-Regulation and Early Childhood Media Exposure. *Pediatrics.* 2014 April 14. PMID: 24733868.

186. **Christakis DA.** Interactive media use at younger than the age of 2 years: time to rethink the American Academy of Pediatrics guideline? *JAMA Pediatr.* 2014 May. PMID: 24615347.

187. Brockman LN, **Christakis DA,** *Moreno MA. Friending adolescents on social networking websites: a feasible research tool. *Journal of Interaction Science.* 2014 May 2. PMID: 25485226.

188. Jelenchick LA, Eickhoff J, **Christakis DA,** Brown RL, Zhang C, Benson M, *Moreno MA. The Problematic and Risky Internet Use Screening Scale (PRIUSS) for adolescents and young adults: Scale development and refinement. *Computers in Human Behavior.* 2014 June. PMID: 24882938.

189. Jelenchick LA, **Christakis DA**. Problematic internet use during adolescence and young adulthood. *Adolesc Med Stat Art Rev.* 2014 Dec; 25(3); 605-20. PMID: 27120888.

190. McCormick Erin, Kerns Suzanne EU, McPhillips Heather, Wright Jeffrey, **Christakis DA**, Rivara Frederick. Training Pediatric Residents to Provide Parent Education: A Randomized Controlled Trial. *Academic Pediatric.* 2014 Jul-Aug. PMID: 24976347.

191. Tandon Pooja S., Saelens Brian E., **Christakis DA.** Active Play Opportunities at Child Care. *Pediatrics.* 2015 May 18. PMID: 25986016.

192. Moreno MA,*Jelenchick LA, **Christakis DA.** Problematic Internet Use Among Young Adults: A Conceptual Framework *Computers in Human Behavior. In press.*

193. Jelenchick LA, Eickhoff J, Zhang C, Kraniger K, **Christakis DA**, Moreno MA. Screening for adolescent problematic internet use: Validation of the PRIUSS *Acad Pediar* 2015 Nov-Dec; 15(6) 658-65. PMID: 16547545.

194. Jelenchick LA, Eickhoff JE, **Christakis DA**, *Moreno MA**.** An exploratory factor analysis of the Young Internet Addiction Scale. *Psychiatry Research*. *In press.*

195. Waite, Whitney, **Christakis DA.** Mailed samples of infant formula and the association with breastfeeding duration and exclusivity. *Breastfeeding Medicine.* 2016 11(1) 21-5. PMID: 26701801.

196. Waite, Whitney, **Christakis DA.** Maternal perceptions of workplace breastfeeding support and its association with job satisfaction. *Breastfeeding Medicine.* 2015 May;10(4) 222-7. PMID: 25831141.

197. **Christakis DA**. Rethinking Attention Deficit Hyperactivity Disorder. *JAMA Pediatr*. 2016 Jan 4:1-2. doi: 10.1001/jamapediatrics.2015.3372.

198. Jelenchick LA, Eickhoff J, Zhang C, Kraninger K, **Christakis DA**, Moreno MA Screening for Adolescent Problematic Internet Use: Validation of the Problematic and Risky Internet Use Screening Scale (PRIUSS).. *Acad Pediatr*. 2015 Nov-Dec;15(6):658-65. doi: 10.1016/j.acap.2015.07.001.

199. Waite, Whitney, **Christakis DA**. The Impact of Mailed Samples of Infant Formula on Breastfeeding Rates. *Breastfeed Med.* 2016 Jan-Feb;11(1):21-5. doi: 10.1089/bfm.2015.0099. Epub 2015 Dec 24. PMID: 26701801.

200. Radesky JS, **Christakis DA**. Keeping Children's Attention: The Problem With Bells and Whistles. *JAMA Pediatr*. 2016 Feb;170(2):112-3. doi: 10.1001/jamapediatrics.2015.3877. No abstract available. PMID: 26720712.

201. **Christakis DA.** Rethinking Attention-Deficit/Hyperactivity Disorder. *JAMA Pediatr*. 2016 Feb;170(2):109-10. doi: 10.1001/jamapediatrics.2015.3372. No abstract available. PMID: 26746874.

202. Radesky JS, **Christakis DA**. Increased Screen Time: Implications for Early Childhood Development and Behavior. Pediatr Clin North Am. 2016 Oct;63(5):827-39. doi: 10.1016/j.pcl.2016.06.006. Review. PMID: 27565361.

203. **Christakis DA**. Focusing on the Smaller Adverse Childhood Experiences: The overlooked importance of Aces. *JAMA Pediatr*. 2016 Jun 13. doi: 10.1001/jamapediatrics.2016.0392. [Epub ahead of print] No abstract available. PMID: 27295168.

204. Ravinder S, Donckels EA, Ramirez JS, **Christakis DA**, Ramirez JM, Ferguson SM. Excessive Sensory Stimulation during Development Alters Neural Plasticity and Vulnerability to Cocaine in Mice. *eNeuro*. 2016 Aug 23;3(4). pii: ENEURO.0199-16.2016. doi: 10.1523/ENEURO.0199-16.2016. PMID: 27588306.

205. **Christakis DA** Virtual Violence COUNCIL ON COMMUNICATIONS AND MEDIA *Pediatrics*, Aug 2016, 138 (2) e20161298.

206. Wright DR, Lozano P, Dawson-Hahn E, **Christakis DA**, Haaland WL, Basu A. Parental Predictions and Perceptions Regarding Long-Term Childhood Obesity-Related Health Risks. *Acad Pediatr*. 2016 Jul;16(5):475-81. doi: 10.1016/j.acap.2016.02.007.

207. **Christakis DA.** In Support of Breastfeeding Support in Primary Care. *JAMA Pediatr*. 2016 Dec 1;170(12):1138-1139. doi: 10.1001/jamapediatrics.2016.3390.

208. Radesky JS, **Christakis DA**. Media and Young Minds COUNCIL ON COMMUNICATIONS AND MEDIA *Pediatrics*, Nov 2016, 138 (5) e20162591.

209. Thomas MB, Stapleton HM, Dills RL, Violette HD, **Christakis DA**, Sathyanarayana S. Demographics and dietary risk factors in relation to urinary metabolites of organophosphate flame retardants in toddlers. *Chemosphere*. 2017 Oct;185:918-925. doi: 10.1016/j.chemosphere.2017.07.015. Epub 2017 Jul 4. PMID: 28763939.

210. Wright DR, Lozano P, Dawson-Hahn E, **Christakis DA**, Haaland WL, Basu A. Parental optimism about childhood obesity-related disease risks. *Int J Obes (Lond)*. 2017 Oct;41(10):1467-1472. doi: 10.1038/ijo.2017.103. Epub 2017 May 3. PMID: 28465611; PMCID: PMC5626577.

211. **Christakis DA**, Ramirez JSB, Ferguson SM, Ravinder R, Ramirez JM. How early media exposure may affect cognitive function: A review of results from observations in humans and experiments in mice. *PNAS*. 2018 Oct;115(40); 9851-58. PMID: 30275319; PMCID: PMC6176595.

212. Tandon PS, Saelens BE, Zhou C, **Christakis DA.** A Comparison of Preschoolers' Physical Activity Indoors versus Outdoors at Child Care. *Int J Environ Res Public Health*. 2018 Nov;15(11):2463. PMID: 30400603.

213. Sathyanarayana S, Flynn JT, Messito MJ, Gross R, Whitlock KB, Kannan K, Karthikraj R, Morrison D, Huie M, **Christakis D**, Trasande L. Melamine and cyanuric acid exposure and kidney injury in US children. *Environ Res*. 2019 Apr;171:18-23. doi: 10.1016/j.envres.2018.10.038. Epub 2018 Nov 2. PMID: 30641369.

214. Tandon PS, Sasser T, Gonzalez ES, Whitlock KB, **Christakis DA**, Stein MA. Physical Activity, Screen Time, and Sleep in Children with ADHD. *J Phys Act Health*. 2019 Jun 1;16(6):416-422. doi: 10.1123/jpah.2018-0215. Epub 2019 May 5. PMID: 31056020.

215. **Christakis DA.** The Challenges of Defining and Studying "Digital Addiction" in Children. *JAMA*. 2019 Jun 18;321(23):2277-2278. PMID: 31095260.

216. **Christakis DA**, Lowry SJ, Goldberg G, Violette H, Garrison MM. Assessment of a Parent-Child Interaction for Language Development in Children. *JAMA Netw Open*. 2019 Jun 5;2(6):e195738. PMID: 31199447.

217. Galbraith AA, Carroll AE, **Christakis D.** JAMA Pediatrics Call for Papers on Election-Year Policies and Children's Health. *JAMA Pediatr*. 2019 Jul 22. Online ahead of print. PMID: 31329219.

218. **Christakis DA.** Decision to Publish Study on Maternal Fluoride Exposure During Pregnancy. *JAMA Pediatr.* 2019 Aug 19. Online ahead of print. PMID: 31424484.

219. Tandon PS, Downing KL, Saelens BE, **Christakis DA.** Two Approaches to Increase Physical Activity for Preschool Children in Child Care Centers: A Matched-Pair Cluster-Randomized Trial. *Int J Environ Res Public Health*. 2019 Oct 21;16(20):4020. PMID: 31640110.

220. Browne DT, May S, Hurst-Della Pietra P, **Christakis D**, Asamoah T, Hale L, Delrahim-Howlett K, Emond JA, Fiks AG, Madigan S, Prime H, Perlman G, Rumpf HJ, Thompson D, Uzzo S, Stapleton J, Neville R; Media Impact Screening Toolkit Workgroup of Children and Screens: Institute of Digital Media and Child Development. From 'screen time' to the digital level of analysis: protocol for a scoping review of digital media use in children and adolescents. *BMJ Open*. 2019 Nov 25;9(11):e032184. PMID: 31772098.

221. Trasande L, Aldana SI, Trachtman H, Kannan K, Morrison D, **Christakis DA**, Whitlock K, Messito MJ, Gross RS, Karthikraj R, Sathyanarayana S. Glyphosate exposures and kidney injury biomarkers in infants and young children. *Environ Pollut.* 2020 Jan;256:113334. Epub 2019 Oct 23. PMID: 31677874.

222. **Christakis DA.** JAMA Pediatrics-The Year in Review, 2019. *JAMA Pediatr*. 2020 Mar 23. Online ahead of print. PMID: 32202600.

223. Madigan S, McArthur BA, Anhorn C, Eirich R, **Christakis DA.** Associations Between Screen Use and Child Language Skills: A Systematic Review and Meta-analysis. *JAMA Pediatr*. 2020 Mar 23:e200327. Online ahead of print. PMID: 32202633.

224. **Christakis DA.** Early Media Exposure and Autism Spectrum Disorder: Heat and Light. *JAMA Pediatr.* 2020 Apr. Online ahead of print. PMID: 32310269.

225. **Christakis, D. A.** (2020). "School Reopening-The Pandemic Issue That Is Not Getting Its Due." JAMA Pediatr **174**(10): 928.

226. **Christakis, D. A.** (2020). "Pediatrics and COVID-19." JAMA **324**(12): 1147-1148.

227. **Christakis, D. A.**, W. Van Cleve and F. J. Zimmerman (2020). "Estimation of US Children's Educational Attainment and Years of Life Lost Associated With Primary School Closures During the Coronavirus Disease 2019 Pandemic." JAMA Netw Open **3**(11): e2028786.

228. Dibner, K. A., H. A. Schweingruber and **D. A. Christakis** (2020). "Reopening K-12 Schools During the COVID-19 Pandemic: A Report From the National Academies of Sciences, Engineering, and Medicine." JAMA **324**(9): 833-834.

229. Kroshus, E., M. Hawrilenko, P. S. Tandon and **D. A. Christakis** (2020). "Plans of US Parents Regarding School Attendance for Their Children in the Fall of 2020: A National Survey." JAMA Pediatr.

(b) Book Chapters

1. Kazak A, **Christakis D**. Caregiving issues in families of children with chronic medical conditions *Family Caregiving across the Life Cycle*. Kahana, E., Biegel, D., Wykle, M. (Editors). London: Sage Publications, 1994: 331-355.

2. Kazak A, **Christakis D**. Family responses to the stress from childhood cancer. *Intense Stress and Mental Disturbance in Children*. Pfeffer, CR. (Editor) Washington, DC: American Psychiatric Association Press, 1996: 277-306.

3. **Christakis DA**. Television viewing and attention problems. *Encyclopedia of Media and Children*. In press.

(c) Published books, video, software

1. Migita D, **Christakis DA**. *The Saint-Frances Guide to Pediatrics*. Lippincott Williams. Philadelphia, PA. 2003.

2. Garrison MM, **Christakis DA**. *A teacher in the living Room: Electronic media and babies, toddlers, and Preschoolers.* Kaiser Family Foundation. Dec 2005.

3. **Christakis DA**, Zimmerman FJ. *The Elephant in the Living Room: Make Television Work for your Kids*. Rodale, New York, NY. 2006.

(d) Other publications

(1). Book reviews and letters

1. Kazak A, **Christakis D**. Constant companion: living with chronic illness. [review] *Bulletin of the Menninger Clinic*. 1992; 56(4): 541-2..

2. Kazak A, **Christakis D**. Supporting families with a child with disability. [review] *The Child, Youth and Family Services Quarterly* 1992; 15: 12

3. **Christakis D**, Feudtner C. Becoming a doctor. [letter] *New England Journal of Medicine* 1994*;* 330:720

4. **Christakis DA**. Evidence-based Medicine: It's a Matter of Interpretation. *PediatricBasics*. 2000; 93:

5. **Christakis, DA**. Parental Smoking Cessation Counseling. *Arch Pediatr Adolesc Med.* 2001; 155: 15-16.

6. **Christakis DA**. Does Continuity of Care Matter? *West J Med* 2001 Jul;175(1):4.

7. **Christakis DA**. Systematic Reviews: A critical first step. *Arch Pediatr Adolesc Med.* 2001; 155: 636.

8. Juul-Dam N, Brunner S, Katzenellenbogen R, Silverstein M, **Christakis DA**. Does problem-based learning improve residents' self-directed learning? *Arch Pediatr Adolesc Med.* 2001; 155(6): 673-5.

9. **Christakis DA**. Evaluating articles about treatment. *Contemporary Pediatrics* 2003; May: 79-85.

10. **Christakis DA**. Continuity of care: process or outcome? *Ann Fam Med.* 2003 Sep-Oct;1(3):131-3.

11. Rivara FP, **Christakis DA,** Cummings P. Duplicate publication. What it is and how we determine it. *Arch Pediatr Adolesc Med*. 2004 Sep;158(9):926.

12. **Christakis DA**, Zimmerman FJ. Media as a public health issue. Arch Pediatr Adolesc Med, 2006. **160**(4): p. 445-6.

13. **Christakis DA.** What to do about the new and growing digital divide? *Arch Pediatr Adolesc Med*. 2007 Feb;161(2):204-5.

14. **Christakis DA**. Towards 21st century TV alchemy: Can we turn a toxic into a tonic. *Pediatrics* September 2007.

15. **Christakis DA**, Moreno MA. Trapped in the net: will internet addiction become a 21st-century epidemic? *Arch Pediatr Adolesc Med*. 2009 Oct;163(10):959-60.

(2). Selected Non-peer reviewed publications

1. Kazak A, **Christakis D**. Constant companion: living with chronic illness. [review] *Bulletin of the Menninger Clinic*. 1992; 56(4): 541-2.

2. Kazak A, **Christakis D**. Supporting families with a child with disability. [review] *The Child, Youth and Family Services Quarterly* 1992; 15:12.

3. **Christakis D**, Feudtner C. Becoming a doctor. [letter] *New England Journal of Medicine* 1994*;* 330:720.

4. **Christakis DA.** Evidence-based Medicine: It's a Matter of Interpretation. *Pediatric Basics*. 2000; 93: 12-16.

5. **Christakis DA.** Parental Smoking Cessation Counseling: It's about time. *Arch Pediatr Adolesc Med.* 2001; 155: 15-16.

6. **Christakis DA.** Does Continuity of Care Matter? *West J Med* 2001 Jul;175(1):4.

7. **Christakis DA.** Systematic Reviews: A critical first step. *Arch Pediatr Adolesc Med.* 2001; 155: 636.

8. Juul-Dam N, Brunner S, Katzenellenbogen R, Silverstein M, **Christakis DA.** Does problem-based learning improve residents' self-directed learning? *Arch Pediatr Adolesc Med.* 2001; 155(6): 673-5.

9. **Christakis DA**. Evaluating articles about treatment. *Contemporary Pediatrics* 2003; May: 79-85.

10. **Christakis DA**. Continuity of care: process or outcome? *Ann Fam Med.* 2003 Sep-Oct;1(3):131-3.

11. Rivara FP, **Christakis DA,** Cummings P. Duplicate publication. What it is and how we determine it *Arch Pediatr Adolesc Med*. 2004 Sep;158(9):926.

12. Radesky JS, **Christakis DA.** Keeping Children's Attention: The Problem With Bells and Whistles. *JAMA Pediatr*. 2015 Dec 23:1-2. doi: 10.1001/jamapediatrics.2015.3877.

17. OTHER

Invited Lectures

(a) National/International

1993 "*The Ethical Life of Medical Students,*" Presentation at the AMA and Directors of Medical Education Conference on Teaching and Assessing Professional Behavior: Models for Physicians in Training. Chicago, IL.

1995 *"Social Ecological Approach to Medical Student Ethical Development,"* Speech delivered at Association of American Medical Colleges' forum of promoting medical student ethical development. Washington, DC.

1996 *"Ethics and the art of confrontation,"* Speech delivered at the 107th Association of American Medical Colleges meeting. San Francisco, CA.

1997 *"Ethical Development of Trainees: Bridging the Knowledge-Behavior Gap,"* Keynote address. Canadian Bioethics Society Annual Meeting. Halifax, Nova Scotia

1999 "*Methodologic issues in Pediatric Outcomes Research,"* AHCPR conference, Washington, DC.

1999 *"Pediatric Evidence Based Medicine,"* American Academy of Pediatrics annual meeting. Washington, DC.

2001 *"Pediatric Evidence Based Medicine: Where it has come from; Where it is going."* Keynote address at Children's Hospital of Providence annual CME, Anchorage, AK.

2003 *"Television and attention problems in children."* The Cornfeld Endowed Lecture: Children's Hospital of Philadelphia.

2004 *"Studying the elephant in the family room: Medical and Social Science perspectives on the effects of television on young children."* Keynote address. Brain and Behavior Conference, Florence, AL.

2006 *Mediatrics: What pediatricians should know about early television viewing and child health outcomes*. Grand Rounds. Mott Children's Hospital Ann Arbor MI.

2006 *TV advertising as the hidden hand in the childhood obesity crisis.* NY State Obesity Summit. Albany, NY

2008 *Mediatrics: What pediatricians should know about infant TV viewing and language development.* Oregon Pediatric Society Annual Meeting, Portland, OR

2008 *TV's effects on early language and cognition*. Learning and the Brain Conference, San Francisco CA

2008 *Infant TV viewing and child development,* Sidbury invited professorship and Grand Rounds Duke University, Durham NC

2008 Visiting Professor and Keynote Speaker, Annual Hsin Yi Family Foundation Conference, Taipei Taiwan

2008 *Infant TV's effects on children's language development and attention spans.* Keynote speaker, Laverne University conference on child development

2009 *On the Hazards of a Technologized Infancy*. Boston University Visiting Professor.

2010 *The effects of early media on child development*. Plenary talk Excellence in Pediatrics Conference, London, England

2010 *Media and children: what physicians need to know.* Invited Lecture Karolinska Institute, Stockholm Sweden

2011 *Media Matters: What parents need to know.* Invited Community Lecture. London, Ontario

2011 *Of Mice and Children: Media's effects on infant development.* First Annual Health Services Research Conference, University of Indiana
2012 *Infant Media Effects:* University of Utah Visiting Professorship
2013 AAP Peds 21 Plenary Presentation
2014 Resources for Infant Development Annual Meeting Keynote, Los Angeles CA
2014 Sharjah Ladies Club, UAE

2015 National Academy of Sciences Sackler Symposium Keynote
2016 AAP Peds 21 Plenary Talk
2016 Majlis Presentation, His Highness Mohammed bin Zayed Al Nahyan
2017 Keynote Lecture Minnesota Spring Pediatric Congress
2017 Yale Goldenring Endowed Lecture
2019 WISE conference speaker, Qatar
2020 University of Alabama Bradford Dean Lecture

(b) Regional

1995 *"Professional Development of Physicians in Training,"* Grand Rounds at the Children's Hospital and Medical Center Seattle, WA.
2003 *"Can Information Technology Bridge the Quality Chasm?"* Grand rounds Children's Hospital and Regional Medical Center; Seattle, WA.
2005 *"Studying the elephant in the family room: Television and children."* Seattle Children's Hospital and Regional Medical Center Grand Rounds.
2007 *21st century well child care: The role of information technology.* Health Plans of Washington Summit. Chelan, WA.
2009 *On the Hazards of a Technologized Infancy.* Harborview Medical Center Psychiatry Grand Rounds

Exhibit B

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
TIKTOK3047MDL-054-LARK-0055999	TIKTOK3047MDL-054-LARK-0056027
SNAP3126937	SNAP3126949
SNAP3157225	SNAP3157284
META3047MDL-035-00001346	META3047MDL-035-00001346
META3047MDL-031-00193154	META3047MDL-031-00193159
META3047MDL-031-00170428	META3047MDL-031-00170437
META3047MDL-031-00120972	META3047MDL-031-00120984
META3047MDL-034-00136153	META3047MDL-034-00136163
META3047MDL-031-00121415	META3047MDL-031-00121429

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-031-00121430	META3047MDL-031-00121441
META3047MDL-031-00131309	META3047MDL-031-00131312
META3047MDL-031-00131639	META3047MDL-031-00131653
META3047MDL-022-00015380	META3047MDL-022-00015395
META3047MDL-047-01373649	META3047MDL-047-01373650
META3047MDL-031-00265655	META3047MDL-031-00265661
META3047MDL-031-00121448	META3047MDL-031-00121456

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-035-00005017	META3047MDL-035-00005017
META3047MDL-031-00024886	META3047MDL-031-00024933
META3047MDL-031-00029654	META3047MDL-031-00029706
META3047MDL-035-00002917	META3047MDL-035-00002917
META3047MDL-031-00262845	META3047MDL-031-00262852
META3047MDL-035-00005132	META3047MDL-035-00005146
TIKTOK3047MDL-001-00060817	TIKTOK3047MDL-001-00060872

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
TIKTOK3047MDL-001-00060862	TIKTOK3047MDL-001-00060917
META3047MDL-031-00265234	META3047MDL-031-00265250
META3047MDL-019-00123373	META3047MDL-019-00123519
META3047MDL-028-00001733	META3047MDL-028-00001742
META3047MDL-031-00246731	META3047MDL-031-00246734
META3047MDL-035-00002651	META3047MDL-035-00002658
TIKTOK3047MDL-001-00057954	TIKTOK3047MDL-001-00058133
META3047MDL-031-00242502	META3047MDL-031-00242504
TIKTOK3047MDL-001-00060814	TIKTOK3047MDL-001-00060830
META3047MDL-014-00356640	META3047MDL-014-00356641
META3047MDL-031-00242612	META3047MDL-031-00242616
META3047MDL-003-00053803	META3047MDL-003-00053805

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-003-00171018	META3047MDL-003-00171020
META3047MDL-031-00118103	META3047MDL-031-00118105
META3047MDL-014-00014801	META3047MDL-014-00014803
META3047MDL-035-00002761	META3047MDL-035-00002761
META3047MDL-014-00355558	META3047MDL-014-00355564
META3047MDL-019-00127577	META3047MDL-019-00127590
META3047MDL-003-00078598	META3047MDL-003-00078599
META3047MDL-003-00169733	META3047MDL-003-00169734

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-014-00355284	META3047MDL-014-00355285
META3047MDL-031-00251445	META3047MDL-031-00251446
META3047MDL-003-00078419	META3047MDL-003-00078425
META3047MDL-003-00077939	META3047MDL-003-00077940
META3047MDL-003-00188109	META3047MDL-003-00188115
META3047MDL-014-00355137	META3047MDL-014-00355138
META3047MDL-031-00255353	META3047MDL-031-00255354
META3047MDL-019-00120925	META3047MDL-019-00120937
META3047MDL-019-00097173	META3047MDL-019-00097173

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-003-00186838	META3047MDL-003-00186840
META3047MDL-034-00056779	META3047MDL-034-00056799
META3047MDL-071-00000537	META3047MDL-071-00000600
META3047MDL-003-00186841	META3047MDL-003-00186885
META3047MDL-031-00089407	META3047MDL-031-00089430
META3047MDL-014-00352799	META3047MDL-014-00352802
META3047MDL-003-00184585	META3047MDL-003-00184589
META3047MDL-083-00000001	META3047MDL-083-00000006
META3047MDL-003-00163233	META3047MDL-003-00163254

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-019-00119896	META3047MDL-019-00119896
META3047MDL-003-00030117	META3047MDL-003-00030117
META3047MDL-014-00352250	META3047MDL-014-00352251
META3047MDL-003-00030070	META3047MDL-003-00030071
META3047MDL-003-00029988	META3047MDL-003-00030011
META3047MDL-003-00123666	META3047MDL-003-00123667
SNAP0000103	SNAP0000136
META3047MDL-003-00161686	META3047MDL-003-00161686
META3047MDL-014-00351807	META3047MDL-014-00351809
Haugen_00010114	Haugen_00010127
Haugen_00005378	Haugen_00005390
META3047MDL-003-00121808	META3047MDL-003-00121810
META3047MDL-015-00000400	META3047MDL-015-00000400
META3047MDL-003-00013254	META3047MDL-003-00013255

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-003-00012994	META3047MDL-003-00012998
META3047MDL-004-00027398	META3047MDL-004-00027446
META3047MDL-014-00350817	META3047MDL-014-00350819
META3047MDL-003-00119838	META3047MDL-003-00119840
META3047MDL-003-00071534	META3047MDL-003-00071545
META3047MDL-003-00011697	META3047MDL-003-00011702
META3047MDL-003-00011760	META3047MDL-003-00011762
META3047MDL-034-00027362	META3047MDL-034-00027403
Haugen_00021096	Haugen_00021143
META3047MDL-035-00007047	META3047MDL-035-00007047
META3047MDL-003-00159559	META3047MDL-003-00159566
TIKTOK3047MDL-001-00060877	TIKTOK3047MDL-001-00060940
TIKTOK3047MDL-001-00060922	TIKTOK3047MDL-001-00060985
META3047MDL-003-00028214	META3047MDL-003-00028219

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-014-00350154	META3047MDL-014-00350159
Haugen_00012303	Haugen_00012320
META3047MDL-019-00022520	META3047MDL-019-00022548
META3047MDL-003-00068860	META3047MDL-003-00068862
SNAP0000137	SNAP0000154
META3047MDL-003-00064697	META3047MDL-003-00064701
META3047MDL-003-00028019	META3047MDL-003-00028020
META3047MDL-031-00084889	META3047MDL-031-00084917
META3047MDL-003-00042548	META3047MDL-003-00042553

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-014-00349432	META3047MDL-014-00349436
META3047MDL-014-00349418	META3047MDL-014-00349421
META3047MDL-003-00107197	META3047MDL-003-00107200
Haugen_00015958	Haugen_00016000
Haugen_00019219	Haugen_00019275
META3047MDL-003-00009133	META3047MDL-003-00009134
Haugen_00005458	Haugen_00005869
Haugen_00011969	Haugen_00011983
META3047MDL-003-00157133	META3047MDL-003-00157137
Haugen_00016373	Haugen_00016502
META3047MDL-003-00157020	META3047MDL-003-00157027
META3047MDL-003-00157036	META3047MDL-003-00157037
Haugen_00017263	Haugen_00017300
Haugen_00008207	Haugen_00008255

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-003-00103260	META3047MDL-003-00103260
META3047MDL-003-00156702	META3047MDL-003-00156730
META3047MDL-020-00535383	META3047MDL-020-00535400
Haugen_00007481	Haugen_00007503
TIKTOK3047MDL-001-00000622	TIKTOK3047MDL-001-00000690
Haugen_00007350	Haugen_00007465
Haugen_00021247	Haugen_00021281
META3047MDL-003-00153157	META3047MDL-003-00153160
META3047MDL-003-00153063	META3047MDL-003-00153067
META3047MDL-003-00178333	META3047MDL-003-00178337
META3047MDL-031-00137474	META3047MDL-031-00137489
Haugen_00020135	Haugen_00020196
META3047MDL-019-00106590	META3047MDL-019-00106601
Haugen_00023066	Haugen_00023086

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-003-00093303	META3047MDL-003-00093304
Haugen_00017069	Haugen_00017176
META3047MDL-035-00002796	META3047MDL-035-00002796
Haugen_00003463	Haugen_00003465
META3047MDL-003-00178437	META3047MDL-003-00178438
Haugen_00006798	Haugen_00006813
META3047MDL-047-00097321	META3047MDL-047-00097342
Haugen_00020607	Haugen_00020626
META3047MDL-019-00106371	META3047MDL-019-00106390
META3047MDL-003-00089174	META3047MDL-003-00089178
META3047MDL-003-00089107	META3047MDL-003-00089110
Haugen_00024450	Haugen_00024468
META3047MDL-003-00087111	META3047MDL-003-00087117
META3047MDL-020-00588248	META3047MDL-020-00588267
Haugen_00023087	Haugen_00023100

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Bates Beg	Bates End
META3047MDL-003-00176638	META3047MDL-003-00176657
Haugen_00007055	Haugen_00007062
META3047MDL-003-00043617	META3047MDL-003-00043661
META3047MDL-003-00068863	META3047MDL-003-00068907
Haugen_00024997	Haugen_00025044
META3047MDL-003-00086015	META3047MDL-003-00086016
TIKTOK3047MDL-001-00000215	TIKTOK3047MDL-001-00000256
META3047MDL-003-00146492	META3047MDL-003-00146501
META3047MDL-084-00000400	META3047MDL-084-00000404
META3047MDL-003-00003731	META3047MDL-003-00003732
Haugen_00000797	Haugen_00000882
Haugen_00017177	Haugen_00017237
META3047MDL-031-00048769	META3047MDL-031-00048808
META3047MDL-003-00003188	META3047MDL-003-00003189
SNAP0000008	SNAP0000008
Haugen_00021690	Haugen_00021731

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Bates Beg	Bates End
TIKTOK3047MDL-001-00058090	TIKTOK3047MDL-001-00058097
META3047MDL-014-00346869	META3047MDL-014-00346873
Haugen_00017698	Haugen_00017786
Haugen_00006240	Haugen_00006261
META3047MDL-003-00146240	META3047MDL-003-00146260
META3047MDL-014-00359270	META3047MDL-014-00359336
TIKTOK3047MDL-001-00000177	TIKTOK3047MDL-001-00000181
Haugen_00008303	Haugen_00008315
Haugen_00002372	Haugen_00002396
Haugen_00000934	Haugen_00000969
META3047MDL-020-00479648	META3047MDL-020-00479656
META3047MDL-003-00082165	META3047MDL-003-00082169
META3047MDL-014-00346525	META3047MDL-014-00346526

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Bates Beg	Bates End
Haugen_00023849	Haugen_00023895
Haugen_00016893	Haugen_00016920
Haugen_00001033	Haugen_00001064
GOOG-3047MDL-00204566	GOOG-3047MDL-00204566
TIKTOK3047MDL-024-LARK-00043697	TIKTOK3047MDL-024-LARK-00043699
META3047MDL-003-00170806	META3047MDL-003-00170855
TIKTOK3047MDL-001-00002975	TIKTOK3047MDL-001-00003039
Haugen_00003739	Haugen_00003744
Haugen_00017238	Haugen_00017242
Haugen_00002527	Haugen_00002568
Haugen_00007080	Haugen_00007101
Haugen_00016728	Haugen_00016750
Haugen_00016699	Haugen_00016716
Haugen_00025741	Haugen_00025764
META3047MDL-003-00000029	META3047MDL-003-00000094
META3047MDL-003-00001846	META3047MDL-003-00001889
META3047MDL-003-00028226	META3047MDL-003-00028226
META3047MDL-003-00161881	META3047MDL-003-00161923
META3047MDL-003-00171899	META3047MDL-003-00171923
META3047MDL-020-00535571	META3047MDL-020-00535609
META3047MDL-020-00538452	META3047MDL-020-00538455
SNAP0000001	SNAP0000007
SNAP0000246	SNAP0000253

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Bates Beg	Bates End
TIKTOK3047MDL-001-00000769	TIKTOK3047MDL-001-00000802
TIKTOK3047MDL-001-00000813	TIKTOK3047MDL-001-00000817
TIKTOK3047MDL-001-00002375	TIKTOK3047MDL-001-00002376
TIKTOK3047MDL-001-00002937	TIKTOK3047MDL-001-00002980
TIKTOK3047MDL-001-00060811	TIKTOK3047MDL-001-00060816
TIKTOK3047MDL-001-00060941	TIKTOK3047MDL-001-00061214
SNAP7148843	SNAP7148854
META3047MDL-003-00160083	META3047MDL-003-00160085
META3047MDL-003-00160424	META3047MDL-003-00160431
META3047MDL-020-00342154	META3047MDL-020-00342154
META3047MDL-020-00342155	META3047MDL-020-00342155
SNAP5950589	SNAP5950610
TIKTOK3047MDL-001-00061286	TIKTOK3047MDL-001-00061312
TIKTOK3047MDL-004-00122686	TIKTOK3047MDL-004-00122690
TIKTOK3047MDL-015-00341931	TIKTOK3047MDL-015-00342393
TIKTOK3047MDL-015-00342728	TIKTOK3047MDL-015-00342746
TIKTOK3047MDL-015-00343407	TIKTOK3047MDL-015-00343435
TIKTOK3047MDL-015-00343527	TIKTOK3047MDL-015-00343552
TIKTOK3047MDL-016-00351969	TIKTOK3047MDL-016-00351971
TIKTOK3047MDL-056-00964171	TIKTOK3047MDL-056-00964425
TIKTOK3047MDL-060-01110007	TIKTOK3047MDL-060-01110041
TIKTOK3047MDL-060-01158658	TIKTOK3047MDL-060-01158678
TIKTOK3047MDL-069-01206536	TIKTOK3047MDL-069-01206545

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Bates Beg	Bates End
TIKTOK3047MDL-115-04352891	TIKTOK3047MDL-115-04352898
GOOG-3047MDL-00000001	GOOG-3047MDL-00000026
META3047MDL-003-00021048	META3047MDL-003-00021069
META3047MDL-003-00028701	META3047MDL-003-00028703
META3047MDL-003-00042307	META3047MDL-003-00042311
META3047MDL-003-00045087	META3047MDL-003-00045089
META3047MDL-003-00045154	META3047MDL-003-00045164
META3047MDL-003-00053543	META3047MDL-003-00053544
META3047MDL-003-00066361	META3047MDL-003-00066405
META3047MDL-003-00071396	META3047MDL-003-00071405
META3047MDL-003-00079909	META3047MDL-003-00079911
META3047MDL-003-00083199	META3047MDL-003-00083222
META3047MDL-003-00086451	META3047MDL-003-00086465
META3047MDL-003-00089132	META3047MDL-003-00089140
META3047MDL-003-00089141	META3047MDL-003-00089146
META3047MDL-003-00089823	META3047MDL-003-00089824
META3047MDL-003-00095008	META3047MDL-003-00095034
META3047MDL-003-00095993	META3047MDL-003-00096010
META3047MDL-003-00096948	META3047MDL-003-00096991
META3047MDL-003-00106174	META3047MDL-003-00106217

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Bates Beg	Bates End
META3047MDL-003-00109173	META3047MDL-003-00109239
META3047MDL-003-00118507	META3047MDL-003-00118522
META3047MDL-003-00120590	META3047MDL-003-00120617
META3047MDL-003-00121726	META3047MDL-003-00121726
META3047MDL-003-00132592	META3047MDL-003-00132636
META3047MDL-003-00132740	META3047MDL-003-00132836
META3047MDL-003-00134794	META3047MDL-003-00134796
META3047MDL-003-00144400	META3047MDL-003-00144403
META3047MDL-003-00144500	META3047MDL-003-00144504
META3047MDL-003-00151869	META3047MDL-003-00151876
META3047MDL-003-00156508	META3047MDL-003-00156512
META3047MDL-003-00156888	META3047MDL-003-00156916
META3047MDL-003-00157185	META3047MDL-003-00157189
META3047MDL-003-00159293	META3047MDL-003-00159296
META3047MDL-003-00175114	META3047MDL-003-00175118
META3047MDL-003-00175961	META3047MDL-003-00175995
META3047MDL-003-00178107	META3047MDL-003-00178131
META3047MDL-003-00178926	META3047MDL-003-00178938
META3047MDL-004-00002225	META3047MDL-004-00002237
META3047MDL-004-00027515	META3047MDL-004-00027533
META3047MDL-005-00000096	META3047MDL-005-00000131
META3047MDL-013-00000612	META3047MDL-013-00000616
META3047MDL-014-00275614	META3047MDL-014-00275614

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Bates Beg	Bates End
META3047MDL-031-00246746	META3047MDL-031-00246762
META3047MDL-034-00251794	META3047MDL-034-00251794
META3047MDL-034-00337750	META3047MDL-034-00337759
META3047MDL-037-00007064	META3047MDL-037-00007075
META3047MDL-037-00058094	META3047MDL-037-00058129
META3047MDL-044-00077299	META3047MDL-044-00077299
META3047MDL-047-01197619	META3047MDL-047-01197619
META3047MDL-053-00048552	META3047MDL-053-00048576
META3047MDL-079-00000177	META3047MDL-079-00000272
META3047MDL-087-00030017	META3047MDL-087-00030114
META3047MDL-092-00003365	META3047MDL-092-00003372
META3047MDL-106-00000004	META3047MDL-106-00000039
META3047MDL-113-00082996	META3047MDL-113-00082998
SNAP0188592	SNAP0188614
SNAP0685579	SNAP0685584
SNAP1831415	SNAP1831415
SNAP1894507	SNAP1894507
SNAP2183204	SNAP2183275
SNAP2519329	SNAP2519335
SNAP2676224	SNAP2676228
SNAP3840584	SNAP3840584
SNAP3843487	SNAP3843488
SNAP4137645	SNAP4137646
SNAP4306791	SNAP4306794
SNAP4416908	SNAP4416914
SNAP4427929	SNAP4427945
SNAP4723815	SNAP4723826

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Bates Beg	Bates End
SNAP4911296	SNAP4911298
SNAP4955371	SNAP4955382
SNAP5059169	SNAP5059321
SNAP5123134	SNAP5123165
SNAP5300084	SNAP5300120

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Bates Beg	Bates End
SNAP5442338	SNAP5442358
SNAP5499098	SNAP5499127
SNAP5557063	SNAP5557107
SNAP5567580	SNAP5567588
SNAP5573679	SNAP5573690
SNAP5852948	SNAP5852968
SNAP6050928	SNAP6050936
SNAP6110503	SNAP6110505
SNAP6145093	SNAP6145115
TIKTOK3047MDL-060-01155277	TIKTOK3047MDL-060-01155279
TIKTOK3047MDL-060-01160939	TIKTOK3047MDL-060-01160990
TIKTOK3047MDL-060-01160991	TIKTOK3047MDL-060-01161052
SNAP6110234	SNAP6110234
GOOG-3047MDL-05713335	GOOG-3047MDL-05713337
GOOG-3047MDL-05692313	GOOG-3047MDL-05692482
GOOG-3047MDL-04269559	GOOG-3047MDL-04269662
GOOG-3047MDL-05711561	GOOG-3047MDL-05711573
GOOG-3047MDL-05712622	GOOG-3047MDL-05712634

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Bates Beg	Bates End
GOOG-3047MDL-02328077	GOOG-3047MDL-02328088
GOOG-3047MDL-02328163	GOOG-3047MDL-02328163
META3047MDL-038-00000234	META3047MDL-038-00000247
GOOG-3047MDL-02194639	GOOG-3047MDL-02194639
GOOG-3047MDL-02185032	GOOG-3047MDL-02185109
GOOG-3047MDL-03526606	GOOG-3047MDL-03526626
GOOG-3047MDL-04585554	GOOG-3047MDL-04585564
TIKTOK3047MDL-023-00636163	TIKTOK3047MDL-023-00636163
TIKTOK3047MDL-023-00715222	TIKTOK3047MDL-023-00715222
GOOG-3047MDL-02938010	GOOG-3047MDL-02938010
GOOG-3047MDL-02937495	GOOG-3047MDL-02937517
GOOG-3047MDL-05704979	GOOG-3047MDL-05705084
GOOG-3047MDL-05705191	GOOG-3047MDL-05705401
GOOG-3047MDL-05710407	GOOG-3047MDL-05710407
TIKTOK3047MDL-016-00344108	TIKTOK3047MDL-016-00344108
SNAP0004800	SNAP0004800
SNAP0004802	SNAP0004802
TIKTOK3047MDL-084-LARK-03068759	TIKTOK3047MDL-084-LARK-03068797
SNAP1285001	SNAP1285079
SNAP1287052	SNAP1287128
GOOG-3047MDL-02172004	GOOG-3047MDL-02172195
META3047MDL-072-00715443	META3047MDL-072-00715443
GOOG-3047MDL-02169773	GOOG-3047MDL-02169798
SNAP2096698	SNAP2096699
GOOG-3047MDL-04605758	GOOG-3047MDL-04605763
GOOG-3047MDL-02324910	GOOG-3047MDL-02324910
GOOG-3047MDL-03596273	GOOG-3047MDL-03596273

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Bates Beg	Bates End
GOOG-3047MDL-02442044	GOOG-3047MDL-02442044
GOOG-3047MDL-03359281	GOOG-3047MDL-03359302
GOOG-3047MDL-04703742	GOOG-3047MDL-04703746
GOOG-3047MDL-01785937	GOOG-3047MDL-01785937
GOOG-3047MDL-00442481	GOOG-3047MDL-00442481
GOOG-3047MDL-05101508	GOOG-3047MDL-05101530
GOOG-3047MDL-01342809	GOOG-3047MDL-01342819
GOOG-3047MDL-03277297	GOOG-3047MDL-03277368
SNAP3074358	SNAP3074435
GOOG-3047MDL-01412811	GOOG-3047MDL-01412943
GOOG-3047MDL-01977358	GOOG-3047MDL-01977365
SNAP4767879	SNAP4767957
GOOG-3047MDL-00780619	GOOG-3047MDL-00780631
GOOG-3047MDL-00854334	GOOG-3047MDL-00854362
GOOG-3047MDL-01339056	GOOG-3047MDL-01339106
GOOG-3047MDL-01435767	GOOG-3047MDL-01435767
GOOG-3047MDL-05100478	GOOG-3047MDL-05100482
TIKTOK3047MDL-021-LARK-00014427	TIKTOK3047MDL-021-LARK-00014428
GOOG-3047MDL-04503606	GOOG-3047MDL-04503606
GOOG-3047MDL-02163259	GOOG-3047MDL-02163259
GOOG-3047MDL-03506846	GOOG-3047MDL-03506853
GOOG-3047MDL-00045137	GOOG-3047MDL-00045153
GOOG-3047MDL-00414697	GOOG-3047MDL-00414705

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Bates Beg	Bates End
GOOG-3047MDL-00808421	GOOG-3047MDL-00808421
GOOG-3047MDL-00012460	GOOG-3047MDL-00012462
GOOG-3047MDL-00408442	GOOG-3047MDL-00408442
GOOG-3047MDL-00411255	GOOG-3047MDL-00411255
GOOG-3047MDL-01922869	GOOG-3047MDL-01922879
TIKTOK3047MDL-058-LARK-00710555	TIKTOK3047MDL-058-LARK-00710564
GOOG-3047MDL-00009463	GOOG-3047MDL-00009472
GOOG-3047MDL-01433964	GOOG-3047MDL-01434072
GOOG-3047MDL-00402820	GOOG-3047MDL-00402820
GOOG-3047MDL-00403435	GOOG-3047MDL-00403435
GOOG-3047MDL-00807297	GOOG-3047MDL-00807297
SNAP3711959	SNAP3712129
GOOG-3047MDL-00865565	GOOG-3047MDL-00865565
GOOG-3047MDL-02436956	GOOG-3047MDL-02436969
GOOG-3047MDL-00213861	GOOG-3047MDL-00213870

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Bates Beg	Bates End
GOOG-3047MDL-00647420	GOOG-3047MDL-00647420
GOOG-3047MDL-00665175	GOOG-3047MDL-00665175
SNAP3702950	SNAP3702953
GOOG-3047MDL-03504706	GOOG-3047MDL-03504711
SNAP2316618	SNAP2316620
TIKTOK3047MDL-044-00839323	TIKTOK3047MDL-044-00839326
TIKTOK3047MDL-072-LARK-01137552	TIKTOK3047MDL-072-LARK-01137556
SNAP2316627	SNAP2316665
GOOG-3047MDL-00394672	GOOG-3047MDL-00394681
GOOG-3047MDL-04310272	GOOG-3047MDL-04310278
META3047MDL-047-01205048	META3047MDL-047-01205049
GOOG-3047MDL-00553311	GOOG-3047MDL-00553329
GOOG-3047MDL-05665186.ECM	GOOG-3047MDL-05665207.ECM
TIKTOK3047MDL-006-00326005	TIKTOK3047MDL-006-00326005

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Bates Beg	Bates End
GOOG-3047MDL-05053396	GOOG-3047MDL-05053396
SNAP1281651	SNAP1281671
TIKTOK3047MDL-006-00325873	TIKTOK3047MDL-006-00325911
TIKTOK3047MDL-006-00327088	TIKTOK3047MDL-006-00327090
TIKTOK3047MDL-006-00327425	TIKTOK3047MDL-006-00327445
TIKTOK3047MDL-056-00952288	TIKTOK3047MDL-056-00952291
TIKTOK3047MDL-060-01155581	TIKTOK3047MDL-060-01155594
SNAP2987900	SNAP2987902
TIKTOK3047MDL-007-00327815	TIKTOK3047MDL-007-00327871
SNAP2076002	SNAP2076003
GOOG-3047MDL-03499498	GOOG-3047MDL-03499513
META3047MDL-039-00000058	META3047MDL-039-00000078
GOOG-3047MDL-00804080	GOOG-3047MDL-00804100
GOOG-3047MDL-04068497	GOOG-3047MDL-04068505
GOOG-3047MDL-03388306	GOOG-3047MDL-03388319
GOOG-3047MDL-00864164	GOOG-3047MDL-00864164
GOOG-3047MDL-01766902	GOOG-3047MDL-01766904
GOOG-3047MDL-02353923	GOOG-3047MDL-02353923
GOOG-3047MDL-02501314	GOOG-3047MDL-02501320
GOOG-3047MDL-00000048	GOOG-3047MDL-00000050
GOOG-3047MDL-00000053	GOOG-3047MDL-00000057
GOOG-3047MDL-00000058	GOOG-3047MDL-00000063
GOOG-3047MDL-00000064	GOOG-3047MDL-00000067
GOOG-3047MDL-00000252	GOOG-3047MDL-00000254

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Bates Beg	Bates End
GOOG-3047MDL-00000258	GOOG-3047MDL-00000261
GOOG-3047MDL-00000262	GOOG-3047MDL-00000264
SNAP2311510	SNAP2311519
GOOG-3047MDL-02435420	GOOG-3047MDL-02435420
GOOG-3047MDL-02435441	GOOG-3047MDL-02435441
GOOG-3047MDL-00551136	GOOG-3047MDL-00551136
GOOG-3047MDL-04973896	GOOG-3047MDL-04973896
SNAP3664412	SNAP3664415
GOOG-3047MDL-00117617	GOOG-3047MDL-00117617
GOOG-3047MDL-00803402	GOOG-3047MDL-00803402
GOOG-3047MDL-02313239	GOOG-3047MDL-02313239
META3047MDL-040-00056476	META3047MDL-040-00056529
GOOG-3047MDL-00646316	GOOG-3047MDL-00646316
GOOG-3047MDL-00275948	GOOG-3047MDL-00276387
TIKTOK3047MDL-004-00316891	TIKTOK3047MDL-004-00316891
SNAP2926182	SNAP2926192
SNAP2924607	SNAP2924607
GOOG-3047MDL-00898168	GOOG-3047MDL-00898168
SNAP0002558	SNAP0002566
TIKTOK3047MDL-004-00311638	TIKTOK3047MDL-004-00311702
TIKTOK3047MDL-002-00077367	TIKTOK3047MDL-002-00077427
SNAP3652736	SNAP3652813
SNAP5197673	SNAP5197749

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Bates Beg	Bates End
TIKTOK3047MDL-067-LARK-00989338	TIKTOK3047MDL-067-LARK-00989
GOOG-3047MDL-01372609	GOOG-3047MDL-01372681
SNAP1251784	SNAP1251785
GOOG-3047MDL-02499068	GOOG-3047MDL-02499078
SNAP4699129	SNAP4699130
GOOG-3047MDL-01453609	GOOG-3047MDL-01453613
GOOG-3047MDL-03906534	GOOG-3047MDL-03906609
GOOG-3047MDL-02144626	GOOG-3047MDL-02144690
TIKTOK3047MDL-021-LARK-00014689	TIKTOK3047MDL-021-LARK-00014692
SNAP2897372	SNAP2897376
SNAP4694745	SNAP4694775
SNAP2896831	SNAP2896834
GOOG-3047MDL-00802141	GOOG-3047MDL-00802148
GOOG-3047MDL-04191118	GOOG-3047MDL-04191125
GOOG-3047MDL-03492168	GOOG-3047MDL-03492367
SNAP3626065	SNAP3626067
GOOG-3047MDL-00801921	GOOG-3047MDL-00801925
GOOG-3047MDL-04728903	GOOG-3047MDL-04728905
SNAP2883624	SNAP2883647
SNAP2043503	SNAP2043504
META3047MDL-072-00704205	META3047MDL-072-00704207
SNAP2298677	SNAP2298691

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Bates Beg	Bates End
TIKTOK3047MDL-004-00257578	TIKTOK3047MDL-004-00257579
META3047MDL-065-00240362	META3047MDL-065-00240383
META3047MDL-031-00131562	META3047MDL-031-00131572
SNAP0019456	SNAP0019464
SNAP0471925	SNAP0471933
GOOG-3047MDL-00236723	GOOG-3047MDL-00236723
TIKTOK3047MDL-089-03736501	TIKTOK3047MDL-089-03736511
GOOG-3047MDL-04343712	GOOG-3047MDL-04343713
TIKTOK3047MDL-017-00361022	TIKTOK3047MDL-017-00361022
SNAP0019241	SNAP0019243
GOOG-3047MDL-03385518	GOOG-3047MDL-03385523
SNAP4679915	SNAP4679966
GOOG-3047MDL-01552207	GOOG-3047MDL-01552210
SNAP0019128	SNAP0019150
SNAP0019153	SNAP0019175
SNAP0019103	SNAP0019125
SNAP0019094	SNAP0019102

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Bates Beg	Bates End
TIKTOK3047MDL-004-00141896	TIKTOK3047MDL-004-00141901
GOOG-3047MDL-00547397	GOOG-3047MDL-00547397
TIKTOK3047MDL-099-LARK-04519067	TIKTOK3047MDL-099-LARK-04519099
SNAP0464451	SNAP0464455
TIKTOK3047MDL-002-00100047	TIKTOK3047MDL-002-00100093
GOOG-3047MDL-04882611	GOOG-3047MDL-04882611
SNAP4281401	SNAP4281432
SNAP2014853	SNAP2014876
GOOG-3047MDL-04495322	GOOG-3047MDL-04495397
TIKTOK3047MDL-002-00091621	TIKTOK3047MDL-002-00091633
TIKTOK3047MDL-078-LARK-01368033	TIKTOK3047MDL-078-LARK-01368036
TIKTOK3047MDL-002-00099983	TIKTOK3047MDL-002-00099989
GOOG-3047MDL-01751480	GOOG-3047MDL-01751481
TIKTOK3047MDL-004-00151118	TIKTOK3047MDL-004-00151124
TIKTOK3047MDL-004-00225450	TIKTOK3047MDL-004-00225457
TIKTOK3047MDL-004-00308575	TIKTOK3047MDL-004-00308583
TIKTOK3047MDL-002-00101838	TIKTOK3047MDL-002-00101846
TIKTOK3047MDL-002-00101847	TIKTOK3047MDL-002-00101861
SNAP2857789	SNAP2857822
GOOG-3047MDL-04579493	GOOG-3047MDL-04579493
GOOG-3047MDL-01749873	GOOG-3047MDL-01749873
GOOG-3047MDL-01206344	GOOG-3047MDL-01206348
TIKTOK3047MDL-002-00083974	TIKTOK3047MDL-002-00083976

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Bates Beg	Bates End
META3047MDL-163-00005993	META3047MDL-163-00006014
TIKTOK3047MDL-002-00120082	TIKTOK3047MDL-002-00120083
META3047MDL-050-00215087	META3047MDL-050-00215087
SNAP4798341	SNAP4798353
META3047MDL-047-00977914	META3047MDL-047-00977914
SNAP1284262	SNAP1284292
TIKTOK3047MDL-060-01120905	TIKTOK3047MDL-060-01120917
GOOG-3047MDL-02132875	GOOG-3047MDL-02132890
SNAP1944733	SNAP1944734
SNAP1942575	SNAP1942576
TIKTOK3047MDL-067-LARK-01022641	TIKTOK3047MDL-067-LARK-01022645
TIKTOK3047MDL-056-00987598	TIKTOK3047MDL-056-00987608
TIKTOK3047MDL-078-LARK-01708409	TIKTOK3047MDL-078-LARK-01708409
TIKTOK3047MDL-078-LARK-01708413	TIKTOK3047MDL-078-LARK-01708413
GOOG-3047MDL-00799590	GOOG-3047MDL-00799590
SNAP1219126	SNAP1219127
SNAP1937542	SNAP1937560
TIKTOK3047MDL-024-LARK-00063289	TIKTOK3047MDL-024-LARK-00063303
GOOG-3047MDL-03080564	GOOG-3047MDL-03080699
SNAP4637142	SNAP4637167
TIKTOK3047MDL-002-00091456	TIKTOK3047MDL-002-00091459
SNAP2268186	SNAP2268198
SNAP0423280	SNAP0423284
SNAP3578884	SNAP3579040

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Bates Beg	Bates End
SNAP4630879	SNAP4631035
GOOG-3047MDL-01963802	GOOG-3047MDL-01963804
GOOG-3047MDL-02653013	GOOG-3047MDL-02653018
GOOG-3047MDL-02858727	GOOG-3047MDL-02858757
GOOG-3047MDL-03343214	GOOG-3047MDL-03343250
SNAP1910063	SNAP1910065
TIKTOK3047MDL-002-00087370	TIKTOK3047MDL-002-00087381
TIKTOK3047MDL-002-00119426	TIKTOK3047MDL-002-00119442
GOOG-3047MDL-01289501	GOOG-3047MDL-01289502
SNAP4235758	SNAP4235767
TIKTOK3047MDL-002-00118748	TIKTOK3047MDL-002-00118784
SNAP0016526	SNAP0016572
GOOG-3047MDL-01371725	GOOG-3047MDL-01371752
GOOG-3047MDL-00798577	GOOG-3047MDL-00798583
GOOG-3047MDL-01288827	GOOG-3047MDL-01288832
META3047MDL-040-00197549	META3047MDL-040-00197549
TIKTOK3047MDL-036-LARK-00150084	TIKTOK3047MDL-036-LARK-00150088
META3047MDL-040-00200757	META3047MDL-040-00200757
TIKTOK3047MDL-023-00658004	TIKTOK3047MDL-023-00658005

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Bates Beg	Bates End
SNAP5154720	SNAP5154769
GOOG-3047MDL-02299400	GOOG-3047MDL-02299401
SNAP0716336	SNAP0716367
GOOG-3047MDL-01371645	GOOG-3047MDL-01371645
META3047MDL-034-00504412	META3047MDL-034-00504412
SNAP1234546	SNAP1234597
TIKTOK3047MDL-079-LARK-02066585	TIKTOK3047MDL-079-LARK-02066591
TIKTOK3047MDL-036-LARK-00173301	TIKTOK3047MDL-036-LARK-00173301
Haugen_00021372	Haugen_00021394
TIKTOK3047MDL-036-LARK-00106162	TIKTOK3047MDL-036-LARK-00106169
SNAP0404262	SNAP0404318
TIKTOK3047MDL-021-LARK-00009049	TIKTOK3047MDL-021-LARK-00009055
META3047MDL-014-00244582	META3047MDL-014-00244584
TIKTOK3047MDL-004-00149154	TIKTOK3047MDL-004-00149184
TIKTOK3047MDL-067-LARK-01026274	TIKTOK3047MDL-067-LARK-01026278
SNAP4227244	SNAP4227246
SNAP2247951	SNAP2247975
GOOG-3047MDL-01989488	GOOG-3047MDL-01989647

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Bates Beg	Bates End
SNAP1200316	SNAP1200319
GOOG-3047MDL-00119545	GOOG-3047MDL-00119548
META3047MDL-040-00200269	META3047MDL-040-00200270
META3047MDL-111-00374934	META3047MDL-111-00374934
TIKTOK3047MDL-036-LARK-00164712	TIKTOK3047MDL-036-LARK-00164716
GOOG-3047MDL-02486605	GOOG-3047MDL-02486605
SNAP0399594	SNAP0399601
SNAP1869405	SNAP1869408
SNAP3554531	SNAP3554533
SNAP0396889	SNAP0396891
GOOG-3047MDL-00085593	GOOG-3047MDL-00085595
TIKTOK3047MDL-111-LARK-05924521	TIKTOK3047MDL-111-LARK-05924528
SNAP0015311	SNAP0015313
SNAP0840796	SNAP0840805
SNAP6398196	SNAP6398202
TIKTOK3047MDL-010-00329585	TIKTOK3047MDL-010-00329606
TIKTOK3047MDL-002-00091748	TIKTOK3047MDL-002-00091760
TIKTOK3047MDL-002-00091761	TIKTOK3047MDL-002-00091776
GOOG-3047MDL-01735688	GOOG-3047MDL-01735692
SNAP1193165	SNAP1193165
GOOG-3047MDL-00797172	GOOG-3047MDL-00797273
GOOG-3047MDL-01929900	GOOG-3047MDL-01929900
SNAP1847822	SNAP1847832
GOOG-3047MDL-02352329	GOOG-3047MDL-02352329
TIKTOK3047MDL-002-00101525	TIKTOK3047MDL-002-00101541
TIKTOK3047MDL-067-LARK-01021636	TIKTOK3047MDL-067-LARK-01021639

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Bates Beg	Bates End
SNAP4209960	SNAP4209970
GOOG-3047MDL-01280461	GOOG-3047MDL-01280461
SNAP3528080	SNAP3528084
GOOG-3047MDL-03706722	GOOG-3047MDL-03706722
GOOG-3047MDL-00542226	GOOG-3047MDL-00542242
META3047MDL-111-00369868	META3047MDL-111-00369868
META3047MDL-136-00013164	META3047MDL-136-00013216
SNAP1186681	SNAP1186684
META3047MDL-040-00199456	META3047MDL-040-00199460
SNAP4189090	SNAP4189191
META3047MDL-072-00376915	META3047MDL-072-00376965
TIKTOK3047MDL-021-LARK-00005593	TIKTOK3047MDL-021-LARK-00005598
TIKTOK3047MDL-021-LARK-00005437	TIKTOK3047MDL-021-LARK-00005441
TIKTOK3047MDL-078-LARK-01429319	TIKTOK3047MDL-078-LARK-01429343
TIKTOK3047MDL-002-00099874	TIKTOK3047MDL-002-00099891
SNAP0419215	SNAP0419217
TIKTOK3047MDL-002-00085753	TIKTOK3047MDL-002-00085791
TIKTOK3047MDL-001-00004654	TIKTOK3047MDL-001-00004669
GOOG-3047MDL-00233489	GOOG-3047MDL-00233503
GOOG-3047MDL-02426813	GOOG-3047MDL-02426813
META3047MDL-031-00115856	META3047MDL-031-00115904

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Bates Beg	Bates End
SNAP1806711	SNAP1806724
TIKTOK3047MDL-002-00098058	TIKTOK3047MDL-002-00098071
GOOG-3047MDL-00816707	GOOG-3047MDL-00816707
GOOG-3047MDL-05040450	GOOG-3047MDL-05040450
SNAP2727159	SNAP2727172
SNAP4571055	SNAP4571059
GOOG-3047MDL-03303713	GOOG-3047MDL-03303713
GOOG-3047MDL-01275937	GOOG-3047MDL-01275967
SNAP6110229	SNAP6110233
SNAP2221629	SNAP2221664
TIKTOK3047MDL-036-LARK-00172521	TIKTOK3047MDL-036-LARK-00172527
SNAP1175793	SNAP1175822
META3047MDL-136-00013164	META3047MDL-136-00013216
GOOG-3047MDL-02115397	GOOG-3047MDL-02115411
GOOG-3047MDL-02856550	GOOG-3047MDL-02856552
TIKTOK3047MDL-055-LARK-00698648	TIKTOK3047MDL-055-LARK-00698651
SNAP1768432	SNAP1768433
SNAP0350175	SNAP0350179
SNAP1267538	SNAP1267538
GOOG-3047MDL-01903132	GOOG-3047MDL-01903133
SNAP2713404	SNAP2713405
TIKTOK3047MDL-079-LARK-02079422	TIKTOK3047MDL-079-LARK-02079429
TIKTOK3047MDL-002-00102517	TIKTOK3047MDL-002-00102549
SNAP0000652	SNAP0000653

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Bates Beg	Bates End
SNAP0345159	SNAP0345181
TIKTOK3047MDL-079-LARK-02069378	TIKTOK3047MDL-079-LARK-02069384
GOOG-3047MDL-02287803	GOOG-3047MDL-02287806
META3047MDL-004-00003255	META3047MDL-004-00003264
GOOG-3047MDL-02113187	GOOG-3047MDL-02113187
GOOG-3047MDL-05659775.ECM	GOOG-3047MDL-05659782.ECM
GOOG-3047MDL-05039951	GOOG-3047MDL-05039951
SNAP2712883	SNAP2712888
TIKTOK3047MDL-067-LARK-01025176	TIKTOK3047MDL-067-LARK-01025181
TIKTOK3047MDL-004-00226207	TIKTOK3047MDL-004-00226209
GOOG-3047MDL-01719787	GOOG-3047MDL-01719787
SNAP1731042	SNAP1731076
TIKTOK3047MDL-021-LARK-00005510	TIKTOK3047MDL-021-LARK-00005516
SNAP0332716	SNAP0332720
TIKTOK3047MDL-001-00001985	TIKTOK3047MDL-001-00002019
TIKTOK3047MDL-039-LARK-00214455	TIKTOK3047MDL-039-LARK-00214455
GOOG-3047MDL-03705514	GOOG-3047MDL-03705514
SNAP4872383	SNAP4872411
GOOG-3047MDL-03928001	GOOG-3047MDL-03928001
SNAP1718147	SNAP1718156
META3047MDL-072-00318089	META3047MDL-072-00318089
SNAP0010984	SNAP0010986

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Bates Beg	Bates End
SNAP1155821	SNAP1155824
TIKTOK3047MDL-010-00329274	TIKTOK3047MDL-010-00329289
TIKTOK3047MDL-010-00329290	TIKTOK3047MDL-010-00329318
SNAP0351938	SNAP0351942
SNAP1155580	SNAP1155584
TIKTOK3047MDL-002-00084410	TIKTOK3047MDL-002-00084415
META3047MDL-046-00239694	META3047MDL-046-00239694
SNAP1152337	SNAP1152337
SNAP0321529	SNAP0321535
SNAP1700500	SNAP1700554
SNAP4525411	SNAP4525430
SNAP4525431	SNAP4525450
GOOG-3047MDL-00794077	GOOG-3047MDL-00794077
META3047MDL-054-00000061	META3047MDL-054-00000070
SNAP0320113	SNAP0320116
GOOG-3047MDL-00874191	GOOG-3047MDL-00874191
TIKTOK3047MDL-039-LARK-00213033	TIKTOK3047MDL-039-LARK-00213037
TIKTOK3047MDL-022-00522549	TIKTOK3047MDL-022-00522549
TIKTOK3047MDL-045-LARK-00457587	TIKTOK3047MDL-045-LARK-00457591
META3047MDL-014-00366232	META3047MDL-014-00366239
META3047MDL-047-00922214	META3047MDL-047-00922218
TIKTOK3047MDL-019-00373603	TIKTOK3047MDL-019-00373603
SNAP0316064	SNAP0316066
TIKTOK3047MDL-045-LARK-00457972	TIKTOK3047MDL-045-LARK-00457974

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Bates Beg	Bates End
TIKTOK3047MDL-042-LARK-00264028	TIKTOK3047MDL-042-LARK-00264028
META3047MDL-020-00236842	META3047MDL-020-00236847
TIKTOK3047MDL-004-00131967	TIKTOK3047MDL-004-00132066
META3047MDL-169-00000143	META3047MDL-169-00000264
TIKTOK3047MDL-002-00064418	TIKTOK3047MDL-002-00064428
GOOG-3047MDL-00793501	GOOG-3047MDL-00793501
GOOG-3047MDL-01537774	GOOG-3047MDL-01537774
SNAP1151560	SNAP1151587
GOOG-3047MDL-05214601	GOOG-3047MDL-05214620
META3047MDL-047-01167629	META3047MDL-047-01167748
TIKTOK3047MDL-036-LARK-00111985	TIKTOK3047MDL-036-LARK-00111991
TIKTOK3047MDL-002-00113213	TIKTOK3047MDL-002-00113232
GOOG-3047MDL-01268284	GOOG-3047MDL-01268284
TIKTOK3047MDL-021-LARK-00014505	TIKTOK3047MDL-021-LARK-00014516
SNAP1669311	SNAP1669363
META3047MDL-019-00057847	META3047MDL-019-00057851
META3047MDL-020-00137195	META3047MDL-020-00137195
SNAP0455294	SNAP0455297
SNAP0308313	SNAP0308317
SNAP0010269	SNAP0010271
TIKTOK3047MDL-088-03734025	TIKTOK3047MDL-088-03734029
SNAP0307144	SNAP0307149
GOOG-3047MDL-02424452	GOOG-3047MDL-02424456
META3047MDL-037-00016218	META3047MDL-037-00016225

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Bates Beg	Bates End
TIKTOK3047MDL-038-LARK-00192083	TIKTOK3047MDL-038-LARK-00192088
SNAP0347522	SNAP0347531
GOOG-3047MDL-01714567	GOOG-3047MDL-01714567
TIKTOK3047MDL-099-LARK-04796954	TIKTOK3047MDL-099-LARK-04796990
GOOG-3047MDL-00995151	GOOG-3047MDL-00995151
SNAP1638832	SNAP1638883
META3047MDL-020-00694412	META3047MDL-020-00694460
META3047MDL-014-00336267	META3047MDL-014-00336270
SNAP3374916	SNAP3374934
SNAP2654170	SNAP2654289
TIKTOK3047MDL-010-00329723	TIKTOK3047MDL-010-00329751
TIKTOK3047MDL-002-00073596	TIKTOK3047MDL-002-00073603
TIKTOK3047MDL-004-00131528	TIKTOK3047MDL-004-00131535
GOOG-3047MDL-00641947	GOOG-3047MDL-00641982
TIKTOK3047MDL-004-00310982	TIKTOK3047MDL-004-00310990
GOOG-3047MDL-03566682	GOOG-3047MDL-03566732
GOOG-3047MDL-01266470	GOOG-3047MDL-01266490
SNAP0009893	SNAP0009894
TIKTOK3047MDL-002-00101348	TIKTOK3047MDL-002-00101355
SNAP4512897	SNAP4512915
GOOG-3047MDL-00792514	GOOG-3047MDL-00792514

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Bates Beg	Bates End
GOOG-3047MDL-05456797	GOOG-3047MDL-05456797
TIKTOK3047MDL-004-00145020	TIKTOK3047MDL-004-00145032
GOOG-3047MDL-04929304	GOOG-3047MDL-04929324
TIKTOK3047MDL-047-LARK-00510814	TIKTOK3047MDL-047-LARK-00510821
SNAP2192357	SNAP2192366
TIKTOK3047MDL-002-00091546	TIKTOK3047MDL-002-00091558
SNAP2631307	SNAP2631632
GOOG-3047MDL-00687451	GOOG-3047MDL-00687451
META3047MDL-020-00130679	META3047MDL-020-00130685
META3047MDL-019-00099920	META3047MDL-019-00099920
SNAP1117208	SNAP1117208
SNAP0009825	SNAP0009844
SNAP1601242	SNAP1601242
META3047MDL-037-00022598	META3047MDL-037-00022599
META3047MDL-037-00028264	META3047MDL-037-00028270
SNAP3318166	SNAP3318183
SNAP3371390	SNAP3371404
SNAP3371421	SNAP3371431
SNAP6471191	SNAP6471199
TIKTOK3047MDL-036-LARK-00181240	TIKTOK3047MDL-036-LARK-00181240

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
TIKTOK3047MDL-002-00091521	TIKTOK3047MDL-002-00091545
GOOG-3047MDL-02468921	GOOG-3047MDL-02468921
META3047MDL-056-00003662	META3047MDL-056-00003669
TIKTOK3047MDL-002-00077590	TIKTOK3047MDL-002-00077590
TIKTOK3047MDL-004-00147779	TIKTOK3047MDL-004-00147789
TIKTOK3047MDL-054-LARK-00552309	TIKTOK3047MDL-054-LARK-00552326
META3047MDL-020-00651532	META3047MDL-020-00651533
META3047MDL-040-00049387	META3047MDL-040-00049387
SNAP4486211	SNAP4486215
TIKTOK3047MDL-029-LARK-00091675	TIKTOK3047MDL-029-LARK-00091679
GOOG-3047MDL-02746243	GOOG-3047MDL-02746251
GOOG-3047MDL-04926458	GOOG-3047MDL-04926461
SNAP1103775	SNAP1104028
TIKTOK3047MDL-004-00290064	TIKTOK3047MDL-004-00290065
SNAP0007545	SNAP0007560
GOOG-3047MDL-00170759	GOOG-3047MDL-00170759
TIKTOK3047MDL-004-00151098	TIKTOK3047MDL-004-00151110

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
GOOG-3047MDL-03704131	GOOG-3047MDL-03704131
SNAP1556755	SNAP1556758
GOOG-3047MDL-00654060	GOOG-3047MDL-00654060
TIKTOK3047MDL-001-00060313	TIKTOK3047MDL-001-00060323
TIKTOK3047MDL-002-00122131	TIKTOK3047MDL-002-00122143
TIKTOK3047MDL-004-00138686	TIKTOK3047MDL-004-00138690
META3047MDL-034-00152676	META3047MDL-034-00152679
SNAP0265413	SNAP0265413
META3047MDL-014-00355780	META3047MDL-014-00355782
META3047MDL-037-00032900	META3047MDL-037-00032937
TIKTOK3047MDL-111-LARK-05912863	TIKTOK3047MDL-111-LARK-05912868
SNAP6934061	SNAP6934064
TIKTOK3047MDL-068-LARK-01057252	TIKTOK3047MDL-068-LARK-01057259
TIKTOK3047MDL-117-04509578	TIKTOK3047MDL-117-04509603

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-014-00074230	META3047MDL-014-00074247
SNAP3286213	SNAP3286215
META3047MDL-035-00002750	META3047MDL-035-00002750
SNAP3285645	SNAP3285645
TIKTOK3047MDL-039-LARK-00193617	TIKTOK3047MDL-039-LARK-00193621
META3047MDL-060-00000335	META3047MDL-060-00000335
TIKTOK3047MDL-024-LARK-00043038	TIKTOK3047MDL-024-LARK-00043054
TIKTOK3047MDL-002-00091634	TIKTOK3047MDL-002-00091647
META3047MDL-062-00000129	META3047MDL-062-00000135
TIKTOK3047MDL-001-00060308	TIKTOK3047MDL-001-00060312
META3047MDL-047-00647437	META3047MDL-047-00647444
GOOG-3047MDL-02097533	GOOG-3047MDL-02097538
SNAP4009751	SNAP4009756
TIKTOK3047MDL-004-00138026	TIKTOK3047MDL-004-00138047
META3047MDL-034-00152702	META3047MDL-034-00152702
TIKTOK3047MDL-054-LARK-00587949	TIKTOK3047MDL-054-LARK-00587949
TIKTOK3047MDL-004-00318166	TIKTOK3047MDL-004-00318181
TIKTOK3047MDL-099-LARK-04759856	TIKTOK3047MDL-099-LARK-04759882
SNAP0741744	SNAP0741751
TIKTOK3047MDL-001-00060515	TIKTOK3047MDL-001-00060529

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-163-00007398	META3047MDL-163-00007499
SNAP2171829	SNAP2171882
SNAP0270760	SNAP0270778
META3047MDL-047-01028819	META3047MDL-047-01028842
TIKTOK3047MDL-038-LARK-00192063	TIKTOK3047MDL-038-LARK-00192067
TIKTOK3047MDL-004-00138339	TIKTOK3047MDL-004-00138345
GOOG-3047MDL-01262144	GOOG-3047MDL-01262144
META3047MDL-031-00133522	META3047MDL-031-00133588
SNAP0007264	SNAP0007299
SNAP2164487	SNAP2164495
SNAP1086844	SNAP1086851
TIKTOK3047MDL-060-01119793	TIKTOK3047MDL-060-01119795
TIKTOK3047MDL-002-00075240	TIKTOK3047MDL-002-00075242
TIKTOK3047MDL-002-00094384	TIKTOK3047MDL-002-00094430
SNAP0244386	SNAP0244434
SNAP3968448	SNAP3968726
SNAP2162262	SNAP2162268
SNAP3251459	SNAP3252025
SNAP2581635	SNAP2581636
SNAP2581637	SNAP2581638
GOOG-3047MDL-05204517	GOOG-3047MDL-05204519
TIKTOK3047MDL-060-01124427	TIKTOK3047MDL-060-01124443
SNAP0015373	SNAP0015405
SNAP0728177	SNAP0728179

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Bates Beg	Bates End
GOOG-3047MDL-05204037	GOOG-3047MDL-05204081
TIKTOK3047MDL-024-LARK-00042912	TIKTOK3047MDL-024-LARK-00042950
TIKTOK3047MDL-002-00101574	TIKTOK3047MDL-002-00101612
GOOG-3047MDL-00188446	GOOG-3047MDL-00188446
META3047MDL-040-00229264	META3047MDL-040-00229266
SNAP0241635	SNAP0241645
SNAP3242221	SNAP3242234
TIKTOK3047MDL-045-LARK-00447874	TIKTOK3047MDL-045-LARK-00447879
GOOG-3047MDL-04798264	GOOG-3047MDL-04798323
SNAP2568676	SNAP2568851
GOOG-3047MDL-02264827	GOOG-3047MDL-02264864
TIKTOK3047MDL-078-LARK-01711316	TIKTOK3047MDL-078-LARK-01711340
META3047MDL-111-00086015	META3047MDL-111-00086026
SNAP2565799	SNAP2565811
GOOG-3047MDL-01258481	GOOG-3047MDL-01258627
GOOG-3047MDL-04918852	GOOG-3047MDL-04918852
SNAP2561579	SNAP2562075
GOOG-3047MDL-02840254	GOOG-3047MDL-02840256
META3047MDL-148-00001309	META3047MDL-148-00001378
SNAP0746762	SNAP0746774
TIKTOK3047MDL-079-LARK-02008119	TIKTOK3047MDL-079-LARK-02008123
TIKTOK3047MDL-002-00102051	TIKTOK3047MDL-002-00102051
GOOG-3047MDL-01864482	GOOG-3047MDL-01864491
META3047MDL-148-00005208	META3047MDL-148-00005234
SNAP0736229	SNAP0736236

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Bates Beg	Bates End
META3047MDL-019-00036342	META3047MDL-019-00036342
META3047MDL-072-00319412	META3047MDL-072-00319412
GOOG-3047MDL-01696006	GOOG-3047MDL-01696007
META3047MDL-020-00592294	META3047MDL-020-00592303
GOOG-3047MDL-02631963	GOOG-3047MDL-02631966
TIKTOK3047MDL-004-00286929	TIKTOK3047MDL-004-00286935
SNAP4452586	SNAP4452595
SNAP0750644	SNAP0750646
META3047MDL-020-00278479	META3047MDL-020-00278479
META3047MDL-037-00030033	META3047MDL-037-00030070
GOOG-3047MDL-00000027	GOOG-3047MDL-00000039
META3047MDL-044-00022409	META3047MDL-044-00022436
META3047MDL-019-00036714	META3047MDL-019-00036714
TIKTOK3047MDL-045-LARK-00468321	TIKTOK3047MDL-045-LARK-00468335
META3047MDL-040-00545973	META3047MDL-040-00545973
SNAP0205584	SNAP0205586
SNAP0211828	SNAP0211832
TIKTOK3047MDL-043-00834241	TIKTOK3047MDL-043-00834241
TIKTOK3047MDL-005-00325851	TIKTOK3047MDL-005-00325872
TIKTOK3047MDL-024-LARK-00035705	TIKTOK3047MDL-024-LARK-00035710
META3047MDL-014-00401896	META3047MDL-014-00401907
META3047MDL-020-00005380	META3047MDL-020-00005388

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Bates Beg	Bates End
GOOG-3047MDL-03604439	GOOG-3047MDL-03604443
META3047MDL-020-00216683	META3047MDL-020-00216690
META3047MDL-014-00247017	META3047MDL-014-00247019
TIKTOK3047MDL-021-LARK-00026469	TIKTOK3047MDL-021-LARK-00026477
TIKTOK3047MDL-004-00290146	TIKTOK3047MDL-004-00290159
SNAP3210317	SNAP3210318
GOOG-3047MDL-03604113	GOOG-3047MDL-03604116
SNAP0005726	SNAP0005731
SNAP0005694	SNAP0005711
SNAP3206770	SNAP3206779
GOOG-3047MDL-02089371	GOOG-3047MDL-02089373
TIKTOK3047MDL-072-LARK-01062915	TIKTOK3047MDL-072-LARK-01062918
SNAP0188573	SNAP0188591
GOOG-3047MDL-01195859	GOOG-3047MDL-01195863
SNAP1047045	SNAP1047165
GOOG-3047MDL-03861314	GOOG-3047MDL-03861333
META3047MDL-019-00078581	META3047MDL-019-00078597
SNAP1393050	SNAP1393052
SNAP0996673	SNAP0996673

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Bates Beg	Bates End
META3047MDL-138-00000416	META3047MDL-138-00000455
SNAP0397014	SNAP0397025
SNAP0682877	SNAP0682888
META3047MDL-014-00206538	META3047MDL-014-00206544
META3047MDL-074-00051929	META3047MDL-074-00051951
SNAP0005508	SNAP0005511
META3047MDL-034-00037237	META3047MDL-034-00037283
META3047MDL-047-00603560	META3047MDL-047-00603565
SNAP6434698	SNAP6434707
GOOG-3047MDL-00671604	GOOG-3047MDL-00671635
META3047MDL-020-00342152	META3047MDL-020-00342153
META3047MDL-020-00588281	META3047MDL-020-00588290
TIKTOK3047MDL-004-00216708	TIKTOK3047MDL-004-00216714
META3047MDL-020-00588060	META3047MDL-020-00588077
SNAP2462286	SNAP2462294
SNAP0677724	SNAP0677743
META3047MDL-020-00342286	META3047MDL-020-00342373
META3047MDL-031-00114544	META3047MDL-031-00114544
SNAP2459988	SNAP2459993
GOOG-3047MDL-01839246	GOOG-3047MDL-01839293
GOOG-3047MDL-02086033	GOOG-3047MDL-02086033
SNAP1000621	SNAP1000634

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Bates Beg	Bates End
META3047MDL-053-00007873	META3047MDL-053-00007882
META3047MDL-053-00007843	META3047MDL-053-00007851
TIKTOK3047MDL-001-00000812	TIKTOK3047MDL-001-00000812
SNAP0007318	SNAP0007335
TIKTOK3047MDL-002-00103474	TIKTOK3047MDL-002-00103487
GOOG-3047MDL-00225068	GOOG-3047MDL-00225069
SNAP0506749	SNAP0506762
SNAP0525975	SNAP0525988
SNAP0818696	SNAP0818709
TIKTOK3047MDL-044-00859648	TIKTOK3047MDL-044-00859648
SNAP0525938	SNAP0525947
SNAP0777590	SNAP0777599
SNAP0831964	SNAP0831964
SNAP4416813	SNAP4416907
META3047MDL-020-00340672	META3047MDL-020-00340681
TIKTOK3047MDL-004-00291835	TIKTOK3047MDL-004-00291839
SNAP3182100	SNAP3182128
TIKTOK3047MDL-024-LARK-00026749	TIKTOK3047MDL-024-LARK-00026760
META3047MDL-003-00158816	META3047MDL-003-00158817
META3047MDL-003-00191207	META3047MDL-003-00191217
META3047MDL-163-00001583	META3047MDL-163-00001640
GOOG-3047MDL-02616134	GOOG-3047MDL-02616135
META3047MDL-019-00092508	META3047MDL-019-00092508
META3047MDL-020-00340104	META3047MDL-020-00340107
META3047MDL-014-00054063	META3047MDL-014-00054094

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Bates Beg	Bates End
TIKTOK3047MDL-099-LARK-04504706	TIKTOK3047MDL-099-LARK-04504706
META3047MDL-020-00270857	META3047MDL-020-00270858
TIKTOK3047MDL-024-LARK-00026665	TIKTOK3047MDL-024-LARK-00026667
META3047MDL-014-00377295	META3047MDL-014-00377298
META3047MDL-163-00045441	META3047MDL-163-00045570
GOOG-3047MDL-04220318	GOOG-3047MDL-04220318
TIKTOK3047MDL-004-00144763	TIKTOK3047MDL-004-00144764
SNAP1068641	SNAP1068679
TIKTOK3047MDL-054-LARK-00559991	TIKTOK3047MDL-054-LARK-00560027
SNAP3173074	SNAP3173081
SNAP2425354	SNAP2425378
SNAP0945315	SNAP0945322
SNAP0119026	SNAP0119026
META3047MDL-014-00335618	META3047MDL-014-00335619
GOOG-3047MDL-03678102	GOOG-3047MDL-03678107
META3047MDL-020-00270223	META3047MDL-020-00270223
META3047MDL-050-00004448	META3047MDL-050-00004448
GOOG-3047MDL-00224480	GOOG-3047MDL-00224480

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Bates Beg	Bates End
SNAP0943173	SNAP0943176
SNAP3172386	SNAP3172389
TIKTOK3047MDL-099-LARK-04558012	TIKTOK3047MDL-099-LARK-04558035
META3047MDL-019-00036538	META3047MDL-019-00036588
SNAP0224369	SNAP0224431
TIKTOK3047MDL-004-00323234	TIKTOK3047MDL-004-00323240
META3047MDL-014-00260869	META3047MDL-014-00260876
META3047MDL-040-00544758	META3047MDL-040-00544759
SNAP3168148	SNAP3168150
TIKTOK3047MDL-002-00100441	TIKTOK3047MDL-002-00100462
GOOG-3047MDL-05657463.ECM	GOOG-3047MDL-05657481.ECM
GOOG-3047MDL-02712067	GOOG-3047MDL-02712071
SNAP3167874	SNAP3167940
GOOG-3047MDL-04819374	GOOG-3047MDL-04819374
TIKTOK3047MDL-004-00144753	TIKTOK3047MDL-004-00144755
SNAP2420547	SNAP2420549
META3047MDL-019-00097380	META3047MDL-019-00097389
GOOG-3047MDL-00224027	GOOG-3047MDL-00224027

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Bates Beg	Bates End
META3047MDL-034-00078516	META3047MDL-034-00078521
SNAP4773692	SNAP4773696
SNAP0933703	SNAP0933735
SNAP5553072	SNAP5553073
TIKTOK3047MDL-001-00060255	TIKTOK3047MDL-001-00060287
META3047MDL-020-00575591	META3047MDL-020-00575599
SNAP2115818	SNAP2115831
SNAP3503805	SNAP3503821
TIKTOK3047MDL-002-00102328	TIKTOK3047MDL-002-00102328
GOOG-3047MDL-00632685	GOOG-3047MDL-00632689
SNAP3160903	SNAP3160913
SNAP0649519	SNAP0649523
GOOG-3047MDL-05193958	GOOG-3047MDL-05193959
GOOG-3047MDL-05284976	GOOG-3047MDL-05284976
META3047MDL-020-00711513	META3047MDL-020-00711524
TIKTOK3047MDL-004-00139811	TIKTOK3047MDL-004-00139824
GOOG-3047MDL-02036365	GOOG-3047MDL-02036376
GOOG-3047MDL-04462537	GOOG-3047MDL-04462537
GOOG-3047MDL-04626757	GOOG-3047MDL-04626757

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Bates Beg	Bates End
META3047MDL-047-00006815	META3047MDL-047-00006815
SNAP2407226	SNAP2407227
META3047MDL-040-00075210	META3047MDL-040-00075210
SNAP0927309	SNAP0927322
TIKTOK3047MDL-004-00321758	TIKTOK3047MDL-004-00322097
GOOG-3047MDL-04167772	GOOG-3047MDL-04167776
TIKTOK3047MDL-004-00285574	TIKTOK3047MDL-004-00285599
SNAP3811531	SNAP3811543
GOOG-3047MDL-01666532	GOOG-3047MDL-01666535
META3047MDL-040-00337135	META3047MDL-040-00337172
SNAP1185221	SNAP1185322
TIKTOK3047MDL-002-00099764	TIKTOK3047MDL-002-00099831
META3047MDL-053-00053202	META3047MDL-053-00053219
SNAP0652397	SNAP0652397
TIKTOK3047MDL-015-00331402	TIKTOK3047MDL-015-00331402
SNAP6423878	SNAP6423894
SNAP3808814	SNAP3808847
SNAP6423845	SNAP6423877
SNAP3156939	SNAP3156941
SNAP6108957	SNAP6108958
GOOG-3047MDL-00500385	GOOG-3047MDL-00500393
TIKTOK3047MDL-004-00290586	TIKTOK3047MDL-004-00290623
SNAP3155743	SNAP3155744
GOOG-3047MDL-01663615	GOOG-3047MDL-01663615
GOOG-3047MDL-02034241	GOOG-3047MDL-02034241

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Bates Beg	Bates End
META3047MDL-019-00016249	META3047MDL-019-00016261
SNAP0649237	SNAP0649237
META3047MDL-019-00064740	META3047MDL-019-00064782
TIKTOK3047MDL-004-00316716	TIKTOK3047MDL-004-00316726
SNAP2394847	SNAP2394848
TIKTOK3047MDL-044-00844575	TIKTOK3047MDL-044-00844577
TIKTOK3047MDL-079-LARK-02017133	TIKTOK3047MDL-079-LARK-02017138
SNAP0092646	SNAP0092650
SNAP0335300	SNAP0335311
TIKTOK3047MDL-004-00290821	TIKTOK3047MDL-004-00290897
TIKTOK3047MDL-022-00522755	TIKTOK3047MDL-022-00522755
SNAP0755817	SNAP0755826
GOOG-3047MDL-02602651	GOOG-3047MDL-02602670
GOOG-3047MDL-03001805	GOOG-3047MDL-03001807
GOOG-3047MDL-00246776	GOOG-3047MDL-00246776
SNAP2109600	SNAP2109616
SNAP0912095	SNAP0912098
SNAP0924794	SNAP0924810
SNAP0087818	SNAP0087820
SNAP3800391	SNAP3800392
TIKTOK3047MDL-004-00139825	TIKTOK3047MDL-004-00139827
TIKTOK3047MDL-004-00314472	TIKTOK3047MDL-004-00314532
SNAP2389358	SNAP2389386
META3047MDL-014-00166515	META3047MDL-014-00166517
SNAP0905847	SNAP0905854

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Bates Beg	Bates End
GOOG-3047MDL-01247025	GOOG-3047MDL-01247025
GOOG-3047MDL-01654851	GOOG-3047MDL-01654859
META3047MDL-014-00360058	META3047MDL-014-00360058
SNAP0084814	SNAP0084814
META3047MDL-019-00049429	META3047MDL-019-00049461
META3047MDL-020-00260850	META3047MDL-020-00260855
META3047MDL-014-00163784	META3047MDL-014-00163791
GOOG-3047MDL-01653710	GOOG-3047MDL-01653713
META3047MDL-014-00377058	META3047MDL-014-00377104
GOOG-3047MDL-04533875	GOOG-3047MDL-04533881
SNAP0668593	SNAP0668593
SNAP2385816	SNAP2385817
TIKTOK3047MDL-023-00630640	TIKTOK3047MDL-023-00630640
TIKTOK3047MDL-001-00000888	TIKTOK3047MDL-001-00000904
SNAP0737277	SNAP0737334
META3047MDL-004-00025094	META3047MDL-004-00025107
META3047MDL-014-00159841	META3047MDL-014-00159843
META3047MDL-014-00159841	META3047MDL-014-00159843
SNAP2382505	SNAP2382505
META3047MDL-014-00048060	META3047MDL-014-00048071
META3047MDL-004-00013865	META3047MDL-004-00013869

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Bates Beg	Bates End
SNAP3793778	SNAP3793858
META3047MDL-014-00156024	META3047MDL-014-00156025
SNAP4388742	SNAP4388746
GOOG-3047MDL-03715502	GOOG-3047MDL-03715630
SNAP1330007	SNAP1330015
META3047MDL-019-00033465	META3047MDL-019-00033475
META3047MDL-020-00082810	META3047MDL-020-00082810
SNAP3791003	SNAP3791082
GOOG-3047MDL-02250801	GOOG-3047MDL-02250801
META3047MDL-014-00376297	META3047MDL-014-00376305
META3047MDL-014-00376309	META3047MDL-014-00376317
SNAP4837277	SNAP4837299
META3047MDL-014-00152942	META3047MDL-014-00152944
SNAP0896563	SNAP0896563
GOOG-3047MDL-04457555	GOOG-3047MDL-04457560
GOOG-3047MDL-05190031	GOOG-3047MDL-05190040
META3047MDL-037-00058561	META3047MDL-037-00058573
GOOG-3047MDL-05275966	GOOG-3047MDL-05275973
GOOG-3047MDL-00159023	GOOG-3047MDL-00159023
META3047MDL-040-00399876	META3047MDL-040-00399876
GOOG-3047MDL-02794557.C	GOOG-3047MDL-02794566.C
META3047MDL-020-00256107	META3047MDL-020-00256114
SNAP4836937	SNAP4836940
SNAP1322227	SNAP1322242
SNAP1321683	SNAP1321686
GOOG-3047MDL-03305969	GOOG-3047MDL-03305969
META3047MDL-034-00354685	META3047MDL-034-00354694

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
SNAP0892766	SNAP0892766
SNAP0755683	SNAP0755688
META3047MDL-044-00108564	META3047MDL-044-00108582
SNAP0755697	SNAP0755698
SNAP3784179	SNAP3784183
GOOG-3047MDL-02028788	GOOG-3047MDL-02028788
META3047MDL-014-00298174	META3047MDL-014-00298228
GOOG-3047MDL-02722034	GOOG-3047MDL-02722039
GOOG-3047MDL-01643156	GOOG-3047MDL-01643164
META3047MDL-020-00563113	META3047MDL-020-00563179
GOOG-3047MDL-00488901	GOOG-3047MDL-00488908
META3047MDL-044-00091392	META3047MDL-044-00091392
SNAP3781717	SNAP3781718
META3047MDL-040-00332134	META3047MDL-040-00332136
SNAP0889433	SNAP0889435
SNAP2367515	SNAP2367527
GOOG-3047MDL-00197779	GOOG-3047MDL-00197779
GOOG-3047MDL-04456196	GOOG-3047MDL-04456198
GOOG-3047MDL-03000812	GOOG-3047MDL-03000812
GOOG-3047MDL-04456177	GOOG-3047MDL-04456180
GOOG-3047MDL-00197772	GOOG-3047MDL-00197775
GOOG-3047MDL-00080597	GOOG-3047MDL-00080601
GOOG-3047MDL-02027137	GOOG-3047MDL-02027142
SNAP6900119	SNAP6900129
SNAP7307710	SNAP7307721

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Bates Beg	Bates End
SNAP0886473	SNAP0886479
GOOG-3047MDL-04455868	GOOG-3047MDL-04455869
GOOG-3047MDL-02787109	GOOG-3047MDL-02787111
GOOG-3047MDL-00197742	GOOG-3047MDL-00197742
GOOG-3047MDL-02204366	GOOG-3047MDL-02204369
META3047MDL-020-00253760	META3047MDL-020-00253818
SNAP0886013	SNAP0886015
GOOG-3047MDL-04455801	GOOG-3047MDL-04455801
GOOG-3047MDL-03856852	GOOG-3047MDL-03856852
SNAP6892932	SNAP6892940
SNAP0884986	SNAP0884987
GOOG-3047MDL-00197735	GOOG-3047MDL-00197737
GOOG-3047MDL-02026373	GOOG-3047MDL-02026374
GOOG-3047MDL-03856819	GOOG-3047MDL-03856820
META3047MDL-040-00583291	META3047MDL-040-00583292
META3047MDL-059-00000325	META3047MDL-059-00000335
META3047MDL-005-00000333	META3047MDL-005-00000357
SNAP0541886	SNAP0541886
META3047MDL-014-00071620	META3047MDL-014-00071623
SNAP5486213	SNAP5486215
SNAP4378245	SNAP4378249
SNAP3133152	SNAP3133153
META3047MDL-014-00133717	META3047MDL-014-00133734
SNAP2102892	SNAP2102903
META3047MDL-035-00004529	META3047MDL-035-00004598

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Bates Beg	Bates End
META3047MDL-044-00026817	META3047MDL-044-00026905
SNAP0878303	SNAP0878310
SNAP0040771	SNAP0040778
SNAP3129690	SNAP3129699
META3047MDL-005-00000001	META3047MDL-005-00000013
META3047MDL-047-01199274	META3047MDL-047-01199275
SNAP3129214	SNAP3129218
GOOG-3047MDL-03765037	GOOG-3047MDL-03765043
META3047MDL-022-00006927	META3047MDL-022-00006927
SNAP3126959	SNAP3126962
SNAP3126923	SNAP3126935
GOOG-3047MDL-02022090	GOOG-3047MDL-02022093
SNAP6118652	SNAP6118662
SNAP0640337	SNAP0640342
SNAP0666370	SNAP0666375
META3047MDL-019-00059356	META3047MDL-019-00059356
META3047MDL-019-00059532	META3047MDL-019-00059532
META3047MDL-037-00068917	META3047MDL-037-00068917
SNAP2348639	SNAP2348640
META3047MDL-044-00171345	META3047MDL-044-00171371
SNAP3760712	SNAP3760713
SNAP2346697	SNAP2346698
GOOG-3047MDL-00080516	GOOG-3047MDL-00080518
SNAP0757877	SNAP0757879
SNAP6411772	SNAP6411826
SNAP2345620	SNAP2345622

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Bates Beg	Bates End
GOOG-3047MDL-01241038	GOOG-3047MDL-01241039
META3047MDL-004-00000315	META3047MDL-004-00000317
GOOG-3047MDL-00767071	GOOG-3047MDL-00767071
SNAP1298915	SNAP1298996
META3047MDL-031-00096208	META3047MDL-031-00096217
SNAP0857671	SNAP0857671
GOOG-3047MDL-00122963	GOOG-3047MDL-00122963
SNAP6110159	SNAP6110160
GOOG-3047MDL-01608261	GOOG-3047MDL-01608261
SNAP4358317	SNAP4358324
META3047MDL-014-00026293	META3047MDL-014-00026296
SNAP3744792	SNAP3744794
SNAP0024870	SNAP0024870
META3047MDL-020-00476530	META3047MDL-020-00476530
META3047MDL-040-00449305	META3047MDL-040-00449316
SNAP3742780	SNAP3742782
META3047MDL-014-00092206	META3047MDL-014-00092207
GOOG-3047MDL-02009802	GOOG-3047MDL-02009802
SNAP4354972	SNAP4354978
SNAP0850987	SNAP0850992
META3047MDL-044-00100788	META3047MDL-044-00100789
GOOG-3047MDL-03714938	GOOG-3047MDL-03714938
GOOG-3047MDL-05025310	GOOG-3047MDL-05025314
SNAP3739123	SNAP3739123
GOOG-3047MDL-05263731	GOOG-3047MDL-05263731

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Bates Beg	Bates End
GOOG-3047MDL-00579554	GOOG-3047MDL-00579554
META3047MDL-072-01105909	META3047MDL-072-01105913
META3047MDL-072-01105914	META3047MDL-072-01105922
META3047MDL-034-00385869	META3047MDL-034-00385870
META3047MDL-065-00311801	META3047MDL-065-00311801
SNAP0850116	SNAP0850117
GOOG-3047MDL-01604798	GOOG-3047MDL-01604798
META3047MDL-091-00077741	META3047MDL-091-00077812
GOOG-3047MDL-03929013	GOOG-3047MDL-03929014
GOOG-3047MDL-02001804	GOOG-3047MDL-02001811
GOOG-3047MDL-01603982	GOOG-3047MDL-01603982
META3047MDL-047-00094089	META3047MDL-047-00094119
GOOG-3047MDL-04441419	GOOG-3047MDL-04441423
META3047MDL-072-01394520	META3047MDL-072-01394627
SNAP3118038	SNAP3118073
TIKTOK3047MDL-024-LARK-00043256	TIKTOK3047MDL-024-LARK-00043256
GOOG-3047MDL-00000922	GOOG-3047MDL-00000931
GOOG-3047MDL-00666027	GOOG-3047MDL-00666027
GOOG-3047MDL-00937887	GOOG-3047MDL-00937984
GOOG-3047MDL-00952609	GOOG-3047MDL-00952610
GOOG-3047MDL-00990013	GOOG-3047MDL-00990015
GOOG-3047MDL-01078823	GOOG-3047MDL-01078827

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Bates Beg	Bates End
GOOG-3047MDL-01373290	GOOG-3047MDL-01373290
GOOG-3047MDL-01653327	GOOG-3047MDL-01653335
GOOG-3047MDL-01707652	GOOG-3047MDL-01707657
GOOG-3047MDL-01725085	GOOG-3047MDL-01725091
GOOG-3047MDL-01738317	GOOG-3047MDL-01738318
GOOG-3047MDL-01741439	GOOG-3047MDL-01741444
GOOG-3047MDL-01786683	GOOG-3047MDL-01786696
GOOG-3047MDL-02024105	GOOG-3047MDL-02024106
GOOG-3047MDL-02025298	GOOG-3047MDL-02025298
GOOG-3047MDL-02031811	GOOG-3047MDL-02031811
GOOG-3047MDL-02036500	GOOG-3047MDL-02036511
GOOG-3047MDL-02603564	GOOG-3047MDL-02603564
GOOG-3047MDL-02820161	GOOG-3047MDL-02820161
GOOG-3047MDL-02850443	GOOG-3047MDL-02850443
GOOG-3047MDL-02946487	GOOG-3047MDL-02946501
GOOG-3047MDL-03547420	GOOG-3047MDL-03547420
GOOG-3047MDL-04461233	GOOG-3047MDL-04461318
GOOG-3047MDL-04601837	GOOG-3047MDL-04601868
GOOG-3047MDL-04618585	GOOG-3047MDL-04618585
GOOG-3047MDL-04625648	GOOG-3047MDL-04625648
GOOG-3047MDL-04683418	GOOG-3047MDL-04683418
GOOG-3047MDL-04683749	GOOG-3047MDL-04683749
GOOG-3047MDL-04922012	GOOG-3047MDL-04922012
GOOG-3047MDL-05096751	GOOG-3047MDL-05096772
GOOG-3047MDL-05712453	GOOG-3047MDL-05712520
GOOG-MDL3047-00085593	GOOG-MDL3047-00085595

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Bates Beg	Bates End
GOOG-MDL3047-02299400	GOOG-MDL3047-02299401
META3047MDL-014-00046464	META3047MDL-014-00046476
META3047MDL-020-00126630	META3047MDL-020-00126634
META3047MDL-020-00208020	META3047MDL-020-00208020
META3047MDL-020-00208021	META3047MDL-020-00208026
META3047MDL-020-00208027	META3047MDL-020-00208027
META3047MDL-020-00340122	META3047MDL-020-00340248
META3047MDL-046-00113377	META3047MDL-046-00113377
META3047MDL-046-00113378	META3047MDL-046-00113378
META3047MDL-073-00000019	META3047MDL-073-00000056
SNAP0029949	SNAP0029960
SNAP0173071	SNAP0173072
SNAP0173430	SNAP0173446
SNAP0255654	SNAP0255654
SNAP0373208	SNAP0373220
SNAP0467577	SNAP0467580
SNAP0640776	SNAP0640777
SNAP0646353	SNAP0646359
SNAP0745587	SNAP0745588
SNAP0840009	SNAP0840025
SNAP0903271	SNAP0903289

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Bates Beg	Bates End
SNAP1098525	SNAP1098532
SNAP1213658	SNAP1213671
SNAP1242891	SNAP1242893
SNAP1303811	SNAP1303823
SNAP1415121	SNAP1415142
SNAP1957460	SNAP1957465
SNAP2324154	SNAP2324155
SNAP2346647	SNAP2346648
SNAP2346701	SNAP2346702
SNAP2372970	SNAP2372974
SNAP2377455	SNAP2377460
SNAP2894057	SNAP2894064
SNAP3121196	SNAP3121225
SNAP3129584	SNAP3129628
SNAP3151495	SNAP3151503
SNAP3386748	SNAP3386757
SNAP3808780	SNAP3808813
SNAP3931041	SNAP3931043
SNAP4301491	SNAP4301537
SNAP4383753	SNAP4383754
SNAP4389271	SNAP4389271
SNAP4527267	SNAP4527271
SNAP4838936	SNAP4838936
SNAP5125871	SNAP5125911
SNAP5145629	SNAP5145668
SNAP5182516	SNAP5182536
SNAP5193118	SNAP5193139
SNAP5251965	SNAP5252015
SNAP5269822	SNAP5269866
SNAP5326775	SNAP5326795

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Bates Beg	Bates End
SNAP5405366	SNAP5405391
SNAP5447598	SNAP5447616
SNAP5473633	SNAP5473653
SNAP5562636	SNAP5562655
SNAP5950611	SNAP5950611
SNAP5950612	SNAP5950612
SNAP5950613	SNAP5950613
SNAP5950614	SNAP5950614
SNAP6119957	SNAP6119966
SNAP6120291	SNAP6120303
SNAP6157644	SNAP6157649
SNAP6163825	SNAP6163858
SNAP6163859	SNAP6163939
SNAP6182524	SNAP6182535
SNAP6340758	SNAP6340790
SNAP6424511	SNAP6424514
SNAP6550958	SNAP6550999
SNAP6759344	SNAP6759347
SNAP6759364	SNAP6759367
SNAP6759368	SNAP6759370
SNAP6759371	SNAP6759373
SNAP6906160	SNAP6906161
SNAP6916189	SNAP6916193
SNAP7140931	SNAP7140932
SNAP7141013	SNAP7141016
SNAP7341442	SNAP7341450
TIKTOK3047MDL-001-00003427	TIKTOK3047MDL-001-00003461
TIKTOK3047MDL-001-00005690	TIKTOK3047MDL-001-00005697
TIKTOK3047MDL-001-00060349	TIKTOK3047MDL-001-00060362
TIKTOK3047MDL-002-00077113	TIKTOK3047MDL-002-00077140
TIKTOK3047MDL-002-00091657	TIKTOK3047MDL-002-00091667
TIKTOK3047MDL-002-00091798	TIKTOK3047MDL-002-00091805
TIKTOK3047MDL-002-00091857	TIKTOK3047MDL-002-00091865

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Bates Beg	Bates End
TIKTOK3047MDL-002-00098195	TIKTOK3047MDL-002-00098227
TIKTOK3047MDL-002-00099913	TIKTOK3047MDL-002-00099924
TIKTOK3047MDL-002-00100415	TIKTOK3047MDL-002-00100425
TIKTOK3047MDL-002-00120866	TIKTOK3047MDL-002-00120899
TIKTOK3047MDL-004-00137151	TIKTOK3047MDL-004-00137163
TIKTOK3047MDL-004-00138978	TIKTOK3047MDL-004-00138978
TIKTOK3047MDL-004-00138994	TIKTOK3047MDL-004-00139009
TIKTOK3047MDL-004-00141926	TIKTOK3047MDL-004-00141931
TIKTOK3047MDL-004-00144498	TIKTOK3047MDL-004-00144530
TIKTOK3047MDL-004-00147649	TIKTOK3047MDL-004-00147661
TIKTOK3047MDL-004-00148774	TIKTOK3047MDL-004-00148838
TIKTOK3047MDL-004-00150774	TIKTOK3047MDL-004-00150775
TIKTOK3047MDL-004-00182071	TIKTOK3047MDL-004-00182075
TIKTOK3047MDL-004-00217059	TIKTOK3047MDL-004-00217082
TIKTOK3047MDL-004-00226215	TIKTOK3047MDL-004-00226215
TIKTOK3047MDL-004-00286777	TIKTOK3047MDL-004-00286780
TIKTOK3047MDL-004-00291668	TIKTOK3047MDL-004-00291703
TIKTOK3047MDL-004-00292376	TIKTOK3047MDL-004-00292384
TIKTOK3047MDL-004-00292408	TIKTOK3047MDL-004-00292419
TIKTOK3047MDL-004-00306861	TIKTOK3047MDL-004-00306886
TIKTOK3047MDL-004-00312958	TIKTOK3047MDL-004-00313005
TIKTOK3047MDL-004-00318099	TIKTOK3047MDL-004-00318136
TIKTOK3047MDL-004-00318462	TIKTOK3047MDL-004-00318467
TIKTOK3047MDL-004-00318974	TIKTOK3047MDL-004-00318974
TIKTOK3047MDL-004-00319782	TIKTOK3047MDL-004-00319800
TIKTOK3047MDL-004-00323281	TIKTOK3047MDL-004-00323281
TIKTOK3047MDL-004-00324091	TIKTOK3047MDL-004-00324107
TIKTOK3047MDL-006-00326007	TIKTOK3047MDL-006-00326007
TIKTOK3047MDL-010-00330011	TIKTOK3047MDL-010-00330021
TIKTOK3047MDL-016-00351152	TIKTOK3047MDL-016-00351152

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Bates Beg	Bates End
TIKTOK3047MDL-016-00355207	TIKTOK3047MDL-016-00355214
TIKTOK3047MDL-018-00372373	TIKTOK3047MDL-018-00372374
TIKTOK3047MDL-020-00376995	TIKTOK3047MDL-020-00377022
TIKTOK3047MDL-020-00433713	TIKTOK3047MDL-020-00433713
TIKTOK3047MDL-021-LARK-00012902	TIKTOK3047MDL-021-LARK-00012907
TIKTOK3047MDL-021-LARK-00013349	TIKTOK3047MDL-021-LARK-00013356
TIKTOK3047MDL-021-LARK-00021837	TIKTOK3047MDL-021-LARK-00021852
TIKTOK3047MDL-024-LARK-00026653	TIKTOK3047MDL-024-LARK-00026653
TIKTOK3047MDL-024-LARK-00042686	TIKTOK3047MDL-024-LARK-00042694
TIKTOK3047MDL-024-LARK-00043068	TIKTOK3047MDL-024-LARK-00043075
TIKTOK3047MDL-024-LARK-00043517	TIKTOK3047MDL-024-LARK-00043518
TIKTOK3047MDL-024-LARK-00058762	TIKTOK3047MDL-024-LARK-00058762
TIKTOK3047MDL-024-LARK-00063580	TIKTOK3047MDL-024-LARK-00063603
TIKTOK3047MDL-029-LARK-00072840	TIKTOK3047MDL-029-LARK-00072849
TIKTOK3047MDL-029-LARK-00079871	TIKTOK3047MDL-029-LARK-00079877
TIKTOK3047MDL-042-LARK-00264958	TIKTOK3047MDL-042-LARK-00264965
TIKTOK3047MDL-042-LARK-00273631	TIKTOK3047MDL-042-LARK-00273651
TIKTOK3047MDL-042-LARK-00283496	TIKTOK3047MDL-042-LARK-00283503
TIKTOK3047MDL-043-00836286	TIKTOK3047MDL-043-00836302
TIKTOK3047MDL-045-LARK-00447779	TIKTOK3047MDL-045-LARK-00447785
TIKTOK3047MDL-046-LARK-00497235	TIKTOK3047MDL-046-LARK-00497242
TIKTOK3047MDL-054-LARK-00590474	TIKTOK3047MDL-054-LARK-00590524

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Bates Beg	Bates End
TIKTOK3047MDL-056-00967926	TIKTOK3047MDL-056-00971600
TIKTOK3047MDL-060-01094383	TIKTOK3047MDL-060-01094384
TIKTOK3047MDL-060-01142302	TIKTOK3047MDL-060-01142312
TIKTOK3047MDL-060-01169876	TIKTOK3047MDL-060-01169896
TIKTOK3047MDL-065-LARK-00746787	TIKTOK3047MDL-065-LARK-00746791
TIKTOK3047MDL-065-LARK-00841247	TIKTOK3047MDL-065-LARK-00841253
TIKTOK3047MDL-065-LARK-00868751	TIKTOK3047MDL-065-LARK-00868752
TIKTOK3047MDL-068-LARK-01057872	TIKTOK3047MDL-068-LARK-01057889
TIKTOK3047MDL-072-LARK-01123543	TIKTOK3047MDL-072-LARK-01123553
TIKTOK3047MDL-078-LARK-01910040	TIKTOK3047MDL-078-LARK-01910048
TIKTOK3047MDL-079-LARK-02019915	TIKTOK3047MDL-079-LARK-02019924
TIKTOK3047MDL-080-LARK-02725150	TIKTOK3047MDL-080-LARK-02725155
TIKTOK3047MDL-080-LARK-02727108	TIKTOK3047MDL-080-LARK-02727124
TIKTOK3047MDL-083-LARK-02926886	TIKTOK3047MDL-083-LARK-02926924
TIKTOK3047MDL-084-LARK-02984005	TIKTOK3047MDL-084-LARK-02984021
TIKTOK3047MDL-084-LARK-03141332	TIKTOK3047MDL-084-LARK-03141335
TIKTOK3047MDL-084-LARK-03172633	TIKTOK3047MDL-084-LARK-03172633
TIKTOK3047MDL-085-03563362	TIKTOK3047MDL-085-03563362
TIKTOK3047MDL-090-LARK-03540110	TIKTOK3047MDL-090-LARK-03540118
TIKTOK3047MDL-090-LARK-03854022	TIKTOK3047MDL-090-LARK-03854038
TIKTOK3047MDL-092-03750324	TIKTOK3047MDL-092-03750326
TIKTOK3047MDL-092-03751620	TIKTOK3047MDL-092-03751620

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Bates Beg	Bates End
TIKTOK3047MDL-094-LARK-03983009	TIKTOK3047MDL-094-LARK-03983022
TIKTOK3047MDL-098-04033091	TIKTOK3047MDL-098-04033091
TIKTOK3047MDL-098-04034122	TIKTOK3047MDL-098-04034122
TIKTOK3047MDL-098-04040161	TIKTOK3047MDL-098-04040161
TIKTOK3047MDL-098-04041918	TIKTOK3047MDL-098-04041918
TIKTOK3047MDL-098-04043388	TIKTOK3047MDL-098-04043388
TIKTOK3047MDL-098-04045107	TIKTOK3047MDL-098-04045107
TIKTOK3047MDL-098-04045373	TIKTOK3047MDL-098-04045373
TIKTOK3047MDL-099-LARK-04804937	TIKTOK3047MDL-099-LARK-04804944
TIKTOK3047MDL-099-LARK-04930201	TIKTOK3047MDL-099-LARK-04930213
TIKTOK3047MDL-101-LARK-05146491	TIKTOK3047MDL-101-LARK-05146509
TIKTOK3047MDL-101-LARK-05223785	TIKTOK3047MDL-101-LARK-05223797
TIKTOK3047MDL-111-LARK-06042154	TIKTOK3047MDL-111-LARK-06042195
TIKTOK3047MDL-118-LARK-06076591	TIKTOK3047MDL-118-LARK-06076606
TIKTOK3047MDL-120-LARK-06208410	TIKTOK3047MDL-120-LARK-06208422
TIKTOK3047MDL-128-LARK-06767525	TIKTOK3047MDL-128-LARK-06767535
TIKTOK3047MDL-150-LARK-07285061	TIKTOK3047MDL-150-LARK-07285069
TIKTOK3047MDL-151-LARK-07303693	TIKTOK3047MDL-151-LARK-07303702
TIKTOK3047MDL-153-LARK-07413298	TIKTOK3047MDL-153-LARK-07413313
TIKTOK3047MDL-160-LARK-07431197	TIKTOK3047MDL-160-LARK-07431202
TIKTOK3047MDL-163-04668748	TIKTOK3047MDL-163-04668787

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
TIKTOK3047MDL-168-04772591	TIKTOK3047MDL-168-04772595
TIKTOK3047MDL-169-LARK-07457744	TIKTOK3047MDL-169-LARK-07457781
TIKTOK3047MDL-186-LARK-08176023	TIKTOK3047MDL-186-LARK-08176250
TIKTOK3047MDL-207-LARK-08711479	TIKTOK3047MDL-207-LARK-08711479
META3047MDL-014-00358776	META3047MDL-014-00358795
META3047MDL-019-00127958	
META3047MDL-047-00573740	META3047MDL-047-00573817
META3047MDL-040-00102898	META3047MDL-040-00103051
GOOG-3047MDL-04848897	GOOG-3047MDL-04848897
GOOG-3047MDL-00157413	GOOG-3047MDL-00157413
GOOG-3047MDL-00187874	GOOG-3047MDL-00187874
TIKTOK3047MDL-036-LARK-00107642	TIKTOK3047MDL-036-LARK-00107649
TIKTOK3047MDL-006-00326148	TIKTOK3047MDL-006-00326195
SNAP3803049	SNAP3803095
SNAP0221370	SNAP0221377
META3047MDL-003-00094811	META3047MDL-003-00094837
TIKTOK3047MDL-018-00361108	TIKTOK3047MDL-018-00361109
SNAP1924968	SNAP1925025
META3047MDL-072-00304285	META3047MDL-072-00304305
GOOG-3047MDL-01625570	GOOG-3047MDL-01625574
META3047MDL-003-00145472	META3047MDL-003-00145474
META3047MDL-003-00171401	META3047MDL-003-00171407
META3047MDL-004-00027423	META3047MDL-004-00027445

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
META3047MDL-014-00046411	META3047MDL-014-00046423
META3047MDL-014-00378084	META3047MDL-014-00378085
META3047MDL-014-00378779	META3047MDL-014-00378781
META3047MDL-019-00099847	META3047MDL-019-00099847
META3047MDL-020-00349969	META3047MDL-020-00350077
META3047MDL-020-00609932	META3047MDL-020-00609944
META3047MDL-031-00086272	META3047MDL-031-00086290
META3047MDL-040-00317980	META3047MDL-040-00317990
META3047MDL-046-00477173	META3047MDL-046-00477177
META3047MDL-046-00495408	META3047MDL-046-00495409
META3047MDL-050-00331333	META3047MDL-050-00331334
SNAP0006256	SNAP0006260
SNAP0008117	SNAP0008123
SNAP1197331	SNAP1197331
SNAP2294924	SNAP2294926
SNAP2367438	SNAP2367441
SNAP2367515	SNAP2367527
SNAP4783191	SNAP4783201
SNAP4833189	SNAP4833190

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Bates Beg	Bates End
SNAP6399042	SNAP6399043
SNAP7140925	SNAP7140925
TIKTOK3047MDL-001-00060986	TIKTOK3047MDL-001-00061259
TIKTOK3047MDL-004-00151111	TIKTOK3047MDL-004-00151117
TIKTOK3047MDL-062-01192752	TIKTOK3047MDL-062-01192754
TIKTOK3047MDL-112-04262174	TIKTOK3047MDL-112-04262177
TIKTOK3047MDL-115-04366552	TIKTOK3047MDL-115-04366564
GOOG-3047MDL-01287601	GOOG-3047MDL-01287601
GOOG-3047MDL-01776693	GOOG-3047MDL-01776693
GOOG-3047MDL-02570565	GOOG-3047MDL-02570565
GOOG-3047MDL-03304579	GOOG-3047MDL-03304581
GOOG-3047MDL-04613300	GOOG-3047MDL-04613301
GOOG-3047MDL-05710514	GOOG-3047MDL-05710705
SNAP5499098	SNAP5499127
TIKTOK3047MDL-014-00330672	TIKTOK3047MDL-014-00330683
TIKTOK3047MDL-029-LARK-00069953	TIKTOK3047MDL-029-LARK-00069959
TIKTOK3047MDL-042-LARK-00283114	TIKTOK3047MDL-042-LARK-00283142
TIKTOK3047MDL-080-LARK-02552741	TIKTOK3047MDL-080-LARK-02552748
TIKTOK3047MDL-090-LARK-03471333	TIKTOK3047MDL-090-LARK-03471337
TIKTOK3047MDL-099-LARK-04757966	TIKTOK3047MDL-099-LARK-04757966
TIKTOK3047MDL-111-LARK-05945102	TIKTOK3047MDL-111-LARK-05945107
TIKTOK3047MDL-112-04262174	TIKTOK3047MDL-112-04262177
TIKTOK3047MDL-199-LARK-08546223	TIKTOK3047MDL-199-LARK-08546238

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
Snap	Abby Tran	2/26/2025	Deposition Transcripts and Exhibits of Abby Tran
Meta	Adam Mosseri	3/17/2025	Deposition Transcripts and Exhibits of Adam Mosseri
Meta	Adam Mossseri	3/18/2025	Deposition Transcripts and Exhibits of Adam Mosseri
Snap	Alex Osborne	1/10/2025	Deposition Transcripts and Exhibits of Alex Osborne
Meta	Alison Lee	2/6/2025	Deposition Transcripts and Exhibits of Alison Lee
Snap	Althea Tupper	11/14/2024	Deposition Transcripts and Exhibits of Althea Tupper
Meta	Arturo Bejar	4/7/2025	Rough Deposition Transcripts and Exhibits of Arturo Bejar
Meta	Arturo Bejar	4/8/2025	Rough Deposition Transcripts and Exhibits of Arturo Bejar
Meta	Arturo Bejar	4/9/2025	Rough Deposition Transcripts and Exhibits of Arturo Bejar
Meta	Aza Raskin	3/17/2025	Deposition Transcripts and Exhibits of Aza Raskin
Meta	Charles Sismondo	10/16/2024	Deposition Transcripts and Exhibits of Charles Sismondo
Meta	Charles Sismondo	10/17/2024	Deposition Transcripts and Exhibits of Charles Sismondo
YouTube	Christos Goodrow	2/19/2025	Deposition Transcripts and Exhibits of Christos Goodrow
YouTube	Christos Goodrow	2/20/2025	Deposition Transcripts and Exhibits of Christos Goodrow
Snap	Claudia Chan	2/7/2025	Deposition Transcripts and Exhibits of Claudia Chan
TikTok	Cormac Keenan	3/25/2025	Rough Deposition Transcript of Cormac Keenan
Meta	Darius Kilstein	12/17/2024	Deposition Transcripts and Exhibits of Darius Kilstein
Meta	Darius Kilstein	12/18/2024	Deposition Transcripts and Exhibits of Darius Kilstein
Snap	David Boyle	4/2/2025	Deposition Transcripts and Exhibits of David Boyle
Snap	David Boyle	2/27/2025	Deposition Transcripts and Exhibits of David Boyle

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
Snap	David Boyle (30B6)	2/26/2025	Deposition Transcripts and Exhibits of David Boyle (30b6)
Snap	David Lue	3/26/2025	Deposition Transcripts and Exhibits of David Lue
Snap	Deborah Oshuntola	2/4/2025	Deposition Transcripts and Exhibits of Deborah Oshuntola
Meta	Diego Castaneda	10/22/2024	Deposition Transcripts and Exhibits of Diego Castaneda
Meta	Diego Castaneda	10/23/2024	Deposition Transcripts and Exhibits of Diego Castaneda
TikTok	Drew Kirchhoff	3/16/2025	Deposition Transcripts and Exhibits of Drew Kirchhoff
Meta	Elena Davis	3/6/2025	Deposition Transcripts and Exhibits of Elena Davis
Meta	Elenda Davis	3/5/2025	Deposition Transcripts and Exhibits of Elena Davis
TikTok	Emma Gribbon	2/24/2025	Deposition Transcript and Exhibits of Emma Gribbon
TikTok	Eric Han	3/11/2025	Deposition Transcripts and Exhibits of Eric Han
TikTok	Eric Han	3/12/2025	Deposition Transcripts and Exhibits of Eric Han
YouTube	Erin Turner	1/22/2025	Deposition Transcripts and Exhibits of Erin Turner
YouTube	Fred Gilbert	2/20/2025	Deposition Transcripts and Exhibits of Fred Gilbert
Google	Garth Graham	3/5/2025	Deposition Transcript and Exhibits of Garth Graham
Meta	George Volichenko	12/16/2024	Deposition Transcripts and Exhibits of George Volichenko
Snap	Jack Brody	2/5/2025	Deposition Transcripts and Exhibits of Jack Brody
Snap	Jacqueline Beauchere	3/13/2025	Deposition Transcripts and Exhibits of Jacqueline Beauchere
Snap	Jacqueline Beauchere	3/14/2025	Deposition Transcripts and Exhibits of Jacqueline Beauchere
Google	James Beser	4/2/1935	Deposition Transcript and Exhibits of James Beser
Google	James Beser	4/3/2025	Deposition Transcript and Exhibits of James Beser

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
Google	James Beser	4/9/2025	Deposition Transcript and Exhibits of James Beser (30b6)
Snap	Jeb Boniakowski	3/20/2025	Deposition Transcripts and Exhibits of Jeb Boniakowski
Meta	Jennifer Guadagno	11/14/2024	Deposition Transcripts and Exhibits of Jennifer Guadagno
Snap	Jennifer Stout	3/26/2025	Rough Deposition Transcripts and Exhibits of Jennifer Stout
Snap	Jennifer Stout	3/27/2025	Rough Deposition Transcripts and Exhibits of Jennifer Stout
Google	Jessica Dzuban	2/26/2025	Deposition Transcript and Exhibits of Jessica Dzuban
TikTok	Jordan Furlong	4/11/2025	Deposition Transcripts and Exhibits of Jordan Furlong
TikTok	Jordan Furlong	4/12/2025	Deposition Transcripts and Exhibits of Jordan Furlong
Snap	Josh Siegel	3/20/2025	Deposition Transcripts and Exhibits of Josh Siegel
TikTok	Julie De Balliencourt	3/27/2025	Deposition Transcript and Exhibits of Julie De Balliencourt
Snap	Juliet Shen	3/4/2025	Deposition Transcripts and Exhibits of Juliet Shen
Meta	Justin Cheng	3/13/2025	Deposition Transcripts and Exhibits of Justin Cheng
Meta	Justin Cheng	4/1/2025	Rough Deposition Transcripts and Exhibits of Justin Cheng
Google	Jyoti Ramnath	11/19/2024	Deposition Transcript and Exhibits of Jyoti Ramnath
Snap	Kale Zicafoose	12/4/2024	Deposition Transcripts and Exhibits of Kale Zicafoose
Meta	Kang-Xing Jin	10/24/2024	Deposition Transcripts and Exhibits of Kang-Xing Jin
Meta	Kang-Xing Jin	10/25/2024	Deposition Transcripts and Exhibits of Kang-Xing Jin
Meta	Karina Newton	2/27/2025	Deposition Transcripts and Exhibits of Karina Newton
Meta	Karina Newton	2/28/2025	Deposition Transcripts and Exhibits of Karina Newton
YouTube	Katharina Ostergaard	1/15/2025	Rough Deposition Transcript of Katharina Ostergaard

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
YouTube	Kim Woojin	3/11/2025	Deposition Transcripts and Exhibits of Kim Woojin
Meta	Kristen Hendrix	1/22/2025	Deposition Transcripts and Exhibits of Kristen Hendrix
Meta	Kristen Hendrix	1/23/2025	Deposition Transcripts and Exhibits of Kristen Hendrix
Meta	Kyle Andrews	11/19/2024	Deposition Transcripts and Exhibits of Kyle Andrews
Meta	Kyle Andrews	11/20/2024	Deposition Transcripts and Exhibits of Kyle Andrews
Snap	Lauryl Schraedly	1/24/2025	Deposition Transcripts and Exhibits of Lauryl Schraedly
Snap	Lisa Duron (30B6)	5/1/2024	Deposition Transcripts and Exhibits of Lisa Duron (30b6)
Meta	Margaret Gould Stewart	10/21/2024	Deposition Transcripts and Exhibits of Margaret Gould Stewart
Meta	Mark Zuckerberg	3/27/2025	Deposition Transcripts and Exhibits of Mark Zuckerberg
Meta	Mark Zuckerberg	3/28/2025	Deposition Transcripts and Exhibits of Mark Zuckerberg
YouTube	Matt Fischer-Colbrie	3/7/2025	Deposition Transcripts and Exhibits of Matt Fischer-Colbrie
Google	Matt Halprin	2/11/2025	Deposition Transcript and Exhibits of Matt Halprin
Snap	Matthew Jackson (30B6)	11/19/2024	Deposition Transcripts and Exhibits of Matthew Jackson (30b6)
Meta	Michael Rothschild	1/21/2025	Deposition Transcripts and Exhibits of Michael Rothschild
Meta	Michael Rothschild	1/22/2025	Deposition Transcripts and Exhibits of Michael Rothschild
Snap	Michael Weissinger	12/18/2024	Rough Deposition Transcripts and Exhibits of Michael Weissinger
Meta	Moira Burke	1/28/2025	Deposition Transcripts and Exhibits of Moira Burke
Meta	Moira Burke	1/29/2025	Deposition Transcripts and Exhibits of Moira Burke
Snap	Morgan Hammerstrom	2/12/2025	Deposition Transcripts and Exhibits of Morgan Hammerstrom
Meta	Nick Clegg	3/20/2025	Deposition Transcripts and Exhibits of Nick Clegg

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
Meta	Nick Clegg	3/21/2025	Deposition Transcripts and Exhibits of Nick Clegg
Snap	Nona Yadegar	12/16/2024	Deposition Transcripts and Exhibits of Nona Yadegar
Meta	Paul Alexander Dow	11/7/2024	Deposition Transcripts and Exhibits of Paul Alexander Dow
Meta	Paul Alexander Dow	11/8/2024	Deposition Transcripts and Exhibits of Paul Alexander Dow
Meta	Pavni Diwanji	3/3/2025	Deposition Transcripts and Exhibits of Pavni Diwanji
Snap	Peter Sellis	2/6/2025	Deposition Transcripts and Exhibits of Peter Sellis
Meta	Pratiti Raychoudhury	12/12/2024	Deposition Transcripts and Exhibits of Pratiti Raychoudhury
Meta	Pratiti Raychoudhury	12/13/2024	Deposition Transcripts and Exhibits of Pratiti Raychoudhury
YouTube	Raj Iyengar	3/13/2025	Deposition Transcripts and Exhibits of Raj Iyengar
Meta	Ravi Sinha	12/5/2024	Deposition Transcripts and Exhibits of Ravi Sinha
Meta	Ravi Sinha	12/6/2024	Deposition Transcripts and Exhibits of Ravi Sinha
YouTube	Reid Watson	3/12/2025	Deposition Transcripts and Exhibits of Reid Watson
Google	Sharon Stovezky	12/11/2024	Deposition Transcript and Exhibits of Sharon Stovezky
Meta	Shayli Jimenez	2/11/2025	Deposition Transcripts and Exhibits of Shayli Jimenez
Meta	Shayli Jimenez	2/12/2025	Deposition Transcripts and Exhibits of Shayli Jimenez
Snap	Shimrit Ben-Yair	3/20/2025	Deposition Transcripts and Exhibits of Shimrit Ben-Yair
Meta	Shruti Bhutada	11/18/2024	Deposition Transcripts and Exhibits of Shruti Bhutada
Meta	Shruti Bhutada	11/19/2024	Deposition Transcripts and Exhibits of Shruti Bhutada
YouTube	Tanaya Kasavana	1/28/2025	Deposition Transcripts and Exhibits of Tanaya Kasavana
YouTube	Tanaya Kasavana	1/29/2025	Deposition Transcripts and Exhibits of Tanaya Kasavana

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Defendant	Witness	Date	Description
Meta	Vaishnavi Jayakumar	1/30/2025	Deposition Transcripts and Exhibits of Vaishnavi Jayakumar
Meta	Vaishnavi Jayakumar	1/31/2025	Deposition Transcripts and Exhibits of Vaishnavi Jayakumar
TikTok	Victoria McCullough	2/19/2025	Deposition Transcript and Exhibits of Victoria McCullough
Meta	Wendy Gross	1/28/2025	Deposition Transcripts and Exhibits of Wendy Gross

Literature Review - APA Publication Cite
Moreno MA, Brockman LN, Wasserheit JN, Christakis DA. A pilot evaluation of older adolescents' sexual reference displays on Facebook. *J Sex Res* . 2012;49(4):390-9. doi:10.1080/00224499.2011.642903
Radtke, T., Apel, T., Schenkel, K., Keller, J., & von Lindern, E. (2021). Digital detox: An effective solution in the smartphone era? A systematic literature review. *Mobile Media & Communication* , *10* (2), 190–215. https://doi.org/10.1177/20501579211028647
Padilla-Walker, L. M., & Christensen, K. J. (2011). Empathy and self-regulation as mediators between parenting and adolescents' prosocial behavior toward strangers, friends, and family. Journal of Research on Adolescence, 21(3), 545–551. https://doi.org/10.1111/j.1532-7795.2010.00695.x
Thorell, L. B., Burén, J., Ström Wiman, J., Sandberg, D., & Nutley, S. B. (2022). Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. *European Child & Adolescent Psychiatry* , *33* . https://doi.org/10.1007/s00787-022-02130-3
Schlosser A. E. (2020). Self-disclosure versus self-presentation on social media. *Current Opinion in Psychology* , *31* , 1–6. https://doi.org/10.1016/j.copsyc.2019.06.025
Vaterlaus J, Barnett K, Roche C, Young J. "Snapchat is more personal": An exploratory study on Snapchat behaviors and young adult interpersonal relationships. Computers in Human Behavior, 62, 594–601.2016.
Salomon I. "The Selfie Generation: Examining the Relationship Between Social Media Use and Early Adolescent Body Image". Theses and Dissertations--Psychology. 112. 2017. https://uknowledge.uky.edu/psychology_etds/112
Royal Society For Public Health. #StatusofMind: Social media and young people’s mental health and wellbeing. 2017 May. https://www.rsph.org.uk/static/uploaded/d125b27c-0b62-41c5-a2c0155a8887cd01.pdf

Literature Review - APA Publication Cite
Lupinacci L. 'Absentmindedly scrolling through nothing': liveness and compulsory continuous connectedness in social media. Media, Culture & Society. 43. 2020.
Dunn T, Langlais M. "Oh, Snap!": A Mixed-Methods Approach to Analyzing the Dark Side of Snapchat. The Journal of Social Media in Society, 9(2), 69-104. 2020.
Pagano, M., Bacaro, V., & Crocetti, E. (2023). "Using digital media or sleeping … that is the question". A meta-analysis on digital media use and unhealthy sleep in adolescence. *Computers in Human Behavior* , *146* , 107813. https://doi.org/10.1016/j.chb.2023.107813
Hristova D, Jovicic S, Göbl B, De Freitas S, Slunecko T. "Why did we lose our snapchat streak?". Social media gamification and metacommunication. Computers in Human Behavior Reports, 5, 100172. 2022.
Schaeffer K. 7 facts about Americans and Instagram. Pew Research Center, Short Reads. 2021 Oct 7. https://www.pewresearch.org/short-reads/2021/10/07/7-facts-about-americans-and-instagram/
Janssen, L.H.C., Valkenburg, P.M., Keijsers, L. *et al.* A harsher reality for adolescents with depression on social media. *Sci Rep* **15**, 10947 (2025). https://doi.org/10.1038/s41598-025-89762-y
Astatke, M., Weng, C., & Chen, S. (2021). A literature review of the effects of social networking sites on secondary school students' academic achievement. *Interactive Learning Environments* , *31* (4), 2153–2169. https://doi.org/10.1080/10494820.2021.1875002
Ivie EJ, Pettitt A, Moses LJ, Allen NB. A meta-analysis of the association between adolescent social media use and depressive symptoms. Journal of Affective Disorders. 2020/10/01/ 2020;275:165-174. doi:https://doi.org/10.1016/j.jad.2020.06.014
McComb, C. A., Vanman, E. J., & Tobin, S. J. (2023). A Meta-Analysis of the Effects of Social Media Exposure to Upward Comparison Targets on Self-Evaluations and Emotions. *Media Psychology* , *26* (5), 612–635. https://doi.org/10.1080/15213269.2023.2180647

Literature Review - APA Publication Cite
Saiphoo, Alyssa & Vahedi, Zahra. (2019). A meta-analytic review of the relationship between social media use and body image disturbance. Computers in Human Behavior. 101. 10.1016/j.chb.2019.07.028.
Connect Safely. A Parents' Guide to Instagram. 2014. ConnectSafely.org
Moreno MA, Brockman LN, Wasserheit JN, Christakis DA. A Pilot Evaluation of Older Adolescents' Sexual Reference Displays on Facebook(R). *J Sex Res* . Jan 12 2012;doi:10.1080/00224499.2011.642903
Sun, Y., & Zhang, Y. (2021). A review of theories and models applied in studies of social media addiction and implications for future research. *Addictive Behaviors* , *114* , 106699. https://doi.org/10.1016/j.addbeh.2020.106699
Puccio F, Kalathas F, Fuller-Tyszkiewicz M, Krug I. A revised examination of the dual pathway model for bulimic symptoms: The importance of social comparisons made on Facebook and sociotropy. Computers in Human Behavior. 2016/12/01/ 2016;65:142-150. doi:https://doi.org/10.1016/j.chb.2016.08.018
Kofoed J, Larsen M. A snap of intimacy: Photo-sharing practices among young people on social media. First Monday. 21. 2016.
Parry, D. A., Davidson, B. I., Sewall, C. J. R., Fisher, J. T., Mieczkowski, H., & Quintana, D. S. (2021). A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour* , *5* (11). https://doi.org/10.1038/s41562-021-01117-5
Dahlberg, L., McKee, K. J., Frank, A., & Naseer, M. (2022). A systematic review of longitudinal risk factors for loneliness in older adults. *Aging & Mental Health* , *26* (2), 225–249. https://doi.org/10.1080/13607863.2021.1876638
Keles, B., McCrae, N., & Grealish, A. (2019). A Systematic review: the Influence of Social Media on depression, Anxiety and Psychological Distress in Adolescents. *International Journal of Adolescence and Youth* , *25* (1), 79–93. Taylor & Francis Online. https://doi.org/10.1080/02673843.2019.1590851

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Keles B, McCrae N, Grealish A. A systematic review: the influence of social media on depression, anxiety and psychological distress in adolescents, International Journal of Adolescence and Youth, 25:1, 79-93. 2020.
Montag C, Lachmann B, Herrlich M, Zweig K. Addictive Features of Social Media/Messenger Platforms and Freemium Games against the Background of Psychological and Economic Theories. Int J Environ Res Public Health. 2019 Jul 23;16(14):2612.
Crews F, He J, Hodge C. Adolescent cortical development: a critical period of vulnerability for addiction. Pharmacol Biochem Behav. 2007 Feb;86(2):189-99.
Chung, A., Vieira, D., Donley, T., Tan, N., Jean-Louis, G., Kiely Gouley, K., & Seixas, A. (2020). Adolescent peer influence via social media on eating behaviors: A scoping review. *Journal of Medical Internet Research* , *23* (6). https://doi.org/10.2196/19697
Christakis, D. A., Mathew, G. M., Reichenberger, D. A., Rodriguez, I. R., Ren, B., & Hale, L. (2025). Adolescent Smartphone Use During School Hours. *JAMA pediatrics* , *179* (4), 475–478. https://doi.org/10.1001/jamapediatrics.2024.6627
Weinstein, E. (2017). Adolescents' differential responses to social media browsing: Exploring causes and consequences for intervention. Computers in Human Behavior, 76, 396–405. https://doi.org/10.1016/j.chb.2017.07.038
Farid H. An Overview of Perceptual Hashing. Journal of Online Trust and Safety, 1(1). 2021.
Godard, R., Holtzman, S. (2024) Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies, Journal of Computer-Mediated Communication, Volume 29, Issue 1, January 2024, zmad055, https://doi.org/10.1093/jcmc/zmad055
Appel, M., Marker, C., & Gnambs, T. (2019). Are Social Media Ruining Our Lives? A Review of Meta-Analytic Evidence. *Review of General Psychology* , *24* (1), 108926801988089. https://doi.org/10.1177/1089268019880891

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Donaldson SI, Dormanesh A, Perez C, Majmundar A, Allem J-P. Association Between Exposure to Tobacco Content on Social Media and Tobacco Use: A Systematic Review and Meta-analysis. *JAMA Pediatrics* . 2022;176(9):878-885. doi:10.1001/jamapediatrics.2022.2223
Niederkrotenthaler, T., Braun, M., Pirkis, J., Till, B., Stack, S., Sinyor, M., Tran, U. S., Voracek, M., Cheng, Q., Arendt, F., Scherr, S., Yip, P. S. F., & Spittal, M. J. (2020). Association between suicide reporting in the media and suicide: systematic review and meta-analysis. *BMJ (Clinical research ed.)* , *368* , m575. https://doi.org/10.1136/bmj.m575
Bridge, J. A., Greenhouse, J. B., Ruch, D., Stevens, J., Ackerman, J., Sheftall, A. H., Horowitz, L. M., Kelleher, K. J., & Campo, J. V. (2020). Association Between the Release of Netflix's 13 Reasons Why and Suicide Rates in the United States: An Interrupted Time Series Analysis. *Journal of the American Academy of Child and Adolescent Psychiatry* , *59* (2), 236–243. https://doi.org/10.1016/j.jaac.2019.04.020
Chen J, Ishii M, Bater KL, Darrach H, Liao D, Huynh PP, Reh IP, Nellis JC, Kumar AR, Ishii LE. Association Between the Use of Social Media and Photograph Editing Applications, Self-esteem, and Cosmetic Surgery Acceptance. JAMA Facial Plast Surg. 2019 Sep 1;21(5):361-367.
Maza, M. T., Fox, K. A., Kwon, S. J., Flannery, J. E., Lindquist, K. A., Prinstein, M. J., & Telzer, E. H. (2023). Association of Habitual Checking Behaviors on Social Media With Longitudinal Functional Brain Development. *JAMA pediatrics* , *177* (2), 160–167. https://doi.org/10.1001/jamapediatrics.2022.4924
Maza MT, Fox KA, Kwon SJ, Flannery JE, Lindquist KA, Prinstein MJ, Telzer EH. Association of Habitual Checking Behaviors on Social Media With Longitudinal Functional Brain Development. JAMA Pediatr. 2023 Feb 1;177(2):160-167.
Moreno, M. A., Christakis, D. A., Egan, K. G., Brockman, L. N., & Becker, T. (2012). Associations between displayed alcohol references on Facebook and problem drinking among college students. *Archives of Pediatrics & Adolescent Medicine* , *166* (2), 157–163. https://doi.org/10.1001/archpediatrics.2011.180

Literature Review - APA Publication Cite
Moreno MA, Christakis DA, Egan KG, Brockman LN, Becker T. Associations Between Displayed Alcohol References on Facebook and Problem Drinking Among College Students. *Arch Pediatr Adolesc Med* . Oct 3 2011;doi:archpediatrics.2011.180 [pii]10.1001/archpediatrics.2011.180
Riehm, K. E., Feder, K. A., Tormohlen, K. N., Crum, R. M., Young, A. S., Green, K. M., Pacek, L. R., La Flair, L. N., & Mojtabai, R. (2019). Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. *JAMA psychiatry* , *76* (12), 1266–1273. https://doi.org/10.1001/jamapsychiatry.2019.2325
Riehm KE, Feder KA, Tormohlen KN, Crum RM, Young AS, Green KM, Pacek LR, La Flair LN, Mojtabai R. Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. JAMA Psychiatry. 2019 Dec 1;76(12):1266-1273.
Verharen JPH, Zhu Y, Lammel S. Aversion hot spots in the dopamine system. Curr Opin Neurobiol. 2020 Oct;64:46-52.
Castelo, N., Kushlev, K., Ward, A. F., Esterman, M., & Reiner, P. B. (2025). Blocking mobile internet on smartphones improves sustained attention, mental health, and subjective well-being. *PNAS Nexus* , *4* (2). https://doi.org/10.1093/pnasnexus/pgaf017
Ali, S., Haykal, H. A., & Youssef, E. Y. M. (2021). Child Sexual Abuse and the Internet—A Systematic Review. *Human Arenas* , *6* . https://doi.org/10.1007/s42087-021-00228-9
Chassiakos, Y. R., Radesky, J., Christakis, D., Moreno, M. A., & Cross, C. (2016). Children and Adolescents and Digital Media. *Pediatrics* , *138* (5). https://doi.org/10.1542/peds.2016-2593
Lo CB, Bridge JA, Shi J, Ludwig L, Stanley RM. Children's Mental Health Emergency Department Visits: 2007-2016. Pediatrics. 2020 Jun;145(6):e20191536.
Cohen, R., & Blaszczynski, A. (2015). Comparative effects of Facebook and conventional media on body image dissatisfaction. *Journal of eating disorders* , *3* , 23. https://doi.org/10.1186/s40337-015-0061-3

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Trunfio, M., & Rossi, S. (2021). Conceptualising and measuring social media engagement: A systematic literature review. *Italian Journal of Marketing* , *2021* (3), 267–292. https://doi.org/10.1007/s43039-021-00035-8
Twenge J, Joiner T, Rogers M, Martin G. Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U.S. Adolescents After 2010 and Links to Increased New Media Screen Time. Clinical Psychological Science. 6. 216770261772337. 2017.
Giumetti, G. W., & Kowalski, R. M. (2022). Cyberbullying via social media and well-being. *Current opinion in psychology* , *45* , 101314. https://doi.org/10.1016/j.copsyc.2022.101314
Center for Countering Digital Hate. Deadly By Design - TikTok pushes harmful content promoting eating disorders and self-harm into young users' feeds. Center for Countering Digital Hate. Research and policy, 2022 Dec. https://counterhate.com/research/deadly-by-design/
Heron M. Deaths: Leading Causes for 2018. National Vital Statistics Reports. Vol 70 No 4. CDC.
Twenge, J. M., Martin, G. N., & Campbell, W. K. (2018). Decreases in psychological well-being among American adolescents after 2012 and links to screen time during the rise of smartphone technology. *Emotion (Washington, D.C.)* , *18* (6), 765–780. https://doi.org/10.1037/emo0000403
Fairplay. Designing for Disorder: Instagram's Pro-eating Disorder Bubble. 2022 Apr.
Goldenberg, A., & Gross, J. J. (2020). Digital Emotion Contagion. *Trends in Cognitive Sciences* , *24* (4), 316–328. https://doi.org/10.1016/j.tics.2020.01.009
Ferguson, C. J. (2025). Do social media experiments prove a link with mental health: A methodological and meta-analytic review. Psychology of Popular Media, 14(2), 201–206. https://doi.org/10.1037/ppm0000541

Literature Review - APA Publication Cite
Coyne, S. M., Rogers, A. A., Zurcher, J. D., Stockdale, L., & Booth, M. (2020). Does time spent using social media impact mental health?: An eight year longitudinal study. Computers in Human Behavior, 104, Article 106160. https://doi.org/10.1016/j.chb.2019.106160
Speranza L, di Porzio U, Viggiano D, de Donato A, Volpicelli F. Dopamine: The Neuromodulator of Long-Term Synaptic Plasticity, Reward and Movement Control. Cells. 2021 Mar 26;10(4):735.
Macnow, T., Curran, T., Tolliday, C., Martin, K., McCarthy, M., Ayturk, D., Babu, K. M., & Mannix, R. (2021). Effect of Screen Time on Recovery From Concussion: A Randomized Clinical Trial. *JAMA pediatrics* , *175* (11), 1124–1131. https://doi.org/10.1001/jamapediatrics.2021.2782
Neophytou, E., Manwell, L. A., & Eikelboom, R. (2019). Effects of excessive screen time on neurodevelopment, learning, memory, mental health, and neurodegeneration: A scoping review. International Journal of Mental Health and Addiction, 19(3), 724–744. https://doi.org/10.1007/s11469-019-00182-2
Arendt, F., Scherr, S., & Romer, D. (2019). Effects of exposure to self-harm on social media: Evidence from a two-wave panel study among young adults. *New Media & Society* , *21* (11-12), 2422–2442. https://doi.org/10.1177/1461444819850106
Jerónimo, F., & Carraça, E. V. (2022). Effects of Fitspiration Content on Body image: a Systematic Review. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* , *27* (8). https://doi.org/10.1007/s40519-022-01505-4
Karen D'Souza, Eight out of 10 Gen Zers say social media distracts from schools, EdSource, https://edsource.org/updates/eight-out-of-10-gen-zers-say-social-media-distracts-from-school
Vuorre M, Przybylski AK. Estimating the association between Facebook adoption and well-being in 72 countries. *R Soc Open Sci* . 2023;10:221451.
Turel, O., He, Q., Xue, G., Xiao, L., & Bechara, A. (2014). Examination of neural systems sub-serving facebook "addiction". *Psychological reports* , *115* (3), 675–695. https://doi.org/10.2466/18.PR0.115c31z8

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Wacks, Y., & Weinstein, A. M. (2021). Excessive Smartphone Use Is Associated With Health Problems in Adolescents and Young Adults. *Frontiers in Psychiatry* , *12* , 669042. https://doi.org/10.3389/fpsyt.2021.669042
A.D.I. Kramer, J.E. Guillory, & J.T. Hancock, Experimental evidence of massive-scale emotional contagion through social networks, Proc. Natl. Acad. Sci. U.S.A. 111 (24) 8788-8790, https://doi.org/10.1073/pnas.1320040111 (2014).
Sun, W., & Chao, M. (2024). Exploring the influence of excessive social media use on academic performance through media multitasking and attention problems: a three-dimension usage perspective. *Education and Information Technologies* . https://doi.org/10.1007/s10639-024-12811-y
Rushton K. Facebook lets teenagers see porn: Children as young as 13 are being exposed to explicit images, gambling websites and dangerous diet plans. Daily Mail, Politics. 2017 May 22. https://www.dailymail.co.uk/news/article-4531934/Facebook-lets-teenagers-porn.html
Meta. Facebook to Acquire Instagram. 2012 Apr. 9. https://about.fb.com/news/2012/04/facebook-to-acquire-instagram/
Gugushvili N, Täht K, Ruiter RAC, Verduyn P. Facebook use intensity and depressive symptoms: a moderated mediation model of problematic Facebook use, age, neuroticism, and extraversion. BMC Psychol. 2022 Nov 28;10(1):279.
Gilmour, J., Machin, T., Brownlow, C., & Jeffries, C. (2020). Facebook-based social support and health: A systematic review. Psychology of Popular Media, 9(3), 328–346. https://doi.org/10.1037/ppm0000246
Fehr E, Gächter S. Fairness and Retaliation: The Economics of Reciprocity. Journal of Economic Perspectives. 14. 159-181. 2000.
Tandon, A., Dhir, A., Almugren, I., AlNemer, G. N., & Mäntymäki, M. (2021). Fear of missing out (FoMO) among social media users: a systematic literature review, synthesis and framework for future research. *Internet Research* , *31* (3). https://doi.org/10.1108/intr-11-2019-0455

Literature Review - APA Publication Cite
Akbari, M., Seydavi, M., Palmieri, S., Mansueto, G., Caselli, G., & Spada, M. M. (2021). Fear of missing out (FoMO) and internet use: A comprehensive systematic review and meta-analysis. *Journal of Behavioral Addictions* , *10* (4). https://doi.org/10.1556/2006.2021.00083
Tanhan, F., Özok, H. İ., & Tayiz, V. (2022). Fear of Missing Out (FoMO): A current review. Psikiyatride Güncel Yaklaşımlar, 14(1), 74–85. https://doi.org/10.18863/pgy.942431
Elhai, J. D., Yang, H., & Montag, C. (2021). Fear of missing out (FOMO): overview, theoretical underpinnings, and literature review on relations with severity of negative affectivity and problematic technology use. *Brazilian Journal of Psychiatry (Sao Paulo, Brazil : 1999)* , *43* (2), 203–209. https://doi.org/10.1590/1516-4446-2020-0870
Fioravanti, G., Casale, S., Benucci, S. B., Prostamo, A., Falone, A., Ricca, V., & Rotella, F. (2021). Fear of missing out and social networking sites use and abuse: A meta-analysis. Computers in Human Behavior, 122(122), 106839. https://doi.org/10.1016/j.chb.2021.106839
Qin, Y., Musetti, A., & Omar, B. (2023). Flow Experience Is a Key Factor in the Likelihood of Adolescents' Problematic TikTok Use: The Moderating Role of Active Parental Mediation. *International Journal of Environmental Research and Public Health* , *20* (3), 2089. https://doi.org/10.3390/ijerph20032089
Alfina, Sri Hartini, & Dien Mardhiyah. (2023). FOMO related consumer behaviour in marketing context: A systematic literature review. *Cogent Business & Management* , *10* (3). https://doi.org/10.1080/23311975.2023.2250033
Young, E., McCain, J. L., Mercado, M. C., Ballesteros, M. F., Moore, S., Licitis, L., Stinson, J., Everett Jones, S., & Wilkins, N. J. (2024). Frequent Social Media Use and Experiences with Bullying Victimization, Persistent Feelings of Sadness or Hopelessness, and Suicide Risk Among High School Students — Youth Risk Behavior Survey, United States, 2023. *MMWR Supplements* , *73* (4), 23–30.https://doi.org/10.15585/mmwr.su7304a3
Meta. Giving people the power to build community and bring the world closer together.

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Instagram. Giving Young People a Safer, More Private Experience. Meta. 2021 Jul. 27.
Meng, S. Q., Cheng, J. L., Li, Y. Y., Yang, X. Q., Zheng, J. W., Chang, X. W., Shi, Y., Chen, Y., Lu, L., Sun, Y., Bao, Y. P., & Shi, J. (2022). Global prevalence of digital addiction in general population: A systematic review and meta-analysis. Clinical psychology review, 92, 102128. https://doi.org/10.1016/j.cpr.2022.102128
Headspace. headspace National Youth Mental Health Survey 2018: mental health and wellbeing over time. Headspace National Youth Mental Health Foundation. 2018.
American Psychological Association. (2023). *Health Advisory on Social Media Use in Adolescence* . Apa.org; American Psychological Association.https://www.apa.org/topics/social-media-internet/health-advisory-adolescent-social-media-use
Horwitz J. His Job Was to Make Instagram Safe for Teens. His 14-Year-Old Showed Him What the App Was Really Like. The Wall Street Journal. 2023 Nov. 2. https://www.wsj.com/tech/instagram-facebook-teens-harassment-safety-5d991be1
Brockman, L. N., Pumper, M. A., Christakis, D. A., & Moreno, M. A. (2012). Hookah's new popularity among US college students: a pilot study of the characteristics of hookah smokers and their Facebook displays. BMJ open, 2(6), e001709. https://doi.org/10.1136/bmjopen-2012-001709
Alhaj, H., Muthana, A., Abdalla, A., Marouf, M., & Awad, N. (2024). How Are FOMO and Nomophobia Linked to Symptoms of Depression, Anxiety and Stress Among University Students?. *BJPsych Open* , *10* (Suppl 1), S16–S17. https://doi.org/10.1192/bjo.2024.104
Snapchat Support, How do Snapstreaks work and when do they expire?, https://help.snapchat.com/hc/en-us/articles/7012394193684-How-do-Snapstreaks-work-and-when-do-they-expire
WSJ Noted. How Instagram is Hurting Teen Girls. The Wall Street Journal, Culture. 2021 Sep. 29. https://www.wsj.com/articles/how-instagram-is-hurting-teen-girls-11632940937

Literature Review - APA Publication Cite
Fioravanti, G., Bocci Benucci, S., Ceragioli, G., & Casale, S. (2022). How the Exposure to Beauty Ideals on Social Networking Sites Influences Body Image: A Systematic Review of Experimental Studies. *Adolescent Research Review* , *7* (7), 419–458. https://doi.org/10.1007/s40894-022-00179-4
Nema, P., Srivastava, R., Bhalla, R. and Chakarboty, A. (2023), "Impact of social media distraction on student evaluation of teacher effectiveness", *International Journal of Educational Management* , Vol. 37 No. 2, pp. 300-313. https://doi.org/10.1108/IJEM-10-2022-0389
Ramadhan, R. N., Rampengan, D. D., Yumnanisha, D. A., Setiono, S. B., Tjandra, K. C., Ariyanto, M. V., Idrisov, B., & Empitu, M. A. (2024). Impacts of digital social media detox for mental health: A systematic review and meta-analysis. *Narra J* , *4* (2), e786. https://doi.org/10.52225/narra.v4i2.786
Twenge, J. M. (2020). Increases in Depression, Self-Harm, and Suicide Among U.S. Adolescents After 2012 and Links to Technology Use: Possible Mechanisms. *Psychiatric Research and Clinical Practice* , *2* (1), appi.prcp.20190. https://doi.org/10.1176/appi.prcp.20190015
Pedalino F, Camerini AL. Instagram Use and Body Dissatisfaction: The Mediating Role of Upward Social Comparison with Peers and Influencers among Young Females. Int J Environ Res Public Health. 2022 Jan 29;19(3):1543.
Lozano-Blasco, R., Robres, A. Q., & Sánchez, A. S. (2022). Internet addiction in young adults: A meta-analysis and systematic review. *Computers in Human Behavior* , *130* (130), 107201. https://doi.org/10.1016/j.chb.2022.107201
Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. *Sleep Med Rev* . Apr 2021;56:101414. doi:10.1016/j.smrv.2020.101414
Instagram. Introducing New Ways to Verify Age on Instagram. Meta. 2022 Jun. 23. https://about.instagram.com/blog/announcements/new-ways-to-verify-age-on-instagram
Instagram. Introducing Stricter Message Settings for Teens on Instagram and Facebook. Meta. 2024 Jan. 25.

Literature Review - APA Publication Cite
Revranche, M., Biscond, M., & Husky, M. M. (2021). [Investigating the relationship between social media use and body image among adolescents: A systematic review]. *L'Encephale* , *48* (2), S0013-7006(21)002189. https://doi.org/10.1016/j.encep.2021.08.006
Sax L. Is TikTok Dangerous for Teens? Institute for Family Studies. 2022 Mar. 29. https://ifstudies.org/blog/is-tiktok-dangerous-for-teens-
Brailovskaia J, Ströse F, Schillack H, Margraf J. Less Facebook use – More well-being and a healthier lifestyle? An experimental intervention study. Computers in Human Behavior. 2020/07/01/ 2020;108:106332. doi:https://doi.org/10.1016/j.chb.2020.106332
Likes vs. Learning: The Real Cost of Social Media for Schools, American Federation of Teachers (July 2023), https://www.aft.org/sites/default/files/media/documents/2023/LikesVSLearning_Report.pdf
Davis, C. G., & Goldfield, G. S. (2025). Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. Psychology of Popular Media, 14(1), 1–11. https://doi.org/10.1037/ppm0000536
Harari, M. B., Parola, H. R., Hartwell, C. J., & Riegelman, A. (2020). Literature searches in systematic reviews and meta-analyses: A review, evaluation, and recommendations. *Journal of Vocational Behavior* , *118* (1), 103377. https://www.sciencedirect.com/science/article/pii/S0001879120300026
Thorell, L. B., Burén, J., Ström Wiman, J., Sandberg, D., & Nutley, S. B. (2024). Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. *European child & adolescent psychiatry* , *33* (8), 2503–2526. https://doi.org/10.1007/s00787-022-02130-3
Instagram. Making Instagram Safer for the Youngest Members of Our Community. Meta. 2019 Dec. 4. https://about.instagram.com/blog/announcements/making-instagram-safer-for-the-youngest-members-of-our-community

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Richards, J., Niitsu, K., Kenworthy, N. (2025) Mental Health v. Social Media: How US pretrial filings against social media platforms frame and leverage evidence for claims of youth mental health harms, SSM - Mental Health, Volume 7, 2025, 100378, ISSN 2666-5603, https://doi.org/10.1016/j.ssmmh.2024.100378.
C.S. Mott Children's Hospital. Mott Poll Report. Sharing Too Soon? Children and Social Media Apps. University of Michigan Health. National Poll on Children's Health, Vol 39, Iss 4. 2021 Oct. 18.
Casale, S., Gemelli, G., Calosi, C., Giangrasso, B., & Fioravanti, G. (2021). Multiple exposure to appearance-focused real accounts on instagram: Effects on body image among both genders. Current Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues, 40(6), 2877–2886. https://doi.org/10.1007/s12144-019-00229-6
Mojtabai, R., Olfson, M., & Han, B. (2016). National Trends in the Prevalence and Treatment of Depression in Adolescents and Young Adults. *Pediatrics* , *138* (6), e20161878. https://doi.org/10.1542/peds.2016-1878
Tiggemann M, Slater A. Nettweens: The internet and body image concerns in preteenage girls. The Journal of Early Adolescence, 34(5), 606–620. 2014.
Adinoff B. Neurobiologic processes in drug reward and addiction. Harv Rev Psychiatry. 2004 Nov-Dec;12(6):305-20.
Koob GF, Volkow ND. Neurobiology of addiction: a neurocircuitry analysis. Lancet Psychiatry. 2016 Aug;3(8):760-773.
Burhan (2020) Neurotransmitter Dopamine (DA) and its Role in Development of Social Media Addiction. Journal of Neurology & Neurophys, Vol 11 Iss 7, 507. 2020.
Hunt M, Young J, Marx R, Lipson C. No More FOMO: Limiting Social Media Decreases Loneliness and Depression. Journal of Social and Clinical Psychology. 37. 751-768. 2018.
Apriyatmoko R, Wakhid A, Aini F. (2025) Occurrence, Contributing Factors, and Impact of Fear of Missing Out (FOMO) in Workers: A Systematic Literature Review. 2025:781-794.

Literature Review - APA Publication Cite
Montag, C., Yang, H., & Elhai, J. D. (2021). On the Psychology of TikTok Use: A First Glimpse From Empirical Findings. *Frontiers in Public Health* , *9* , 641673. https://doi.org/10.3389/fpubh.2021.641673
Jain, A. K., Sahoo, S. R., & Kaubiyal, J. (2021). Online social networks security and privacy: comprehensive review and analysis. *Complex & Intelligent Systems* , *7* (5), 2157–2177. springer. https://link.springer.com/article/10.1007/s40747-021-00409-7
5Rights Foundation. Pathways: How digital design puts children at risk. 2021 Jul.
Mosseri, A. Pausing "Instagram Kids" and Building Parental Supervision Tools. Meta, Instagram. 2021 Sep. 27. https://about.fb.com/news/2021/09/pausing-instagram-kids-building-parental-supervision-tools/
McLean SA, Paxton SJ, Wertheim EH, Masters J. Photoshopping the selfie: Self photo editing and photo investment are associated with body dissatisfaction in adolescent girls. Int J Eat Disord. 2015 Dec;48(8):1132-40.
Kleemans, M., Daalmans, S., Carbaat, I., & Anschütz, D. (2018). Picture perfect: The direct effect of manipulated instagram photos on body image in adolescent girls. Media Psychology, 21(1), 93–110. https://doi.org/10.1080/15213269.2016.1257392
Kleemans M, Daalmans S, Carbaat I, Anschütz D. Picture Perfect: The Direct Effect of Manipulated Instagram Photos on Body Image in Adolescent Girls. Media Psychology, 21:1, 93-110. 2018.
Brailovskaia J, Teismann T, Margraf J. Positive Mental Health Mediates the Relationship Between Facebook Addiction Disorder and Suicide-Related Outcomes: A Longitudinal Approach. Cyberpsychol Behav Soc Netw. 2020 May;23(5):346-350.
Alzuabi I, Jafar A, Aljoumaa K. Predicting customer's gender and age depending on mobile phone data. Journal of Big Data. 2019.

Literature Review - APA Publication Cite
Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and correlates of eating disorders in adolescents. Results from the national comorbidity survey replication adolescent supplement. Arch Gen Psychiatry. 2011 Jul;68(7):714-23.
Cheng, C., Lau, Y., Chan, L., & Luk, J. W. (2021). Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors* , *117* (106845), 106845. Science Direct. https://doi.org/10.1016/j.addbeh.2021.106845
Lopes, L. S., Valentini, J. P., Monteiro, T. H., Costacurta, M. C. F., Soares, L. O. N., Telfar-Barnard, L., & Nunes, P. V. (2022). Problematic Social Media Use and Its Relationship with Depression or Anxiety: A Systematic Review. *Cyberpsychology, behavior and social networking* , *25* (11), 691–702. https://doi.org/10.1089/cyber.2021.0300
Shannon, H., Bush, K., Villeneuve, P., Hellemans, K., & Guimond, S. (2022). Problematic social media use in adolescents and young adults: A meta-analysis. *JMIR Mental Health* , *9* (4). https://doi.org/10.2196/33450
Lonergan AR, Bussey K, Fardouly J, Griffiths S, Murray SB, Hay P, Mond J, Trompeter N, Mitchison D. Protect me from my selfie: Examining the association between photo-based social media behaviors and self-reported eating disorders in adolescence. Int J Eat Disord. 2020 May;53(5):485-496.
U.S. Surgeon General. Protecting Youth Mental Health: The U.S. Surgeon General's Advisory. Office of the U.S. Surgeon General. 2021.
Schlossarek S, Schmidt H, Bischof A, et al. Psychometric Properties of Screening Instruments for Social Network Use Disorder in Children and Adolescents: A Systematic Review. *JAMA Pediatr* . Apr 1 2023;177(4):419-426. doi:10.1001/jamapediatrics.2022.5741
Mosseri A. Raising the Standard for Protecting Teens and Supporting Parents Online. Instagram, blog, announcements. 2021 Dec. 7. https://about.instagram.com/blog/announcements/raising-the-standard-for-protecting-teens-and-supporting-parents-online

Literature Review - APA Publication Cite
Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, Malow BA, Maski K, Nichols C, Quan SF, Rosen CL, Troester MM, Wise MS. Recommended Amount of Sleep for Pediatric Populations: A Consensus Statement of the American Academy of Sleep Medicine. J Clin Sleep Med. 2016 Jun 15;12(6):785-6.
The Coroners Service. Regulation 28 Report to Prevent Future Deaths. 2022 Oct. 13.
Farid H. Reining in Online Abuses. Technology and Innovation, vol 19, pp 593-599. 2018.
Zhou, Z., & Cheng, Q. (2022). Relationship between online social support and adolescents' mental health: A systematic review and meta-analysis. *Journal of Adolescence* , *94* (3), 281–292. https://doi.org/10.1002/jad.12031
Thrul, J., Devkota, J., AlJuboori, D., Regan, T., Alomairah, S., & Vidal, C. (2025). Social media reduction or abstinence interventions are providing mental health benefits—Reanalysis of a published meta-analysis. Psychology of Popular Media, 14(2), 207–209. https://doi.org/10.1037/ppm0000574
Javornik A, Marder B, Pizzetti M, Warlop L. Research: How AR Filters Impact People's Self-Image. Harvard Business Review, Psychology. 2021 Dec 22. https://hbr.org/2021/12/research-how-ar-filters-impact-peoples-self-image
Canadian Centre for Child Protection. Reviewing Child Sexual Abuse Material Reporting Functions On Popular Platforms. 2020.
Goodyear, V. A., Randhawa, A., Adab, P., Al-Janabi, H., Fenton, S., Jones, K., Michail, M., Morrison, B., Patterson, P., Quinlan, J., Sitch, A., Twardochleb, R., Wade, M., & Pallan, M. (2025). School phone policies and their association with mental wellbeing, phone use, and social media use (SMART Schools): a cross-sectional observational study. *The Lancet regional health. Europe* , *51* , 101211. https://doi.org/10.1016/j.lanepe.2025.101211

Literature Review - APA Publication Cite
Schmidt-Persson, J., Rasmussen, M. G. B., Sørensen, S. O., Mortensen, S. R., Olesen, L. G., Brage, S., Kristensen, P. L., Bilenberg, N., & Grøntved, A. (2024). Screen Media Use and Mental Health of Children and Adolescents: A Secondary Analysis of a Randomized Clinical Trial. *JAMA network open* , *7* (7), e2419881. https://doi.org/10.1001/jamanetworkopen.2024.19881
Kunz P, Woolcott M. Season's greetings: From my status to yours. Social Science Research, 5(3), 269–278. 1976.
Liu X, Buysse DJ. Sleep and youth suicidal behavior: a neglected field. Curr Opin Psychiatry. 2006 May;19(3):288-93.
Abi-Jaoude, E., Naylor, K. T., & Pignatiello, A. (2020). Smartphones, Social Media Use and Youth Mental Health. *Canadian Medical Association Journal* , *192* (6), E136–E141. National Library of Medicine. https://doi.org/10.1503/cmaj.190434
Manca, S. (2020). Snapping, pinning, liking or texting: Investigating social media in higher education beyond Facebook. *The Internet and Higher Education* , *44* , 100707. https://doi.org/10.1016/j.iheduc.2019.100707
Bandura, A. (2002). Social cognitive theory of mass communication. In J. Bryant & D. Zillmann (Eds.), *Media effects: Advances in theory and research* (2nd ed., pp. 121–153). Lawrence Erlbaum Associates Publishers.
Meier, A., & Johnson, B. K. (2022). Social comparison and envy on social media: A critical review. *Current Opinion in Psychology* , *45* (101302), 101302. https://doi.org/10.1016/j.copsyc.2022.101302
Verduyn, P., Gugushvili, N., Massar, K., Täht, K., & Kross, E. (2020). Social comparison on social networking sites. *Current Opinion in Psychology* , *36* , 32–37. https://doi.org/10.1016/j.copsyc.2020.04.002
Fardouly J, Diedrichs PC, Vartanian LR, Halliwell E. Social comparisons on social media: The impact of Facebook on young women's body image concerns and mood. Body Image. 2015/03/01/ 2015;13:38-45. doi:https://doi.org/10.1016/j.bodyim.2014.12.002
National Academies of Sciences, Engineering, and Medicine (2024) *Social Media and Adolescent Health* . Washington, DC: The National Academies Press. https://doi.org/10.17226/27396.

Literature Review - APA Publication Cite
Allem, J.-P. (2024). Social Media and Adolescent Health. *American Journal of Public Health* , e1–e3. https://doi.org/10.2105/ajph.2024.307784
Vandenbosch, L., Fardouly, J., & Tiggemann, M. (2022). Social media and body image: Recent trends and future directions. *Current Opinion in Psychology* , *45* (101289). https://doi.org/10.1016/j.copsyc.2021.12.002
Cunningham S, Hudson CC, Harkness K. Social media and depression symptoms: a meta-analysis. *Research on child and adolescent psychopathology* . 2021;49(2):241-253.
Padín, P. F., González-Rodríguez, R., Verde-Diego, C., & Vázquez-Pérez, R. (2021). Social media and eating disorder psychopathology: A systematic review. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* , *15* (3). https://doi.org/10.5817/CP2021-3-6
Braghieri, L., Levy, R., & Makarin, A. (2022). Social media and mental health. *American Economic Review* , *112* (11), 3660–3693. https://doi.org/10.1257/aer.20211218
Haidt, J., Rausch, Z., & Twenge, J. (ongoing). Social media and mental health: A collaborative review. Unpublished manuscript, New York University. Accessed at tinyurl.com/SocialMediaMentalHealthReview
Naslund, J. A., Bondre, A., Torous, J., & Aschbrenner, K. A. (2020). Social Media and Mental Health: Benefits, Risks, and Opportunities for Research and Practice. *Journal of Technology in Behavioral Science* , *5* (3), 245–257. https://doi.org/10.1007/s41347-020-00134-x
Cingel, D. P., Carter, M. C., & Krause, H. V. (2022). Social media and self-esteem. *Current opinion in psychology* , *45* , 101304. https://doi.org/10.1016/j.copsyc.2022.101304
American Academy of Child & Adolescent Psychiatry. Social Media and Teens. American Academy of Child & Adolescent Psychiatry, Families and Youth, Fact Sheets. Mar 2018. https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Social-Media-and-Teens-100.aspx
Kross, E., Verduyn, P., Sheppes, G., Costello, C. K., Jonides, J., & Ybarra, O. (2021). Social Media and Well-Being: Pitfalls, Progress, and Next Steps. *Trends in Cognitive Sciences* , *25* (1), 55–66. https://doi.org/10.1016/j.tics.2020.10.005

Literature Review - APA Publication Cite
Office of the Surgeon General (OSG) (2023) Social Media and Youth Mental Health: The U.S. Surgeon General's Advisory. In *PubMed* . US Department of Health and Human Services. https://pubmed.ncbi.nlm.nih.gov/37721985/
Raffoul A, Ward ZJ, Santoso M, Kavanaugh JR, Austin SB. Social media platforms generate billions of dollars in revenue from U.S. youth: Findings from a simulated revenue model. PLoS One. 2023 Dec 27;18(12):e0295337.
Cataldo, I., Lepri, B., Neoh, M. J. Y., & Esposito, G. (2021). Social Media Usage and Development of Psychiatric Disorders in Childhood and Adolescence: A Review. *Frontiers in psychiatry* , *11* , 508595. https://doi.org/10.3389/fpsyt.2020.508595
Villanti, A. C., Johnson, A. L., Ilakkuvan, V., Jacobs, M. A., Graham, A. L., & Rath, J. M. (2017). Social Media Use and Access to Digital Technology in US Young Adults in 2016. *Journal of Medical Internet Research* , *19* (6). https://doi.org/10.2196/jmir.7303
Kelly, Y., Zilanawala, A., Booker, C., & Sacker, A. (2019). Social Media Use and Adolescent Mental Health: Findings From the UK Millennium Cohort Study. *EClinicalMedicine* , *6* , 59–68. https://doi.org/10.1016/j.eclinm.2018.12.005
Kelly, Y., Zilanawala, A., Booker, C., & Sacker, A. (2019). Social Media Use and Adolescent Mental Health: Findings From the UK Millennium Cohort Study. *EClinicalMedicine* , *6* , 59–68. https://doi.org/10.1016/j.eclinm.2018.12.005
Course-Choi J, Hammond L. Social Media Use and Adolescent Well-Being: A Narrative Review of Longitudinal Studies. *Cyberpsychology, Behavior, and Social Networking* . 2021;24(4):223-236. doi:10.1089/cyber.2020.0020
Biernesser, C., Sewall, C. J. R., Brent, D., Bear, T., Mair, C., & Trauth, J. (2020). Social Media Use and Deliberate Self-Harm Among Youth: A Systematized Narrative Review. Children and youth services review, 116, 105054. https://doi.org/10.1016/j.childyouth.2020.105054
Vidal, C., Lhaksampa, T., Miller, L., & Platt, R. (2020). Social media use and depression in adolescents: a scoping review. *International Review of Psychiatry* , *32* (3), 235–253. https://doi.org/10.1080/09540261.2020.1720623

Literature Review - APA Publication Cite
Berger, M. N., Taba, M., Marino, J. L., Lim, M. S. C., & Skinner, S. R. (2022). Social Media Use and Health and Well-being of Lesbian, Gay, Bisexual, Transgender, and Queer Youth: Systematic Review. *Journal of Medical Internet Research* , *24* (9). https://doi.org/10.2196/38449
Fassi, L., Thomas, K., Parry, D. A., Leyland-Craggs, A., Ford, T. J., & Orben, A. (2024). Social Media Use and Internalizing Symptoms in Clinical and Community Adolescent Samples: A Systematic Review and Meta-Analysis. *JAMA pediatrics* , *178* (8), 814–822. https://doi.org/10.1001/jamapediatrics.2024.2078
Karim, F., Oyewande, A. A., Abdalla, L. F., Chaudhry Ehsanullah, R., & Khan, S. (2020). *Social media use and its connection to Mental Health: A Systematic Review* . Cureus. https://pmc.ncbi.nlm.nih.gov/articles/PMC7364393/
Karim F, Oyewande AA, Abdalla LF, Chaudhry Ehsanullah R, Khan S. Social Media Use and Its Connection to Mental Health: A Systematic Review. Cureus. 2020 Jun 15;12(6):e8627.
Valkenburg, P. M., Meier, A., & Beyens, I. (2022). Social Media Use and Its Impact on Adolescent Mental Health: an Umbrella Review of the Evidence. *Current Opinion in Psychology* , *44* (44), 58–68. https://doi.org/10.1016/j.copsyc.2021.08.017
Schønning, V., Hjetland, G. J., Aarø, L. E., & Skogen, J. C. (2020). Social Media Use and Mental Health and Well-Being Among Adolescents – A Scoping Review. *Frontiers in Psychology* , *11* (1949). https://doi.org/10.3389/fpsyg.2020.01949
Vannucci A, Simpson EG, Gagnon S, Ohannessian CM. Social media use and risky behaviors in adolescents: A meta-analysis. *Journal of adolescence* . 2020;79:258-274.
Nesi J, Burke TA, Bettis AH, et al. Social media use and self-injurious thoughts and behaviors: A Systematic Review and Meta-Analysis. Clinical Psychology Review. 2021/07/01/ 2021;87:102038. doi:https://doi.org/10.1016/j.cpr.2021.102038
Ansari, S., Iqbal, N., Asif, R., Hashim, M., Farooqi, S. R., & Zainab Alimoradi. (2024). Social Media Use And Well-Being: A Systematic Review And Meta-Analysis. *Cyberpsychology Behavior and Social Networking* , *27* (10). https://doi.org/10.1089/cyber.2024.0001

Literature Review - APA Publication Cite
Valkenburg P. M. (2022). Social media use and well-being: What we know and what we need to know. *Current Opinion in Psychology* , *45* , 101294. https://doi.org/10.1016/j.copsyc.2021.12.006
O'Day, E. B., & Heimberg, R. G. (2021). Social media use, social anxiety, and loneliness: A systematic review. *Computers in Human Behavior Reports* , *3* . https://doi.org/10.1016/j.chbr.2021.100070
Manurung, A.A., Saragih, E. P., Gurning, E., Tarigan, I. Y., Silaban, M.W. & Napitupulu, O. (2023). Social Media Utilization in the Digital Era. *Indonesian Journal of Education and Mathematical Science* , *4* (1), 36–39. https://doi.org/10.30596/ijems.v4i1.13394
Rounsefell, K., Gibson, S., Mclean, S., Blair, M., Molenaar, A., Brennan, L., Truby, H., & Mccaffery, T. A. (2019). Social media, Body Image and Food Choices in Healthy Young adults: a Mixed Methods Systematic Review. *Nutrition & Dietetics* , *77* (1), 19–40. https://doi.org/10.1111/1747-0080.12581
Social Media's Impact on Students' Mental Health Comes Into Focus at 2, NEA Today (Sept. 27, 2018), https://www.nea.org/nea-today/all-news-articles/social-medias-impact-students-mental-healthcomes-focus
Saiphoo, A. N., Dahoah Halevi, L., & Vahedi, Z. (2020). Social networking site use and self-esteem: A meta-analytic review. *Personality and Individual Differences* , *153* (109639), 109639. https://doi.org/10.1016/j.paid.2019.109639
Semken, C., & Rossell, D. (2022). Specification analysis for technology use and teenager well-being: Statistical validity and a Bayesian proposal. *Journal of the Royal Statistical Society: Series c (Applied Statistics)* . https://doi.org/10.1111/rssc.12578
Twenge, J. M., Haidt, J., Lozano, J., & Cummins, K. M. (2022). Specification curve analysis shows that social media use is linked to poor mental health, especially among girls. *Acta psychologica* , *224* , 103512. https://doi.org/10.1016/j.actpsy.2022.103512
Picardo, J., McKenzie, S. K., Collings, S., & Jenkin, G. (2020). Suicide and self-harm content on Instagram: A systematic scoping review. *PloS One* , *15* (9), e0238603. https://doi.org/10.1371/journal.pone.0238603

Literature Review - APA Publication Cite
Fioravanti, G., Prostamo, A., & Casale, S. (2020). Taking a Short Break from Instagram: The Effects on Subjective Well-Being. *Cyberpsychology, Behavior and Social Networking* , *23* (2), 107–112. https://doi.org/10.1089/cyber.2019.0400
Piper, Sandler. Taking Stock With Teens: 21 Years Of Researching U.S. Teens GenZ Insights. Piper, Sandler. Fall 2021.
Orben A. (2020). Teenagers, screens and social media: a narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology* , *55* (4), 407–414. https://doi.org/10.1007/s00127-019-01825-4
Vogels E, Gelles-Watnick R, Massarat N. Teens, Social Media and Technology 2022. Pew Research Center. Report. 2022 Aug. 10, https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/
Orben, A., & Przybylski, A. K. (2019). The association between adolescent well-being and digital technology use. *Nature Human Behaviour* , *3* (2), 173–182. https://doi.org/10.1038/s41562-018-0506-1
Levenson JC, Shensa A, Sidani JE, Colditz JB, Primack BA. The association between social media use and sleep disturbance among young adults. Prev Med. 2016 Apr;85:36-41.
Santos, R. M. S., Mendes, C. G., Bressani, G. Y. S., De Alcantara Ventura, S., De Almeida Nogueira, Y. J., De Miranda, D. M., & Romano-Silva, M. A. (2023). The associations between screen time and mental health in adolescents: a systematic review. *BMC Psychology* , *11* (1). https://doi.org/10.1186/s40359-023-01166-7
Valkenburg, P. M., van Driel, I. I., & Beyens, I. (2022). The associations of active and passive social media use with well-being: A critical scoping review. New Media & Society, 24(2), 530-549. https://doi.org/10.1177/14614448211065425
Cohen, R., Newton-John, T., & Slater, A. (2021). The case for body positivity on social media: Perspectives on current advances and future directions. *Journal of health psychology* , *26* (13), 2365–2373. https://doi.org/10.1177/1359105320912450

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Rideout V, Peebles A, Mann S, Robb M. The Common Sense Census: Media Use by Tweens and Teens, 2021. San Francisco, CA: Common Sense. 2022.
Griffiths S, Murray SB, Krug I, McLean SA. The Contribution of Social Media to Body Dissatisfaction, Eating Disorder Symptoms, and Anabolic Steroid Use Among Sexual Minority Men. Cyberpsychol Behav Soc Netw. 2018 Mar;21(3):149-156.
Lee J. The effects of social comparison orientation on psychological well-being in social networking sites: Serial mediation of perceived social support and self-esteem. Current Psychology, 41, 6247 - 6259. 2020.
Böttger H, Költzsch D. The fear factor: Xenoglossophobia or how to overcome the anxiety of speaking foreign languages. Training, Language and Culture, 4(2), 43-55. 2020.
Salari, N., Hosna Zarei, Amin Hosseinian-Far, Shabnam Rasoulpoor, Shamarina Shohaimi, & Mohammadi, M. (2023). The global prevalence of social media addiction among university students: a systematic review and meta-analysis. *Journal of Public Health* . https://doi.org/10.1007/s10389-023-02012-1
López E, Flecha J, Santos-Corrada M, Dones V. The Gratifications of Ephemeral Marketing Content, the Use of Snapchat by the Millennial Generation and Their Impact on Purchase Motivation. Global Business Review. 25. 2021.
Dienlin, T., & Johannes, N. (2020). The Impact of Digital Technology Use on Adolescent Well-Being. *Dialogues in Clinical Neuroscience* , *22* (2), 135–142. National Library of Medicine. https://doi.org/10.31887/dcns.2020.22.2/tdienlin
Herawati, I., Rizal, I., & Amita, N. (2022). The Impact of Social Media on Fear of Missing Out Among Z Generation: A Systematic Literature Review. *Journal of Islamic and Contemporary Psychology (JICOP)* , *2* (2), 92–98. https://doi.org/10.25299/jicop.v2i2.11179
Nesi J. (2020). The Impact of Social Media on Youth Mental Health: Challenges and Opportunities. *North Carolina medical journal* , *81* (2), 116–121. https://doi.org/10.18043/ncm.81.2.116

Literature Review - APA Publication Cite
Chansiri K, Wongphothiphan T. The indirect effects of Instagram images on women's self-esteem: The moderating roles of BMI and perceived weight. New Media & Society, 25(10), 2572-2594. 2023.
De Choudhury, M., & Kıcıman, E. (2017). The Language of Social Support in Social Media and its Effect on Suicidal Ideation Risk. *Proceedings of the ... International AAAI Conference on Weblogs and Social Media. International AAAI Conference on Weblogs and Social Media* , *2017* , 32–41.
Couture Bue, A. C. (2020). The looking glass selfie: Instagram use frequency predicts visual attention to high-anxiety body regions in young women. *Computers in Human Behavior* , *108* , 106329. https://doi.org/10.1016/j.chb.2020.106329
Wang JL, Wang HZ, Gaskin J, Hawk S. The Mediating Roles of Upward Social Comparison and Self-esteem and the Moderating Role of Social Comparison Orientation in the Association between Social Networking Site Usage and Subjective Well-Being. Frontiers in Psychology. 2017.
Eldaly, A. S., & Mashaly, S. M. (2021). The new dilemma of plastic surgery and social media: a systematic review. *European Journal of Plastic Surgery* , *45* . https://doi.org/10.1007/s00238-021-01891-5
Sette, C.P., Lima, N.R.S., Queluz, F.N.F.R. *et al.* (2020). The Online Fear of Missing Out Inventory (ON-FoMO): Development and Validation of a New Tool. *J. technol. behav. sci.* **5**, 20–29 https://doi.org/10.1007/s41347-019-00110-0
Sherman LE, Payton AA, Hernandez LM, Greenfield PM, Dapretto M. The Power of the Like in Adolescence: Effects of Peer Influence on Neural and Behavioral Responses to Social Media. Psychol Sci. 2016 Jul;27(7):1027-35.
Roberts RE, Duong HT. The prospective association between sleep deprivation and depression among adolescents. Sleep. 2014 Feb 1;37(2):239-44.

Literature Review - APA Publication Cite
Marks, R. J., De Foe, A., & Collett, J. (2020). The pursuit of wellness: Social media, body image and eating disorders. *Children and Youth Services Review* , *119* (105659). https://doi.org/10.1016/j.childyouth.2020.105659
Schou Andreassen C, Billieux J, Griffiths MD, Kuss DJ, Demetrovics Z, Mazzoni E, Pallesen S. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. Psychol Addict Behav. 2016 Mar;30(2):252-62.
Groenestein, E., Willemsen, L., van Koningsbruggen, G. M., Ket, H., & Kerkhof, P. (2024). The relationship between fear of missing out, digital technology use, and psychological well-being: A scoping review of conceptual and empirical issues. *PloS One* , *19* (10), e0308643. https://doi.org/10.1371/journal.pone.0308643
Faelens, L., Hoorelbeke, K., Cambier, R., van Put, J., Van de Putte, E., De Raedt, R., & Koster, E. H. W. (2021). The relationship between Instagram use and indicators of mental health: A systematic review. *Computers in Human Behavior Reports* , *4* (100121), 100121. https://doi.org/10.1016/j.chbr.2021.100121
Tang, S., Werner-Seidler, A., Torok, M., Mackinnon, A. J., & Christensen, H. (2021). The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. *Clinical Psychology Review* , *86* , 102021. https://doi.org/10.1016/j.cpr.2021.102021
Wilksch SM, O'Shea A, Ho P, Byrne S, Wade TD. The relationship between social media use and disordered eating in young adolescents. Int J Eat Disord. 2020 Jan;53(1):96-106.
Krach S, Paulus FM, Bodden M, Kircher T. The rewarding nature of social interactions. Front Behav Neurosci. 2010 May 28;4:22.
Memon AM, Sharma SG, Mohite SS, Jain S. The role of online social networking on deliberate self-harm and suicidality in adolescents: A systematized review of literature. Indian J Psychiatry. 2018 Oct-Dec;60(4):384-392.

Literature Review - APA Publication Cite
U.S. Department of Health and Human Services. The Teen Brain: 6 Things To Know. The National Institute of Mental Health. Pub. No. OM 16-4307.
U.S. Department of Health and Human Services. The Teen Brain: Still Under Construction. The National Institute of Mental Health. Pub. No. 11-429. 2011.
Bozzola E, Spina G, Agostiniani R, et al. The Use of Social Media in Children and Adolescents: Scoping Review on the Potential Risks. *International Journal of Environmental Research and Public Health* . 2022;19(16):9960.
Ryding, Kuss. (2020) The use of social networking sites, body image dissatisfaction, and body dysmorphic disorder: A systematic review of psychological research. *Psychology of Popular Media* . ;9(4):412-435. doi:10.1037/ppm0000264
Allcott, H., Braghieri, L., Eichmeyer, S., & Gentzkow, M. (2020). The Welfare Effects of Social Media. *American Economic Review* , *110* (3), 629–676. https://doi.org/10.1257/aer.20190658
Tech Transparency Project. 'Thinstagram': Instagram's algorithm fuels eating disorder epidemic. 2021 Dec. 8. https://www.techtransparencyproject.org/articles/thinstagram-instagrams-algorithm-fuels-eating-disorder-epidemic
Yeung, A., Ng, E., & Abi-Jaoude, E. (2022). TikTok and Attention-Deficit/Hyperactivity Disorder: A Cross-Sectional Study of Social Media Content Quality. *The Canadian Journal of Psychiatry* , *67* (12),070674372210828.https://doi.org/10.1177/0706743 7221082854
Liu, M., Kamper-DeMarco, K. E., Zhang, J., Xiao, J., Dong, D., & Xue, P. (2022). Time Spent on Social Media and Risk of Depression in Adolescents: A Dose-Response Meta-Analysis. *International Journal of Environmental Research and Public Health* , *19* (9), 5164. https://doi.org/10.3390/ijerph19095164
Frison, E., & Eggermont, S. (2020). Toward an integrated and differential approach to the relationships between loneliness, different types of Facebook use, and adolescents' depressed mood. Communication Research, 47(5), 701–728. https://doi.org/10.1177/0093650215617506

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Van Den Beemt, A., Thurlings, M., & Willems, M. (2019). Towards an Understanding of Social Media Use in the classroom: a Literature Review. *Technology, Pedagogy and Education* , *29* (1), 35–55. https://doi.org/10.1080/1475939x.2019.1695657
Aichner, T., Grünfelder, M., Maurer, O., & Jegeni, D. (2021). Twenty-Five Years of Social Media: a Review of Social Media Applications and Definitions from 1994 to 2019. *Cyberpsychology, Behavior, and Social Networking* , *24* (4), 215–222. https://doi.org/10.1089/cyber.2020.0134
Cheng, J., Burke, M., & Davis, E. G. (2019). Understanding Perceptions of Problematic Facebook Use. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19* . https://doi.org/10.1145/3290605.3300429
Krause, H.-V., Baum, K., Baumann, A., & Krasnova, H. (2019). Unifying the Detrimental and Beneficial Effects of Social Network Site Use on self-esteem: a Systematic Literature Review. *Media Psychology* , *24* (1), 1–38. https://doi.org/10.1080/15213269.2019.1656646
Nesi J, Prinstein MJ. Using Social Media for Social Comparison and Feedback-Seeking: Gender and Popularity Moderate Associations with Depressive Symptoms. J Abnorm Child Psychol. 2015 Nov;43(8):1427-1438.
Systrom K. Welcome to IGTV, our New Video App. Instagram. 2018 Jun. 20. https://about.instagram.com/blog/announcements/welcome-to-igtv
Petrillo S. What Makes TikTok so Addictive?: An Analysis of the Mechanisms Underlying the World's Latest Social Media Craze. Brown Undergraduate Journal of Public Health. 2021 Dec 13. https://sites.brown.edu/publichealthjournal/2021/12/13/tiktok/
Midgley, C., Thai, S., Lockwood, P., Kovacheff, C., & Page-Gould, E. (2021). When every day is a high school reunion: Social media comparisons and self-esteem. Journal of Personality and Social Psychology, 121(2), 285–307. https://doi.org/10.1037/pspi0000336

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Kim M, Park W. Who is at risk on Facebook? The effects of Facebook News Feed photographs on female college students' appearance satisfaction. The Social Science Journal. 2016/12/01/ 2016;53(4):427-434. doi:https://doi.org/10.1016/j.soscij.2016.08.007
Abrams Z. Why young brains are especially vulnerable to social media. American Psychological Association. Mental Health, Social Media and Internet, Children, Teens. 2023 Aug. 3. https://www.apa.org/news/apa/2022/social-media-children-teens
Davies T, Cranston P. Youth Work and Social Networking Final Research Report. 2008.
A. Przybylski, et. al., Motivational, Emotional, And Behavioral Correlates Of Fear Of Missing Out, 29 COMPUTERS IN HUMAN BEHAVIOR 1841-1848 (2013), located at https://www.sciencedirect.com/science/article/abs/pii/S0747563213000800
Akbari M, Seydavi M, Palmieri S, Mansueto G, Caselli G, Spada MM. Fear of missing out (FOMO) and internet use: A comprehensive systematic review and meta-analysis. Journal of Behavioral Addictions. 31 Dec. 2021 2021;10(4):879-900. doi:https://doi.org/10.1556/2006.2021.00083
Alexeeff SE, Deosaransingh K, Van Den Eeden S, Schwartz J, Liao NS, Sidney S. Association of Long-term Exposure to Particulate Air Pollution With Cardiovascular Events in California. JAMA Network Open. 2023;6(2):e230561-e230561. doi:10.1001/jamanetworkopen.2023.0561
Allcott H, Braghieri L, Eichmeyer S, Gentzkow M. The Welfare Effects of Social Media. American Economic Review. 2020;110(3):629–76. doi:10.1257/aer.20190658;
Allcott, H., Gentzkow, M., & Song, L. (2022). Digital Addiction, AMERICAN ECONOMIC REVIEW, 112 (7): 2424-63. https://doi.org/10.1257/aer.20210867
Allem J-P. Social Media and Adolescent Health. American Journal of Public Health. 2024;114(10):980-982. doi:10.2105/ajph.2024.307784
Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. Sleep Medicine Reviews. 2021/04/01/ 2021;56:101414. doi:https://doi.org/10.1016/j.smrv.2020.101414

Literature Review - APA Publication Cite
American Psychiatric Association. Desk reference to the diagnostic criteria from DSM-5. American Psychiatric Publishing; 2013:xlviii, p. 395
Amiri S, Behnezhad S. Alcohol use and risk of suicide: a systematic review and Meta-analysis. Journal of Addictive Diseases. 2020/02/17 2020;38(2):200-213. doi:10.1080/10550887.2020.1736757
Arendt F, Scherr S, Romer D. Effects of exposure to self-harm on social media: Evidence from a two-wave panel study among young adults. New Media & Society. 2019/11/01 2019;21(11-12):2422-2442. doi:10.1177/1461444819850106
Baker N, Ferszt G, Breines JG, A qualitative study exploring female college students' Instagram use and body image, Cyberpsychol Behav Soc Netw. 2019;22(4):277–82, https://doi.org/10.1089/cyber.2018.0420.
Bartel K, Scheeren R, Gradisar M. Altering Adolescents' Pre-Bedtime Phone Use to Achieve Better Sleep Health. Health Communication. 2019/03/21 2019;34(4):456-462. doi:10.1080/10410236.2017.1422099
Black MH, Milbourn B, Chen NTM, et al. The use of wearable technology to measure and support abilities, disabilities and functional skills in autistic youth: a scoping review. Scandinavian Journal of Child and Adolescent Psychiatry and Psychology. 2020;8(1):48-69. doi:doi:10.21307/sjcapp-2020-006
Böttger T, Poschik M, Zierer K. Does the Brain Drain Effect Really Exist? A Meta-Analysis. Behav Sci (Basel). Sep 11 2023;13(9)doi:10.3390/bs13090751
Bowers JM, Moyer A. Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: a meta-analysis. Sleep Health. Dec 2017;3(6):423-431. doi:10.1016/j.sleh.2017.08.004
Braghieri L, Levy Re, Makarin A. Social Media and Mental Health. American Economic Review. 2022;112(11):3660–93. doi:10.1257/aer.20211218
Brand M, Can internet use become addictive?, Science. 2022;376:798–9, https://doi.org/10.1126/science.abn4189; Starcevic V, Aboujaoude E., Internet addiction: reappraisal of an increasingly inadequate concept, CNS Spectr. 2017;22(1):7–13.

Literature Review - APA Publication Cite
Bridge JA, Greenhouse JB, Ruch D, et al. Association Between the Release of Netflix's 13 Reasons Why and Suicide Rates in the United States: An Interrupted Time Series Analysis. Journal of the American Academy of Child & Adolescent Psychiatry. 2020/02/01/ 2020;59(2):236-243. doi:https://doi.org/10.1016/j.jaac.2019.04.020
Brown Z, Tiggemann M. Attractive celebrity and peer images on Instagram: Effect on women's mood and body image. Body Image. 2016/12/01/ 2016;19:37-43. doi:https://doi.org/10.1016/j.bodyim.2016.08.007;
Carter B, Rees P, Hale L, Bhattacharjee D, Paradkar MS. Association Between Portable Screen-Based Media Device Access or Use and Sleep Outcomes: A Systematic Review and Meta-analysis. JAMA Pediatr. Dec 1 2016;170(12):1202-1208. doi:10.1001/jamapediatrics.2016.2341
Castelo N, Kushlev K, Ward AF, Esterman M, Reiner PB. Blocking mobile internet on smartphones improves sustained attention, mental health, and subjective well-being. PNAS Nexus. 2025;4(2)doi:10.1093/pnasnexus/pgaf017
Cheng C, Lau Y, Chan L, Luk JW. Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. Addictive Behaviors. 2021/06/01/ 2021;117:106845. doi:https://doi.org/10.1016/j.addbeh.2021.106845
Christakis DA, Mathew GM, Reichenberger DA, Rodriguez IR, Ren B, Hale L. Adolescent Smartphone Use During School Hours. JAMA Pediatrics. 2025;doi:10.1001/jamapediatrics.2024.6627
Chua THH, Chang L, Follow me and like my beautiful selfes: Singapore teenage girls' engagement in self-presentation and peer comparison on social media, Comput Hum Behav. 2016;55:190–7, https://doi.org/10.1016/j.chb.2015.09.011.23;
Coviello L, Sohn Y, Kramer AD, Marlow C, Franceschetti M, Christakis NA, Fowler JH. Detecting emotional contagion in massive social networks. PLoS One. 2014 Mar 12;9(3):e90315. doi: 10.1371/journal.pone.0090315. PMID: 24621792; PMCID: PMC3951248.
Crews F, He J, Hodge C. Adolescent cortical development: a critical period of vulnerability for addiction. Pharmacol Biochem Behav. Feb 2007;86(2):189-99. doi:10.1016/j.pbb.2006.12.001
Csikszentmihalyi M. Flow : the psychology of optimal experience. Simon & Schuster; 1994.

Literature Review - APA Publication Cite
Cunningham S, Hudson CC, Harkness K. Social Media and Depression Symptoms: a Meta-Analysis. Res Child Adolesc Psychopathol. Feb 2021;49(2):241-253. doi:10.1007/s10802-020-00715-7
Dane A, Bhatia K. The social media diet: A scoping review to investigate the association between social media, body image and eating disorders amongst young people. PLOS Global Public Health. 2023;3(3):e0001091.
Danner F, Phillips B. Adolescent sleep, school start times, and teen motor vehicle crashes. J Clin Sleep Med. Dec 15 2008;4(6):533-5.
Davis CG, Goldfield GS. Limiting social media use decreases depression, anxiety, and fear of missing out in youth with emotional distress: A randomized controlled trial. Psychology of Popular Media. 2025;14(1):1-11. doi:10.1037/ppm0000536
De Choudhury M, Kıcıman E. The Language of Social Support in Social Media and its Effect on Suicidal Ideation Risk. Proc Int AAAI Conf Weblogs Soc Media. May 2017;2017:32-41.
Deng H, Song K, Geng X, et al. Online social activity time predicts ADHD problems in youth from late childhood to early adolescence in the ABCD study. European Child & Adolescent Psychiatry. 2024/12/26 2024;doi:10.1007/s00787-024-02620-6
Donaldson SI, Dormanesh A, Perez C, Majmundar A, Allem JP. Association Between Exposure to Tobacco Content on Social Media and Tobacco Use: A Systematic Review and Meta-analysis. JAMA Pediatr. 2022 Sep 1;176(9):878-885. doi: 10.1001/jamapediatrics.2022.2223.
Eltz M, Evans AS, Celio M, et al. Suicide probability scale and its utility with adolescent psychiatric patients. Child Psychiatry Hum Dev. Jun 2007;38(1):17-29. doi:10.1007/s10578-006-0040-7
Eyal N. Hooked: how to build habit-forming products. Portfolio/Penguin; 2014:242 pages.
Fennig S, Hadas A. Suicidal behavior and depression in adolescents with eating disorders. Nord J Psychiatry. 2010;64(1):32-9. doi:10.3109/08039480903265751
Ferguson CJ, Kaye LK, Branley-Bell D, Markey P. There is no evidence that time spent on social media is correlated with adolescent mental health problems: Findings from a meta-analysis. Professional Psychology: Research and Practice. 2025;56(1):73-83. doi:10.1037/pro0000589

Literature Review - APA Publication Cite
Ferguson CJ. Do social media experiments prove a link with mental health: A methodological and meta-analytic review. Psychology of Popular Media. 2024:No Pagination Specified-No Pagination Specified. doi:10.1037/ppm0000541
Fioravanti G, Bocci Benucci S, Ceragioli G, Casale S. How the exposure to beauty ideals on social networking sites influences body image: A systematic review of experimental studies. Adolescent Research Review. 2022:No Pagination Specified-No Pagination Specified. doi:10.1007/s40894-022-00179-4
Fioravanti G, Bocci Benucci S, Ceragioli G, Casale S. How the exposure to beauty ideals on social networking sites influences body image: a systematic review of experimental studies. Adolesc Res Rev. 2022;7(3):419–58. https://doi.org/10.1007/ s40894-022-00179-4.
Fioravanti G, Casale S, Benucci SB, et al. Fear of missing out and social networking sites use and abuse: A meta-analysis. Computers in Human Behavior. 2021/09/01/ 2021;122:106839. doi:https://doi.org/10.1016/j.chb.2021.106839
Flayelle M, Brevers D, King DL, Maurage P, Perales JC, Billieux J, A taxonomy of technology design features that promote potentially addictive online behaviours, Nat Rev Psychol. 2023;2(3):136–50, https://doi.org/10.1038/s44159-023-00153-4.
Franklin JC, Ribeiro JD, Fox KR, et al. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. Psychol Bull. Feb 2017;143(2):187-232. doi:10.1037/bul0000084;
Fry D, Krzeczkowska A, Ren J, et al. Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis. The Lancet Child & Adolescent Health. doi:10.1016/S2352-4642(24)00329-8
Galmiche M, Déchelotte P, Lambert G, Tavolacci MP. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. The American Journal of Clinical Nutrition. 2019/05/01/ 2019;109(5):1402-1413. doi:https://doi.org/10.1093/ajcn/nqy342
Godard R, Holtzman S. Are active and passive social media use related to mental health, wellbeing, and social support outcomes? A meta-analysis of 141 studies. Journal of Computer-Mediated Communication. 2024;29(1)doi:10.1093/jcmc/zmad055

Literature Review - APA Publication Cite
Goldstein RB, Dawson DA, Grant BF. Antisocial Behavioral Syndromes in Adulthood and Alcohol Use Disorder Treatment over Three-Year Follow-Up: Results from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. J Am Psychiatr Nurses Assoc. Jul 2010;16(4):212-26. doi:10.1177/1078390310375846
Goodyear VA, Randhawa A, Adab P, et al. School phone policies and their association with mental wellbeing, phone use, and social media use (SMART Schools): cross-sectional observational study. The Lancet Regional Health – Europe. doi:10.1016/j.lanepe.2025.101211
Grabe S, Ward LM, Hyde JS. The role of the media in body image concerns among women: a meta-analysis of experimental and correlational studies. Psychol Bull. May 2008;134(3):460-76. doi:10.1037/0033-2909.134.3.460
Gregory AM, Sadeh A. Sleep, emotional and behavioral difficulties in children and adolescents. Sleep Med Rev. Apr 2012;16(2):129-36. doi:10.1016/j.smrv.2011.03.007
Hale L, Kirschen GW, LeBourgeois MK, et al. Youth Screen Media Habits and Sleep: Sleep-Friendly Screen Behavior Recommendations for Clinicians, Educators, and Parents. Child Adolesc Psychiatr Clin N Am. Apr 2018;27(2):229-245. doi:10.1016/j.chc.2017.11.014
Hancock et al. “Psychological Well-Being and Social Media Use: A Meta-Analysis of Associations between Social Media Use and Depression, Anxiety, Loneliness, Eudaimonic, Hedonic and Social Well-Being”
Handbook on children and screens p.182
Hartstein LE, Mathew GM, Reichenberger DA, et al. The impact of screen use on sleep health across the lifespan: A National Sleep Foundation consensus statement. Sleep Health. Aug 2024;10(4):373-384. doi:10.1016/j.sleh.2024.05.001
Holland G, Tiggemann M. A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes, Body Image. 2016;17:100–10, https://doi.org/10.1016/j.bodyim.2016.02.008
Ioannidis K, Taylor C, Holt L, et al. Problematic usage of the internet and eating disorder and related psychopathology: A multifaceted, systematic review and meta-analysis. Neuroscience & Biobehavioral Reviews. 2021/06/01/ 2021;125:569-581. doi:https://doi.org/10.1016/j.neubiorev.2021.03.005

Literature Review - APA Publication Cite
Jensen PS, Mrazek D, Knapp PK, et al. Evolution and revolution in child psychiatry: ADHD as a disorder of adaptation. J Am Acad Child Adolesc Psychiatry. Dec 1997;36(12):1672-9; discussion 1679-81. doi:10.1097/00004583-199712000-00015v
Kelly Y, Zilanawala A, Booker C, Sacker A. Social Media Use and Adolescent Mental Health: Findings From the UK Millennium Cohort Study. EClinicalMedicine. Dec 2018;6:59-68. doi:10.1016/j.eclinm.2018.12.005
Keza MacDonald, Crushing it: Why millions of people still can't stop playing Candy Crush, The Guardian (Aug. 1, 2024), https://www.theguardian.com/games/article/2024/aug/01/crushing-it-why-millions-of-people-still-cant-stop-playing-candy-crush.
King KM, Chassin L. A prospective study of the effects of age of initiation of alcohol and drug use on young adult substance dependence. J Stud Alcohol Drugs. Mar 2007
Kleemans M, Daalmans S, Carbaat I, Anschütz D. Picture Perfect: The Direct Effect of Manipulated Instagram Photos on Body Image in Adolescent Girls. Media Psychology. 2018/01/02 2018;21(1):93-110. doi:10.1080/15213269.2016.1257392
Koran LM, Abujaoude E, Large MD, Serpe RT. The Prevalence of Body Dysmorphic Disorder in the United States Adult Population. CNS Spectrums. 2008;13(4):316-322. doi:10.1017/S1092852900016436
Kramer ADI, Guillory JE, Hancock JT. Experimental evidence of massive-scale emotional contagion through social networks. Proceedings of the National Academy of Sciences. 2014;111(24):8788-8790. doi:doi:10.1073/pnas.1320040111
Krebs G, Fernández de la Cruz L, Rijsdijk FV, et al. The association between body dysmorphic symptoms and suicidality among adolescents and young adults: a genetically informative study. Psychol Med. May 2022;52(7):1268-1276. doi:10.1017/s0033291720002998
Lee HY, Jamieson JP, Reis HT, et al, Getting fewer "likes" than others on social media elicits emotional distress among victimized adolescents, Child Dev. 2020;91(6):2141–59, https://doi.org/10.1111/cdev.13422.
Lewy AJ, Wehr TA, Goodwin FK, Newsome DA, Markey SP. Light suppresses melatonin secretion in humans. Science. Dec 12 1980;210(4475):1267-9. doi:10.1126/science.7434030

Literature Review - APA Publication Cite
Lin C-Y, Potenza MN, Ulander M, et al. Longitudinal Relationships between Nomophobia, Addictive Use of Social Media, and Insomnia in Adolescents. Healthcare. 2021;9(9):1201.
Liu M, Kamper-DeMarco KE, Zhang J, Xiao J, Dong D, Xue P. Time spent on social media and risk of depression in adolescents: a dose–response metaanalysis. Int J Environ Res Public Health. 2022:19
Ljungberg T, Apicella P, Schultz W. Responses of monkey dopamine neurons during learning of behavioral reactions. J Neurophysiol. 1992;67(1):145-63.
Marciano L, Schulz PJ, Camerini A-L. Cyberbullying Perpetration and Victimization in Youth: A Meta-Analysis of Longitudinal Studies. Journal of Computer-Mediated Communication. 2020;25(2):163-181. doi:10.1093/jcmc/zmz031
Martin KB, Bednarz JM, Aromataris EC. Interventions to control children's screen use and their effect on sleep: A systematic review and meta-analysis. Journal of Sleep Research. 2021;30(3):e13130. doi:https://doi.org/10.1111/jsr.13130
Maymin, S., Flow, THIS EMOTIONAL LIFE (May 24, 2023), available at https://thisemotionallife.org/blogs/flow/
McComb C, Vanman E, Tobin S. A Meta-Analysis of the Effects of Social Media Exposure to Upward Comparison Targets on Self-Evaluations and Emotions. Media Psychology. 2023;26(5)
McGrath LR, Oey L, McDonald S, Berle D, Wootton BM. Prevalence of body dysmorphic disorder: A systematic review and meta-analysis. Body Image. 2023/09/01/ 2023;46:202-211. doi:https://doi.org/10.1016/j.bodyim.2023.06.008
McLean SA, Paxton SJ, Wertheim EH. The role of media literacy in body dissatisfaction and disordered eating: A systematic review. Body Image. Dec 2016;19:9-23. doi:10.1016/j.bodyim.2016.08.002
Meshi D, Morawetz C, Heekeren HR. Nucleus accumbens response to gains in reputation for the self relative to gains for others predicts social media use. Original Research. Frontiers in Human Neuroscience. 2013-August-29 2013;7doi:10.3389/fnhum.2013.00439
Munzer T, Torres C, Domoff SE, et al. Child media use during COVID-19: associations with contextual and social-emotional factors, J Dev Behav Pediatr. 2022; 43(9):e573, https://doi.org/10.1097/DBP.0000000000001125.

Literature Review - APA Publication Cite
National Academy of Sciences E, and Medicine. A Guide for Committee Members available at https://sites.nationalacademies.org/cs/groups/ssbsite/documents/webpage/ssb_173594.pdf (last accessed Apr. 17, 2025)
Nesi J, Burke TA, Bettis AH, et al. Social media use and self-injurious thoughts and behaviors: A systematic review and meta-analysis. Clinical Psychology Review. 2021/07/01/ 2021;87:102038. doi:https://doi.org/10.1016/j.cpr.2021.102038
Nickolas A. Christakis and James H. Fowler (2009), Connected: The Surprising Power of our Social Networks and How they Shape our Lives, Little, Brown, New York, NY. 353 pages.
Niederkrotenthaler T, Braun M, Pirkis J, et al. Association between suicide reporting in the media and suicide: systematic review and meta-analysis. BMJ. 2020;368:m575. doi:10.1136/bmj.m575
Office of the Surgeon General, Social Media and Youth Mental Health: The U.S. Surgeon General's Advisory (2023), available at https://pubmed.ncbi.nlm.nih.gov/37721985/
Ojeda M, Del Rey R. Lines of Action for Sexting Prevention and Intervention: A Systematic Review. Archives of Sexual Behavior. 2022/04/01 2022;51(3):1659-1687. doi:10.1007/s10508-021-02089-3
Orben A, Przybylski AK, Blakemore S-J, Kievit RA. Windows of developmental sensitivity to social media. Nature Communications. 2022/03/28 2022;13(1):1649. doi:10.1038/s41467-022-29296-3
Orben A, Przybylski AK. The association between adolescent well-being and digital technology use. Nature Human Behaviour. 2019/02/01 2019;3(2):173-182. doi:10.1038/s41562-018-0506-1
Orben A., Teenagers, screens and social media: a narrative review of reviews and key studies. Social Psychiatry and Psychiatric Epidemiology. 2020/04/01 2020;55(4):407-414. doi:10.1007/s00127-019-01825-4
Organization WH. International Classification of Diseases Eleventh Revision (ICD-11). World Health Organization; 2022.
Padilla-Walker LM, Christensen KJ. Empathy and Self-Regulation as Mediators Between Parenting and Adolescents' Prosocial Behavior Toward Strangers, Friends, and Family. Journal of Research on Adolescence. 2011;21(3):545-551. doi:https://doi.org/10.1111/j.1532-7795.2010.00695.x

Literature Review - APA Publication Cite
Pagano M, Bacaro V, Crocetti E. “Using digital media or sleeping … that is the question”. A meta-analysis on digital media use and unhealthy sleep in adolescence. Computers in Human Behavior. 2023/09/01/ 2023;146:107813. doi:https://doi.org/10.1016/j.chb.2023.107813
Parry DA, Davidson BI, Sewall CJR, Fisher JT, Mieczkowski H, Quintana DS. A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. Nature Human Behaviour. 2021/11/01 2021;5(11):1535-1547. doi:10.1038/s41562-021-01117-5
Perloff RM, Social media effects on young women’s body image concerns: theoretical perspectives and an agenda for research, Sex Roles. 2014;71(11-12):363–77, https://doi.org/10.1007/s11199-014-0384-6.
Professional Psychology: Research and Practice. 2025;56(1):73-83. doi:10.1037/pro0000589
Przybylski AK, Nash V. Internet Filtering and Adolescent Exposure to Online Sexual Material. Cyberpsychology, Behavior, and Social Networking. 2018/07/01 2018;21(7):405-410. doi:10.1089/cyber.2017.0466
Puccio F, Kalathas F, Fuller-Tyszkiewicz M, Krug I. A revised examination of the dual pathway model for bulimic symptoms: The importance of social comparisons made on Facebook and sociotropy. Computers in Human Behavior. 2016/12/01/ 2016;65:142-150. doi:https://doi.org/10.1016/j.chb.2016.08.018.
Qin Y, Musetti A, Omar B. Flow Experience Is a Key Factor in the Likelihood of Adolescents' Problematic TikTok Use: The Moderating Role of Active Parental Mediation. Int J Environ Res Public Health. Jan 23 2023;20(3)doi:10.3390/ijerph20032089
Qin Y, Omar B, Musetti A. The addiction behavior of short-form video app TikTok: The information quality and system quality perspective. Front Psychol. 2022;13:932805. doi:10.3389/fpsyg.2022.932805.
Ra CK, Cho J, Stone MD, et al. Association of Digital Media Use With Subsequent Symptoms of Attention-Deficit/Hyperactivity Disorder Among Adolescents. JAMA. 2018;320(3):255-263. doi:10.1001/jama.2018.8931

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Radesky J, Weeks HM, Schaller A, Robb M, Mann S, Lenhart, Constant Companion: A Week in the Life of a Young Person's Smartphone Use (2023), available at https://www.commonsensemedia.org/sites/default/files/research/report/2023-cs-smartphone-research-report_final-for-web.pdf
Ramadhan RN, Rampengan DD, Yumnanisha DA, et al. Impacts of digital social media detox for mental health: A systematic review and meta-analysis. Narra J. Aug 2024;4(2):e786. doi:10.52225/narra.v4i2.786
Rausch Z, Haidt J, Torres L, Social-Media Companies' Worst Argument, THE ATLANTIC (Sep. 12, 2024), https://www.theatlantic.com/ideas/archive/2024/09/social-media-lgbtq-teens-harms/679798/.
Ray A, Henry N. Sextortion: A Scoping Review. Trauma, Violence, & Abuse. 2025;26(1):138-155. doi:10.1177/15248380241277271
Reid Chassiakos YL, Radesky J, Christakis D, Moreno MA, Cross C. Children and Adolescents and Digital Media. American Academy of Pediatrics. Nov 2016;138(5)doi:10.1542/peds.2016-2593
Ribeiro JD, Franklin JC, Fox KR, et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. Psychol Med. Jan 2016;46(2):225-36. doi:10.1017/S0033291715001804
Rideout V, Peebles A, Mann S, Robb MB. Common sense census: media use by tweens and teens, 2021. Common Sense. 2022; Accessed 24 Mar 2023. https://www.commonsensemedia.org/sites/default/files/research/report/8-18-census-integrated-reportfnal-web_0.pdf
Rief McGrath LR, Oey L, McDonald S, Berle D, Wootton BM. Prevalence of body dysmorphic disorder: A systematic review and meta-analysis. Body Image. 2023/09/01/ 2023;46:202-211. doi:https://doi.org/10.1016/j.bodyim.2023.06.008
Rief W, Buhlmann U, Wilhelm S, Borkenhagen ADA, BrÄHler E. The prevalence of body dysmorphic disorder: a population-based survey. Psychological Medicine. 2006;36(6):877-885. doi:10.1017/S0033291706007264
Riehm KE, Feder KA, Tormohlen KN, et al. Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. JAMA Psychiatry. 2019;76(12):1266-1273. doi:10.1001/jamapsychiatry.2019.2325

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Roberts SR, Maheux AJ, Ladd BA, Choukas-Bradley S, The role of digital media in adolescents' body image and disordered eating, In: Nesi J, Telzer EH, Prinstein MJ, editors. HANDBOOK OF ADOLESCENT DIGITAL MEDIA USE AND MENTAL HEALTH, 1ST ED. Cambridge University Press; 2022. p. 242–63, https://doi.org/10.1017/9781108976237.014
Rod NH, Dissing AS, Clark A, Gerds TA, Lund R, Overnight smartphone use: a new public health challenge? A novel study design based on high-resolution smartphone data, PLoS One. 2018;13(10):e0204811, https://doi.org/10.1371/journal.pone.0204811.
Rodgers RF, The relationship between body image concerns, eating disorders and internet use, Part II: An integrated theoretical model, Adolesc Res Rev. 2016;1(2):121–37, https://doi.org/10.1007/s40894-015-0017-5
Ryding FC, Kuss DJ. The use of social networking sites, body image dissatisfaction, and body dysmorphic disorder: A systematic review of psychological research. Psychology of Popular Media. 2020;9(4):412-435. doi:10.1037/ppm0000264
Saiphoo AN, Vahedi Z. A meta-analytic review of the relationship between social media use and body image disturbance. Comput Hum Behav. 2019;101:259-275.
Schlossarek S, Schmidt H, Bischof A, et al. Psychometric Properties of Screening Instruments for Social Network Use Disorder in Children and Adolescents: A Systematic Review. JAMA Pediatr. Apr 1 2023;177(4):419-426. doi:10.1001/jamapediatrics.2022.5741
Shannon H, Bush K, Villeneuve P, Hellemans K, Guimond S. Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-analysis. JMIR Ment Health. 2022;9(4)
Sherman LE, Payton AA, Hernandez LM, Greenfeld PM, Dapretto M, The power of the like in adolescence: effects of peer infuence on neural and behavioral responses to social media, Psychol Sci. 2016;27(7):1027–35, https://doi.org/10.1177/0956797616645673.
Snapchat Support, How do Snapstreaks work and when do they expire?, https://help.snapchat.com/hc/en-us/articles/7012394193684-How-do-Snapstreaks-work-and-when-do-they-expire (last accessed Apr. 14, 2025)
Social Media and Youth Mental Health, The U.S. Surgeon General's Office, available at https://www.hhs.gov/surgeongeneral/reports-and-publications/youth-mental-health/social-media/index.html (2023)

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Stoilova M, Monica B, and Livingstone S. Do parental control tools fulfil family expectations for child protection? A rapid evidence review of the contexts and outcomes of use. Journal of Children and Media. 2024/01/02 2024;18(1):29-49. doi:10.1080/17482798.2023.2265512
Tandon PS, Zhou C, Hogan CM, Christakis DA. Cell Phone Use Policies in US Middle and High Schools. JAMA Netw Open. May 1 2020;3(5):e205183. doi:10.1001/jamanetworkopen.2020.5183
Tang S, Werner-Seidler A, Torok M, Mackinnon AJ, Christensen H. The relationship between screen time and mental health in young people: A systematic review of longitudinal studies. Clin Psychol Rev. Jun 2021;86:102021. doi:10.1016/j.cpr.2021.102021
Tervo-Clemmens B, Calabro FJ, Parr AC, Fedor J, Foran W, Luna B. A canonical trajectory of executive function maturation from adolescence to adulthood. Nature Communications. 2023/10/30 2023;14(1):6922. doi:10.1038/s41467-023-42540-8
Thorell LB, Buren J, Strom Wiman J, Sandberg D, Nutley SB. Longitudinal associations between digital media use and ADHD symptoms in children and adolescents: a systematic literature review. Eur Child Adolesc Psychiatry. Aug 2024;33(8):2503-2526. doi:10.1007/s00787-022-02130-3
Thrul J, Devkota J, AlJuboori D, Regan T, Alomairah S, Vidal C. Social media reduction or abstinence interventions are providing mental health benefits – reanalysis of a published meta-analysis. Psychology of Popular Media. In press;
Tiggemann M, Barbato I. “You look great!”: The effect of viewing appearance-related Instagram comments on women’s body image. Body Image. 2018/12/01/ 2018;27:61-66. doi:https://doi.org/10.1016/j.bodyim.2018.08.009
Tiggemann M, Zaccardo M. “Exercise to be fit, not skinny”: The effect of fitspiration imagery on women's body image. Body Image. 2015/09/01/ 2015;15:61-67. doi:https://doi.org/10.1016/j.bodyim.2015.06.003
Tozzo P, Cuman O, Moratto E, Caenazzo L. Family and Educational Strategies for Cyberbullying Prevention: A Systematic Review. International Journal of Environmental Research and Public Health. 2022;19(16):10452.

Literature Review - APA Publication Cite
Twenge JM. iGEN: Why Today's Super-Connected Kids Are Growing Up Less Rebellious, More Tolerant, Less Happy-- And Completely Unprepared For Adulthood And (What This Means For The Rest Of Us). Atria Books; 2017:viii, 342 pages;
Valkenburg PM. Social media use and well-being: What we know and what we need to know. Curr Opin Psychol. 2022;45:101294. https://doi.org/10.1016/j. copsyc.2021.12.006
Vanden Abeele MMP, Digital wellbeing as a dynamic construct, Com Theory, 2021;31(4):932–55, https:// doi.org/10.1093/ct/qtaa024.
Vannucci, Anna & Simpson, Emily & Gagnon, Sonja & Ohannessian, Christine. (2020). Social media use and risky behaviors in adolescents: A meta-analysis. Journal of Adolescence. 79. 258-274. 10.1016/j.adolescence.2020.01.014.
Viner RM, Gireesh A, Stiglic N, et al. Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: a secondary analysis of longitudinal data. Lancet Child Adolesc Health. Oct 2019;3(10):685-696. doi:10.1016/s2352-4642(19)30186-5
Vuorre M, Przybylski AK. Estimating the association between Facebook adoption and well-being in 72 countries. R Soc Open Sci. 2023;10:221451.
Wadsley M, Ihssen N. A Systematic Review of Structural and Functional MRI Studies Investigating Social Networking Site Use. Brain Sciences. 2023;13(5):787.
Ward A, Duke K, Gneezy A, Bos M, Drain B. The mere presence of smartphones reduces cognitive capacity. J Assoc Consum Res. 2017;2:140-54.
Wheaton AG, Chapman DP, Croft JB. School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. J Sch Health. May 2016;86(5):363-81. doi:10.1111/josh.12388
Whiting P, Savović J, Higgins JP, et al. ROBIS: A new tool to assess risk of bias in systematic reviews was developed. J Clin Epidemiol. Jan 2016;69:225-34. doi:10.1016/j.jclinepi.2015.06.005
Young E, McCain J, Mercado M, al. e. Frequent Social Media Use and Experiences with Bullying Victimization, Persistent Feelings of Sadness or Hopelessness, and Suicide Risk Among High School Students — Youth Risk Behavior Survey, United States, 2023. MMWR Suppl 2024;. 2024;73(4):23-30.

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Literature Review - APA Publication Cite
Zhang J, Wang Y, Li Q, Wu C. The Relationship Between SNS Usage and Disordered Eating Behaviors: A Meta-Analysis. Front Psychol. 2021;12:641919. doi:10.3389/fpsyg.2021.641919
Zhao J, Stockwell T, Naimi T, Churchill S, Clay J, Sherk A. Association Between Daily Alcohol Intake and Risk of All-Cause Mortality: A Systematic Review and Meta-analyses. JAMA Network Open. 2023;6(3):e236185-e236185. doi:10.1001/jamanetworkopen.2023.6185

Ex. B. Materials List for Dr. Dimitri Christakis; April 18, 2025

Date	Description
2023 12 31	United States Securities and Exhange Commission Washington, D.C. 20549 FORM 10-K for Meta Platforms, Inc. Annual Report
2021 10 20	Letter from Richard Blumenthal to Mark Zuckerberg Re: participation in a Congressional hearing on Instagram and kids
2024 11 21	Miki Rothschild Third Amended Deposition Cross-Notice for 11/21/2024
0000 00 00	Miki Rothschild LinkedIn
2021 04 05	Letter from Congress to Mark Zuckerberg RE Facebook's recent announcement to launch an Instagram for users under 13
2024.10.31	2024.10.31 - Second Amended Master Complaint (PI) dkt 494.0.pdf
2024.12.13	Facebook Feed Recommendations AI System
2023.08.09	Scaling the Instagram Explore Recommendations System
5/10/2012	Let's Chat.html
12/20/2009	To Deal With Obsession, Some Defriend Facebook
Feb-24	What is Technology Addiction?
2/6/2024	The Jed Foundation (JED) Recommendations for Safeguarding Youth Well-Being on Social Media Platforms
10/17/2023	Problematic Technology Use

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3/8/2024	Media and Eating Disorders
4/3/2025	Do smartphones and social media teally harm teens' mental health?
4/3/2025	Are screens harming teens? What scientists can do to find answers.
9/12/2024	Social-Media Companies' Worst Argument
	American Psychiatric Association, What is Technology Addiction?, https://www.psychiatry.org/patients-families/technology-addictions-social-media-and-more/what-is-technology-addiction (last accessed Apr. 14, 2025).
	Elisabeth Beauchamp, Lora Novak, At What Age Did Americans Stop Believing in Santa?, TODAY'S HOMEOWNER (Nov. 13, 2024), located at https://todayshomeowner.com/blog/guides/not-believing-in-santa-by-state/
	Families that Flourish, BYU (2012), located at https://magazine.byu.edu/article/families-that-flourish/ (last accessed Apr. 16, 2025).
	FAQ, https://families.google/familylink/faq/ (last visited April 13, 2025) ("Can children or teens be supervised by Family Link on iOS devices and web browsers?" "Children or teens signed into iOS, web browsers, or other unsupervised devices can only be partially supervised.")
	Helen Brown, When Do Children Stop Believing in Santa?, MADE FOR MUMS (Dec. 5, 2023), located at https://www.madeformums.com/news/when-do-children-stop-believing-in-santa/?utm_source=chatgpt.com
	Helping more families set digital ground rules with Family Link, September 18, 2018, https://blog.google/technology/families/helping-more-families-set-digital-ground-rules-family-link/ (last visited April 11, 2025).
	https://jedfoundation.org/the-jed-foundation-jed-recommendations-for-safeguarding-youth-well-being-on-social-media-platforms/
	https://nap.nationalacademies.org/catalog/27396/social-media-and-adolescent-health
	https://shoresofacademia.substack.com?utmsource=navbar&utmmedium=web

	https://www.aap.org/en/patient-care/media-and-children/center-of-excellence-on-social-media-and-youth-mental-health/qa-portal/qa-portal-library/qa-portal-library-questions/problematic-technology-use/?srsltid=AfmBOorKPQQSzENMf3PnJhedPK39d89jvoL7LLSIH9OsEUa5MZ6624M7
	https://www.apa.org/topics/social-media-internet/health-advisory-adolescent-social-media-use
	https://www.cam.ac.uk/stories/BrainCharts
	https://www.nationaleatingdisorders.org/media-and-eating-disorders/
	https://www.nea.org/resource-library/impact-social-media-and-personal-devices-mental-health
	Introducing Instagram Teen Accounts: Built-In Protections for Teens, Peace of Mind for Parents, INSTAGRAM (Sep. 17, 2024), https://about.instagram.com/blog/announcements/instagram-teen-accounts
	Kim M, Park W. Who is at risk on Facebook? The effects of Facebook News Feed photographs on female college students' appearance satisfaction. The Social Science Journal. 2016/12/01/ 2016;53(4):427-434, doi:https://doi.org/10.1016/j.soscij.2016.08.007
	Maza MT, Fox KA, Kwon S-J, et al. Association of Habitual Checking Behaviors on Social Media With Longitudinal Functional Brain Development. JAMA Pediatrics. 2023;177(2):160-167. doi:10.1001/jamapediatrics.2022.4924
	Midgley C, Thai S, Lockwood P, Kovacheff C, Page-Gould E. When every day is a high school reunion: Social media comparisons and self-esteem. Journal of Personality and Social Psychology,. 2021;121(2):285-307.
	Software S. Understanding Digital Parenting. 2021. https://info.smithmicro.com/hubfs/Surveys/eBook_Smith-Micro-Digital-Parenting-Survey.pdf?hsLang=en-us
	Spitzer, Crosby, & Witte (2022). Looking through a filtered lens: Negative social comparison on social media and suicidal ideation among young adults. Psychology of Popular Media
	The evolution of Family Link parental controls, May 7, 2019, https://blog.google/technology/families/evolution-of-family-link-parental-controls/ (last visited April 11, 2025).

	Thompson JK, Heinberg LJ, Altabe M, TantleffDunn S, Exacting beauty: theory, assessment, and treatment of body image disturbance, American Psychological Association 1999. https://doi.org/10.1037/10312-000.
	Yau JC, Reich SM, “It’s just a lot of work”: adolescents’ self-presentation norms and practices on Facebook and Instagram, J Res Adolesc. 2019;29(1):196–209. https://doi.org/10.1111/jora.12376.
	Why Can’t I Access Family Center, SNAP, located at
	Meta Research Summary: https://docs.google.com/document/d/1w-HOfseF2wF9YIpXwUUtP65-olnkPyWcgF5BiAtBEy0/edit?pli=1&tab=t.0#heading=h.sh24qmab6i4m
	The 10 Best Metrics For Software Quality, TABILITY, https://www.tability.io/templates/m/X4kB_LA75HWq (last accessed Apr. 16, 2025)

Exhibit C

Compensation Statement

My hourly rate for all work performed is $800.00.

Exhibit D

History of Testimony

Deposition and Trial Testimony in the last five (5) years:

- Rushing v. Viacom Inc., N.D. California, Case No. 17-4492 (filed 08/07/2017).
- McDonald v. Kiloo, N.D. California, Case No. 17-4344 (filed 07/31/2017).
- Rushing v. The Walt Disney Company, N.D. California, Case No. 17-4419 (filed 08/03/2017).