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EXHIBIT 4

EXPERT REPORT OF DREW P. CINGEL, Ph.D

April 18, 2025

Drew P. Cingel, Ph. D.

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I. Background and Qualifications.

1. I am an Associate Professor and Graduate Program Advisor in the Department of Communication at the University of California, Davis (UC Davis), where I am additionally a member of the Human Development Graduate Group. I have worked as a professor at UC Davis from 2016 to present, first as an Assistant Professor from 2016 to 2021, and as an Associate Professor from 2021 to present. A copy of my Curriculum Vitae is included with this report.

2. I received a Bachelor of Arts (B.A.) degree in Media Effects and a Bachelor of Arts degree (B.A.) in Psychology from the Pennsylvania State University in 2010. I received a Master of Arts degree (M.A.) in Communication from Wake Forest University in 2012. I received a Doctorate of Philosophy (Ph.D.) in Media, Technology, and Society from Northwestern University in 2016. I began work as a professor at UC Davis immediately upon graduation from Northwestern University and received accelerated tenure at UC Davis in 2021.

3. I have researched children, adolescents, and the media for over 15 years, beginning with my Honor's Thesis at Penn State and continuing to the present. I began to study adolescent development, social media use, and mental health beginning with my Master's Thesis at Wake Forest University. I have researched and published extensively on this topic over the past 13 years.

4. Since 2016, I have directed the Human Development and Media Lab at UC Davis, where I lead teams of graduate and undergraduate students in the study of how human development shapes media choices and influences perceptions and effects of media, primarily in the areas of moral development and mental health. During the past nine years, I have mentored nine PhD and MA students in my lab, as well as over 50 undergraduate students. I received the UC Davis Graduate Program Advising and Mentoring Award in 2024 for my contributions to graduate education at the university.

5. Since 2016, I regularly teach classes at the graduate and undergraduate level on children, adolescents, and the media, media effects, theory construction, and experimental methods. I am one of the most highly rated instructors at the university, and in particular, my course on children, adolescents, and the media is one of the more popular classes among undergraduates in the college. Due to its popularity, the Summer Sessions Program at UC Davis asked me to convert my Children, Adolescents, and the Media course to a virtual course so that it could be taught over the summer, in addition to the regular times it is taught in person over the

course of the academic year. I hold a Certificate in Excellence in Teaching from the Searle Teaching Program at Northwestern University.

6. Over the past fifteen years, I have authored or co-authored 56 peer-reviewed journal articles, with approximately an additional 20 in revision, review, or writing stage at the time of writing this document. These publications regularly appear in the highest ranked journals in my field, as well as related fields, including *Journal of Communication*, *Journal of Computer-Mediated Communication*, *Communication Research*, *Telematics and Informatics*, *Computers in Human Behavior*, *Media Psychology*, *Journal of Broadcasting and Electronic Media*, *Journal of Children and Media*, *Mass Communication and Society*, *New Media & Society*, *Psychology of Popular Media*, *Body Image*, *Archives of Sexual Behavior*, *PLoS One*, *Current Opinion in Psychology*, *Annals of the International Communication Association*, *Archives of Sexual Behavior*, and others.

7. These publications examine the intersection between media use, media effects, and human development. Many focus exclusively on the relations between social media use and mental health among adolescent and young adult populations. I regularly collaborate with researchers from other institutions across the United States and around the world, including researchers in Belgium, the Netherlands, and South Korea. Additionally, in an effort to examine cultural differences, as well as to examine the global nature of media influence, I have collected and analyzed data from children and adolescents in Belgium, the Netherlands, South Korea, the United Kingdom, Australia, New Zealand, Brazil, and across the United States. My research on adolescent social media use and adolescent mental health focuses on understanding the nuance and processes by which individuals are affected through their unique uses of social media, with attention to the design and features of social media systems and environments, as well as individual differences.

8. Over the past fifteen years, I have additionally authored or co-authored 16 peer-reviewed invited articles, book chapters, and commentaries. These appear in influential texts, including the *Encyclopedia of Child and Adolescent Health*; *Encyclopedia of Mental Health, Children and Screens: A Handbook on Digital Media and the Development, Health, and Well-being of Children and Adolescents*; *The Social Media Debate: Unpacking the Social, Psychological, and Cultural Effects of Social Media*; and *The International Encyclopedia of Media Psychology.*

9. Further, I have co-authored six technical reports or white papers, including for relevant organizations such as Common Sense Media. These reports are forward-facing and are intended for consumption by the public. I regularly work to communicate science to the public, via collaborations with community organizations, parent groups, and museums, for example.

10. Since 2011, I have presented over 80 conference papers. I regularly present at the annual conferences of the *International Communication Association* and the *National Communication Association,* and the biennial meetings of the *Society for Research in Child Development* and the *Society for Research on Adolescence.*

11. In addition, I have been invited to provide talks to companies, agencies, and universities around the world, often in the domain of media use and youth mental health. For example, I have spoken about youth media use and mental health to researchers in South Korea, Latin America, and the United Kingdom. I have also spoken on the topic to the Nebraska Advisory Committee to the United States Commission on Civil Rights and the Centers for Disease Control. Most recently, I participated in a town hall discussion of cell phones in schools, arranged by the offices of California State Senators Becker and Stern.

12. Since 2013, I have been Principal Investigator, co-Principal Investigator, Collaborator, or Consultant on external grants totaling more than $1,000,000.00 USD. Many of these grants come from non-profit organizations in the United States, media companies in the United States and abroad, and federal agencies in other countries. All are in effort to understand how to better design media products for child and adolescent learning, or to promote child and adolescent mental and physical health. For example, from industry partners, I have received funding from Disney, Alphabet/Google, Netflix, LingoKids, and Newsela; from non-profits, I have received funding from Common Sense Media, the Academy of Television Arts and Sciences Foundation, the Susan Crowne Exchange, the Delaney Fund for Research and Communication, the Waterhouse Family Initiative; and from international federal agencies, I am Co-Principal Investigator on a large multi-year grant from the National Research Foundation of Korea.

13. Since 2019, I regularly work and consult with children's media companies on how to design media that support children's learning, or that support child and adolescent physical and mental health. For example, my work with LingoKids regarded testing which of two versions of their app promoted better learning outcomes in the domains of vocabulary, math, and

socio-emotional learning. My work with Newsela evaluated if their product in schools promoted interest in social studies, diversity, and other prosocial outcomes. My work with Disney regarded an evaluation of how a product promoted elementary children's interest in science, technology, engineering, and math, as well as toward scientists more generally.

14. Since 2021, I have served as Vice-Chair and Chair of the Children, Adolescents, and Media (CAM) Division of the International Communication Association. I was voted into this position by the membership. The division currently has a membership of more than 350 individuals who study children, adolescents, and the media, from around the world. As Chair, I lead a team of four additional individuals in making decisions about the functioning of the division. In this role, I have served as program planner for two years and am responsible for planning the program for the division for our annual conference; in this way, I read and review the most current and cutting-edge research in the field of children and media.

15. Since 2024, I have served as a Board of Directors member for the International Communication Association. In this role, I am a voting member for all aspects related to the functioning of the association, the largest in the world dedicated to the study of Communication (approximately 4,000-5,000 members internationally).

16. Since 2024, I served as Co-Editor of *Media Psychology.* I was also selected to this position by my peers. In this role, I, along with three other co-editors, process nearly 1,000 yearly submissions to the journal, a top-quartile journal in the interdisciplinary areas of media, communication, and psychology. The journal aims to publish empirical research that pushes the boundaries of theory on media uses, processes, and effects. I will serve in this position until late 2028.

17. Given my focus on how to design media to support learning and well-being, since 2024, I have been regularly asked to consult with legislators and other policy makers in the state of California on social media policies. In particular, I have worked with key public health organizations, State Assembly Member offices, and State Senate offices. Over the past two years, I have consulted on bills and laws related to algorithmic design, the establishment of a commission for the study of social media and mental health, a peer-to-peer social media mentorship program, cell phone restrictions in schools, and age verification for the creation of social media profiles.

18. A copy of my current curriculum vitae and a list of all publications authored by me in the past 10 years is attached as **Exhibit A**.

19. Materials I considered in forming my opinions are identified throughout this report and in **Exhibit B**.

20. A statement of my compensation and prior testimony list is attached as **Exhibit C**.

II. Structure of this Report.

21. This report takes the following structure. First, I provide a summary of the opinions that I hold to a reasonable degree of scientific certainty. I then provide an overview of the methodology used to reach my opinions contained in this report. I describe the scholarly definitions of core constructs, including social media and mental health. I then provide an overview of core aspects of adolescent development and use these aspects of development to show how multiple design features, consistent across Instagram, Facebook, TikTok, Snapchat, and YouTube,[1] take advantage of these developmental differences and susceptibilities to promote excessive use of these products. Indeed, nearly all of the design features I identify take advantage of multiple developmental susceptibilities of adolescents. In this way, it becomes very easy for adolescents to struggle to stop using, overuse, or use social media in problematic ways, with negative implications for their mental health.

22. Next, I show the progression of scholarly research on the topic of social media and adolescent mental health. I start with research that used general time-based measures of social media use. I demonstrate that with these measures, researchers have consistently linked social media with multiple adverse adolescent mental health outcomes over the past fifteen years. I show that social media has been linked with adolescent depression, anxiety, suicidal ideation, and body image, among many other mental health issues. I then trace the course of research utilizing within-subject, long-term longitudinal designs, which also show that social media is a factor that substantially contributes to adverse adolescent mental health outcomes over time. I synthesize the most recent research in this area, which computes person-specific effect sizes, showing that multiple studies across multiple countries show a significant number of adolescents

[1] To the extent I generically refer to "social media" throughout this report, it is with reference to Instagram, Facebook, TikTok, Snapchat, and YouTube specifically, unless specifically noted otherwise.

are at risk for adverse mental health outcomes across a number of key indicators related to social media. I note that both long-term and short-term longitudinal designs can speak to the causal ordering of the relationship between social media and adolescent mental health, as they allow for the establishment of time ordering. I also review and synthesize literature that shows that problematic social media use – defined as a type of social media use characterized by addiction-like symptoms, reflecting a non-substance related disorder where negative consequences occur for the user due to a preoccupation and compulsion to excessively use social media platforms (Shannon et al., 2022) – is consistently implicated in adverse adolescent mental health across a range of mental health indicators. In the course of my review, I examine internal documents from the defendant companies, which as I will show are confirmatory of what the external research says about social media's impact on adolescent mental health. Finally, I discuss the internal documents that I reviewed, which show that defendant social media companies acknowledged adolescent problematic use of their products, yet continued to design their products to maximize user engagement time spent on the platforms. These documents provide further support for my opinions.

III. Summary of Opinions.

1. For the convenience of the reader, the following is a list of the expert opinions that I hold. I hold all of my expert opinions to a reasonable degree of scientific certainty or probability:

2. **Opinion 1:** Various unique aspects of adolescent development make adolescents susceptible to negative mental health effects from social media use.

3. **Opinion 2:** Adolescents' developmental stage makes social media especially attractive and they therefore use it in high rates. Further, once one adolescent begins to use social media, use spreads throughout their peer group, as others are developmentally drawn to a space where they can communicate with their friends without time or distance constraints.

4. **Opinion 3:** As designed, defendants' social media platforms pose various risks of harm to adolescents. Specifically, multiple aspects of defendants' social media platform designs take advantage of multiple aspects of adolescent development, promoting more time spent on the platform, excessive use of the platform, negative social comparisons, and displacement from time that could be spent building important developmental capacities.

5. **Opinion 4:** The multiple aspects of defendants' social media platform designs that take advantage of multiple aspects of adolescent development include, but are not necessarily limited to, the following:

a. Infinite or continuous scroll takes advantage of multiple aspects of brain development, less developed self-regulation, adolescents' focus on social connection and peer feedback due to social development, and adolescent egocentrism;

b. Autoplay takes advantage of multiple aspects of adolescent brain development and less developed self-regulation;

c. Push notifications take advantage of multiple aspects of adolescent brain development, less developed self-regulation, social development, and adolescent egocentrism;

d. Recommender algorithms take advantage of multiple aspects of brain development as well as adolescents' less developed self-regulation;

e. Visible social cues and feedback (e.g., likes, streaks, etc.) take advantage of multiple aspects of adolescent brain development, less developed self-regulation, social development, identity development, and adolescent egocentrism;

f. Filters and other image manipulation options take advantage of pubertal development, adolescent egocentrism, and social development;

g. Lack of effective time controls, including lack of controls as default settings, takes advantage of less developed self-regulation and social development;

h. Ephemeral content takes advantage of social development and multiple aspects of adolescent brain development;

i. Location sharing takes advantage of adolescents' social and identity development;

j. Direct messaging with outside contacts, including previously unknown contacts (which could include sexual predators and other bad actors), takes advantage of social development, identity development, and adolescent egocentrism.

6. **Opinion 5:** As seen above, most of the defendants' design choices take advantage of multiple developmental susceptibilities, making it even more difficult for the adolescent user to curtail use, and increasing the likelihood of developing a problematic relationship with social media. These design choices keep them engaged (at the expense of other activities) on the platform.

7. **Opinion 6:** Research in the area of social media and adolescent mental health over the past 15 years is rather consistent over time, over different measures of social media use, contexts of use, and individual user differences, in showing that many adolescents are susceptible to negative mental health effects stemming from their social media use, indicating that social media substantially contributes to adverse adolescent mental health.

8. **Opinion 7:** Social media does not affect just one aspect of mental health; it has been consistently linked to poor mental health among adolescents across a multitude of indicators, including, but not limited to, anxiety, depression, self-esteem, affect, distraction, weight dissatisfaction, overemphasis on muscularity in boys, low body esteem and/or body negativity, eating disorders, anxiety, depression, suicide and suicidal ideation, and general poor mental health.

9. **Opinion 8:** Social media has been consistently linked to poor mental health outcomes among adolescents more than any other form of media, including television and video games. This is particularly noteworthy, given that television has received more than 80 years of research attention, video games forty years of research attention, and contemporary social media just over twenty.

10. **Opinion 9:** Research using general measures of time spent on social media show a relatively consistent link to adverse mental health, and yet, more nuanced measures of a type of social media use, problematic use, shows a stronger link with poor mental health – and social media is designed to promote this type of use.

11. **Opinion 10:** When analyzed at the individual user level, results consistently show that a sizable group of adolescents are susceptible to negative effects of social media use on mental health. The size of this group increases when we consider multiple outcomes of mental health as to which different adolescents might be susceptible.

12. **Opinion 11:** When reviewed in totality, the available evidence, including but not limited to existing literature on the mental health effects of social media on adolescents, demonstrates that social media substantially contributes to negative mental health effects for substantial numbers of adolescents. These negative mental health effects include, but are not limited to, anxiety, depression, self-esteem, affect, distraction, weight dissatisfaction, overemphasis on muscularity in boys, low body esteem and/or body negativity, eating disorders, anxiety, depression, suicide and suicidal ideation, and general poor mental health.

13. **Opinion 12:** The defendants' own studies, analyses, and discussion of the harms of their products to adolescent mental health are consistent with the literature and provide further support for my opinions.

14. **Opinion 13:** Though the defendants studied and commented on problematic use by their adolescent users, they continued to utilize designs that take advantage of developmental susceptibilities to encourage problematic social media use by adolescents.

15. **Opinion 14:** When individuals within the defendant companies noted concerns with the companies' designs and user mental health, companies consistently made design choices that prioritized time spent on the platform (with implications for company revenue) over child and adolescent mental health.

16. **Opinion 15:** The defendant companies' focus on increasing user engagement, while ignoring growing concerns of negative effects on mental health, increased the risk of more users developing a problematic relationship with social media.

17. **Opinion 16:** The defendant companies failed to act reasonably in multiple respects, including:

a. the defendant companies studied and wrote about key child and adolescent developmental differences, and communicated these differences and susceptibilities internally. Often, these developmental differences were discussed alongside different social media design features, in the context of increasing user time on or engagement with the social media platform;

b. the defendant companies designed their products in a way that took advantage of adolescent developmental susceptibilities and promoted use of the product that could become excessive and/or problematic for many users;

c. the defendant companies analyzed and discussed problematic and/or excessive use of their products among youth for years;

d. the defendant companies consistently delayed or withheld from the public research that showed these negative associations and effects, did not expediently re-design their products for the protection of youth mental health, and/or did not expediently fix or otherwise notify or warn parents or adolescents of problems associated with the use of their product, as described in Opinion 11, above; and

e. the defendant companies had ample opportunity to re-design their products to protect and promote adolescent mental health. Yet, over and over again, their fixes were slow to take effect, not endorsed by those in positions of authority, inadequate, or faulty. It is noteworthy that companies had the capacities to design

platforms that drew users to the platform and kept them engaged there, yet did not design safer products in a timely manner or effective way when the need arose.

IV. Methodology.

18. I used the following methodology to arrive at the opinions expressed in this report. First, a substantial portion of my analysis and findings is based on my education, training, and experience, together with research and literature reviews and analyses that I, along with members of my research lab, have conducted over the previous fifteen years. To ensure that I was including the most up-to-date research areas germane to my opinions, I conducted multiple systematic keyword searches over the past two years. Given the focus on adolescents, I ensured that all keyword searches included the words 'adolescents', 'youth', or 'children'. I then systematically changed the outcome variable of interest, including (but not limited to) 'depression', 'anxiety', 'suicidal ideation', and 'body image'. I also systematically changed the keyword for the method, including (but not limited to) 'experiment', 'survey', 'longitudinal', 'meta-analysis', and 'ecological momentary assessment'. I copied the links of each research study. I then went through each study to confirm that it was about (1) adolescents, (2) social media use, (3) and mental health. This removed some studies that featured young adult samples, measures of smartphone use, and variables that are not indications of mental health. I also reviewed other scientific literature and publications and materials from this litigation including documents, depositions and exhibits. In reaching my opinions and conclusions as set forth in this report, I considered the weight and totality of the evidence. My analysis is ongoing, and I reserve the right to supplement and amend my opinions based on information and new materials, testimony and discovery that becomes available to me after the disclosure of my report.

V. What is Social Media?

19. The definition of social media has evolved over the past twenty years, following the continued evolution of social media itself. Over this time, the very construct has changed from 'social network sites' to 'social media'. Indeed, one of the first definitions focused explicitly on social network sites, situating them as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may

vary from site to site" (boyd & Ellison, 2007, p. 211). These authors then listed a set of core features of social network sites, many of which are still key components nearly 20 years later. These features consist of profiles that show a list of friends, followers, or other connected users. These are often public, displaying each user's connections to others. The profiles themselves often include information about the user (solicited by questions from the platform) as well as a profile picture. Users are able to post comments, and most feature a private chat function (boyd & Ellison, 2007).

20. Over time, this definition came to add the notion of user-generated content, as more and more platforms were introduced that allowed users to post their own information for public consumption, or at least for those with whom they were connected (e.g., Kaplan & Haenlein, 2010). At this time, researchers shifted from calling these platforms "social network sites" to "social media," an indication of the broadening of the definition. For example, according to the definition of social network sites proposed by boyd and Ellison (2007), these sites primarily focus on building and maintaining connections between users. By contrast, social media were initially defined as having three parts: "(a) the information infrastructure and tools used to produce and distribute content; (b) the content that takes the digital form of personal messages, news, ideas, and cultural products; and (c) the people, organizations, and industries that produce and consume digital content" (Howard & Parks, 2012, p. 362). In this way, the definition of social network sites was subsumed under the broader definition of social media, and researchers began to refer to these platforms collectively as social media. However, it is important to note that, while all social network sites are social media, all social media *are not necessarily* social network sites, as they may not allow for connections between users (Carr & Hayes, 2015).

21. Carr and Hayes (2015) defined social media as "… Internet-based channels that allow users to opportunistically interact and selectively self-present, either in real-time or asynchronously, with both broad and narrow audiences who derive value from user-generated content and the perception of interaction with others" (p. 50). This definition was necessarily more discriminating, as wider definitions of social media inadvertently ensured that nearly every platform (e.g., Netflix, Wikipedia) could be considered social media. The key aspects of this definition are that social media are Internet-based, and that the channel is persistent. For example, Instagram continues to exist, and communication can continue to occur

asynchronously, even when an individual is not actively using the channel. Further, the user must perceive some level of interaction with other users, and derive value from users' content, including that which is generated by individuals, but also that which is generated by organizations. Finally, social media allow for mass-personal communication, meaning that individual users can communicate interpersonally with each other, through the use of direct messaging, for example, but also individuals can engage in mass communication, such as through posting information that can be seen by thousands, if not more, users. In addition, it is important to note that many social media companies began to shift from a design where users generally saw content from shared connections to a design where users received algorithmically-recommended content from those outside of their connections. Thus, contemporary users of social media platforms generally see algorithmically-recommended content, given the design changes made by social media companies.[2] Under this definition, then, Facebook, Instagram, YouTube, TikTok, and Snapchat would each be classified as social media.

22. Below, I briefly introduce each of the four social media platforms of interest in this report, describing their history, key features, and adolescent user base.

A. Meta Overview.

23. Meta owns and operates two of the world's largest social media platforms – Facebook and Instagram. Facebook, founded in 2004, boasts over 3 billion monthly active users globally.[3] Instagram, founded in 2010 and purchased by Facebook in 2012, has more than 2 billion monthly active users.[4] Instagram and Facebook both have a significant volume of adolescent users in the United States, though Instagram has increasingly become the more popular platform for that age group. A survey conducted in 2022, for example, found that 62% of U.S. teens reported using Instagram.[5] The same survey found that 32% of U.S. teens use

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[2] Mignano, Michael, The End of Social Media and the Rise of Recommendation Media (July 27, 2022), https://mignano.medium.com/the-end-of-social-media-a88ffed21f86.
[3] Facebook Users Statistics (2025) – Worldwide Data, Demand Sage (Jan 1, 2025), https://www.demandsage.com/facebook-statistics/.
[4] How Many People Use Instagram 2025 (New Statistics), Demand Sage (March 18, 2025), https://www.demandsage.com/instagram-statistics/.
[5] Emily Vogels et al., Teens, Social Media and Technology 2022, Pew Research. Ctr. (Aug. 10, 2022), https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022.

Facebook (down from 71% in 2015).[6] As detailed below, Instagram and Facebook have both implemented content-agnostic features intended to encourage longer and more frequent use of their platforms, including (but not limited to) push notifications, "infinite scroll," autoplay, like buttons, view counts and filters/AR effects. As also detailed below, documents and testimony indicate that Meta specifically targeted adolescents with these features, even though the company understood them to be harmful to adolescents' mental health.

B. TikTok Overview.

24. In 2017, ByteDance launched TikTok.[7] TikTok has over 1 billion monthly active users.[8] TikTok utilizes a distinctive vertical full screen video player[9] and it utilizes ByteDance's algorithmic recommendation engine in combination with both video-autoplay and infinite scroll.[10]

25. The TikTok platform was largely based on ByteDance's previous apps outside of the United States. These included Toutiao and Douyin.[11] Toutiao launched in 2012 and included certain features that later were built into TikTok, including the recommendation engine, a format that focused on short form videos, and the infinite scroll.[12] TikTok launched Douyin in 2016 as a video application.[13] Douyin targeted young people from the beginning, especially pre-teen females.[14] Pre-teen girls were encouraged to create content for the app through in-application promotional banners.[15] Douyin utilized a team of account managers that were dedicated to

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[6] *Id.*
[7] TIKTOK3047MDL-072-LARK-01062915.
[8] TIKTOK3047MDL-056-00965196 at 196.
[9] TIKTOK3047MDL-084-LARK-03183934 at -936; TIKTOK3047MDL-081-02992508 at -510.
[10] TIKTOK3047MDL-084-LARK-03183934.
[11] TIKTOK3047MDL-072-LARK-01062915.
[12] *Id*.; Xinmei Shen, *Breaking down China's most popular news app, Toutiao*, South China Morning Post (Oct. 2, 2018), https://archive.fo/lRwYZ. Cao Huanhuan, a Senior ByteDance algorithm architect, stated that the company's "core system for recommending article with Toutiao was later adapted and used for short videos with TikTok and Douyin. All these apps make use of the same ByteDance backend recommendation engine system." Matthew Brennan, *Attention Factory: The Story of TikTok and China's ByteDance,* Kindle Edition (Oct. 2020), at 111.
[13] TIKTOK3047MDL-072-LARK-01062915.
[14] *Attention Factory*, *supra,* at 206-07.
[15] *Id*. at 185.

working closely with these pre-teen content creators, and the account managers provided encouragement and support that ranged from free meals to relationship support.[16]

26. In early 2017, ByteDance began discussions aimed at acquiring Musical.ly, a youth-focused app launched in 2014 that featured a bright pink logo, bright colors and content creators who were young.[17] Musical.ly did not utilize any age-gates until 2017; consequently, it had many users younger than 13.[18] When the combined app launched (which ByteDance branded as TikTok), Musical.ly's base of young users was automatically integrated into the platform.[19] As of the time of writing this report, TikTok continues to operate in the United States, though I understand this is an evolving public policy issue.

C. Snap Overview.

27. Snapchat was launched in July 2011. Snapchat is a photo-sharing application with messages that are available for a limited time and disappear after being viewed.[20] Originally called "Picaboo," the app was rebranded as Snapchat later that year and quickly gained popularity among adolescents. The application's ephemeral nature distinguished it from other social media platforms. It offered a novel form of communication that appealed to users' desire for privacy and particularly resonated with younger demographics.[21] By continuously implementing additional features, Snapchat has quickly evolved into a multifaceted social media application and is now much more than a simple photo-sharing application.

28. In its nascent stages, Snapchat focused on rapidly gaining traction among teenagers and young adults. The platform introduced an array of engagement-maximizing tools and features that, as I will discuss below, exploit the susceptibilities of the development of its young users. By the end of 2012, Snapchat had amassed 50 million daily active users.[22] This

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[16] *Id*. at 187.
[17] *Id*. at 161, 243.
[18] *United States v. Musical.ly*, No. 2:19-cv-1439, ECF 1 at ¶14.
[19] TIKTOK3047MDL-072-LARK-01062915 at -916.
[20] SNAP2097141; SNAP0886747; SNAP0020087; Ken Auletta, Get Rich U, New Yorker (Apr. 30, 2012), https://www.newyorker.com/magazine/2012/04/30/get-rich-u; *see also* Snap, Inc., How Snaps Are Stored and Deleted, Snap Newsroom (May 9, 2013), https://newsroom.snap.com/snaps-stored?lang=en-US, (last accessed April 1, 2025).
[21] SNAP2109601; SNAP2459988; Dep. of M. Weissenger at 298:16-19.
[22] Snap defines Daily Active Users (DAU) as "a registered and logged-in Snapchat user who visits Snapchat through our applications or websites at least once during a defined 24-hour

surge in early popularity alongside ongoing innovation attracted significant investor interest, including a reported $3 billion offer from Mark Zuckerberg to purchase the platform in 2013.[23] Also in 2013, Snapchat introduced its Stories feature, allowing users to compile and post photo and video narratives that are viewable by other users for just 24 hours.[24]

29. After declining Meta's purchase offer, the company continued to grow due to its continued innovation and introduction of features such as Chat (2014)[25], Streaks (2015)[26], Lenses (2015)[27], and Discover (2015). By 2016, Snapchat had 122 million daily active users and rebranded itself as Snap, Inc. The company experienced significant growth and reached 166 million daily active users. Snapchat went public via an initial public offering (IPO) on March 2, 2017[28] and continued to evolve from there, introducing new features such as Snap Map[29] and Spotlight[30] (a TikTok-style video platform).

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period." 2024 Snap Annual Report. https://s25.q4cdn.com/442043304/files/doc_financials/2024/q4/2024-Annual-Report.pdf

[23] Facebook made another offer for Snap in 2016, Axios.com, https://www.axios.com/2018/12/24/facebook-made-another-offer-for-snap-2016-zuckerberg-spiegel.

[24] Darrell Etherington, Snapchat Gets Its Own Timeline With Snapchat Stories, 24-Hour Photo & Video Tales, Tech Crunch (Oct. 3, 2013), https://techcrunch.com/2013/10/03/snapchat-gets-its-own-timeline-with-snapchat-stories-24-hour-photo-video-tales/?guccounter=1&guce_referrer=aHR0cHM6Ly9lbi53aWtpcGVkaWEub3JnLw&guce_referrer_sig=AQAAALOgbfJwbKMgdmcT1mnfSG7MFw0ssELl-8hXmAHyGGGKWqNcDiB6-aBGT0K7nkFLxLglgLk5Tc9sUaU7yW-GAhnQTpVP65ugN2cx9nB17X2EwYa7hLs0taUIqUmFfAc4ZGqdKr6SCOKCLxtbHNck7bbSLgb-niHrz2qbdaIH9u1K, (last accessed April 1, 2025).

[25] Snap, Inc., Putting the Chat into Snapchat, Snap Newsroom (May 1, 2014), https://newsroom.snap.com/putting-the-chat-into-snapchat?lang=en-US, (last accessed April 1, 2025).

[26] SNAP0078233 at -243.

[27] Snap, Inc., Introducing Lens Studio 5.0 Beta, Snap AR (Nov. 9, 2023), https://ar.snap.com/lens-studio-5.0-beta#:~:text=Lens%20Studio%20started%20as%20an%20internal%20tool,3.5M%20Lenses%20for%20250M%20daily%20active%20users (last accessed April 1, 2025).

[28] Statista. https://www.statista.com/statistics/545967/snapchat-app-dau/#:~:text=Daily%20active%20users%20of%20Snapchat%202014%2D2024&text=As%20of%20the%20fourth%20quarter,since%20the%20beginning%20of%202019.

[29] Josh Constine, Snapchat launches location-sharing feature Snap Map, Tech Crunch (June 21, 2017), https://techcrunch.com/2017/06/21/snap-map/. (last accessed April 1, 2025).

[30] Snap, Inc., Snap Inc. Launches Spotlight, a New Entertainment Platform for User Generated Content within Snapchat, Snap Investor Relations (Nov. 23, 2020), https://investor.snap.com/news/news-details/2020/Snap-Inc.-Launches-Spotlight-a-New-

30. Today, the Snapchat application is divided into multiple sections, each with its own page or screen and set of features. Snapchat has five main sections: Camera, Chat, Snap Map, Stories/Discover, and Spotlight. When users open the Snapchat application, they are immediately taken to the Camera page. On the Camera page, users are able to take photos and videos ("Snaps") to share with other Snap users. Snapchat enhances user engagement by offering Lenses and filters, which apply augmented reality effects and are accessible with a simple swipe on the screen. After capturing a Snap, users are prompted to send the Snap to another user or post the Snap to "My Story," where it remains visible to other users for 24 hours. Snaps can also be shared to Spotlight, where an anonymous public audience can view the Snap. On the Chat page, users are able to send text messages ("Chats") in addition to Snaps. In September 2023, Snap reached 405 million daily active users.[31]

D. YouTube Overview.

31. YouTube launched in 2005. In 2006, Google bought YouTube for $1.65 billion. YouTube currently operates as a subsidiary of Google. YouTube operates various platforms including YouTube Main, YouTube Kids and YouTube Shorts. YouTube Main can be used either on a mobile device as an app, on a computer via a website (youtube.com), or as an application on a smart TV. YouTube Kids operates as a distinct platform targeted to children under 13 and was launched in February 2015. In August 2019, YouTube introduced a web-based version at youtubekids.com.[32]

32. YouTube Shorts is included in YouTube Main and features shortened videos which are served to users in a "Shorts Player" on YouTube Main. YouTube Shorts resembles the short form videos that characterize both TikTok and Instagram Reels. The Shorts Player on the web version allows the user to click an up or down arrow and thereby continuously be served an endless stream of content. On the app version of YouTube Shorts, the user can swipe through an endless stream of content. YouTube Shorts includes an option called "Infinite Player" which

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Entertainment-Platform-for-User-Generated-Content-within-Snapchat/default.aspx. (last accessed April 1, 2025).

[31] SNAP4350589.

[32] GOOG-3047MDL-00000922 at -930; GOOG-3047MDL-00952609.

results in a never-ending stream of videos. YouTube acknowledges how important "Shorts" videos are among young users.[33]

33. YouTube was the most popular platform in 2018 with U.S. teenagers, and a study of 8-12-year-old children in the U.S. showed that YouTube is also more popular among this age group than YouTube Kids.[34] Users can engage in very long scrolling sessions from the YouTube recommended homepage feed; indeed, on average, teens spent 1 hour and 22 minutes a day on YouTube.[35] YouTube Main and YouTube kids both employ a number of similar features. These include endless scroll, autoplay, notifications, and incorporation of algorithms and recommendation features.

34. Although YouTube originated as a platform for sharing videos, more recent additions to the Platform have included features prominent on other social media platforms. These include the ability to comment on, "like," and upload other videos, and to subscribe to content from other users.

VI. What is Adolescence?

35. Adolescence is a unique developmental period of the lifespan. According to the World Health Organization, it is the period of life between childhood and adulthood, corresponding to the ages of 10 to 19 years.[36] During this time, adolescents experience physical, cognitive, and socio-emotional changes that influence their thoughts, attitudes, and behaviors, described in detail below.

36. **Identity Development.** Identity development is a key developmental task of adolescence, and it develops slowly but systematically across adolescence and into early adulthood (Branje, 2022). The task of identity development is for the individual to first question their identity and then experiment and explore their identity, prior to committing to a cohesive identity. This means that the individual forms an identity that they commit to, yet one that also

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[33] *See, e.g.*, GOOG-3047MDL-01738317 (2/7/2023 email – "Shorts is our big thing for teen appeal").
[34] Taylor, L. B., Cingel, D. P. (2023). Predicting the use of YouTube and content exposure among 10-12-year-old children: Dispositional, developmental, and social factors. *Psychology of Popular Media, 12*(1), 20-29. https://doi.org/10.1037/ppm0000368.
[35] GOOG-3047MDL-00937887 at -914 [Digital Well Being Two Pager – 10/18].
[36] Adolescent Health, World Health Org., https://www.who.int/health-topics/adolescent-health#tab=tab_1.

emerges based on context (e.g., the individual may have a similar, yet somewhat different identity when with parents compared to when with peers). Identity develops over time as the individual experiences interactions within their daily context (Bosma & Kunnen, 2001; e.g., interactions with parents and peers, both mediated and in person). These changes come along with life changes, as adolescents change schools, decide to go to college or get a job, and develop intimate and/or sexual relationships with others. Indeed, a clear sense of identity is a key component in developing social relationships, as those with a clear identity are better able to have positive interactions with others (Branje, 2022).

37. A core component of adolescent identity development is the separation-individuation process of adolescence, where children seek to balance their own needs from those of their parents (Lapsley, 1993). Here, children seek to individuate themselves by formulating their own identity and renegotiating the relationship they have with their parents. In this way, adolescents begin to shift their main sources of attachment from parents to peers, and in doing so, begin to pay far more attention to their peers' attitudes, beliefs, and behaviors (among other factors) in comparison to their parents.

38. **Social Development.** Developing peer relationships, forming peer groups, and maintaining those peer groups are perhaps the most important developmental goals of adolescence, along with identity development, and the two are linked. Recall that during adolescence, individuals undergo processes of separation-individuation, wherein they shift their identities and attachments from parents to peers. This heightens the developmental need to form and maintain peer groups. Indeed, many peer groups form around a shared identity or interest (Newman et al., 2007). At this time, adolescents experience an increasing psychological desire for social connection, and social connections are essential for positive mental health (Birrell et al., 2025). As a result, adolescents expand their social circles and also expand their social roles, particularly as they simultaneously work to develop their unique identities (Barber & Erickson, 2001). Given the increasing importance of peers, peers also take on increasing influence on individuals. In other words, adolescents pay very close attention to their friends' attitudes, values, and behaviors, and use those things to shape their own identity, through processes of social learning.

39. **Adolescent Egocentrism.** Described by Piaget (1952), egocentrism concerns the lack of differentiation in an area of subject-object interaction. This developmental phenomenon

progresses across four stages during a child's life, from the moment of birth to adolescence. Of particular note to this report is that adolescent egocentrism begins between ages 13 and 15, around the same time that an adolescent may begin to use social media. By this age, adolescents have acquired formal operational thought; that is, they are able to conceptualize their thoughts and the thoughts of others (Elkind, 1967). This phase of development is known as concrete operational egocentrism. As adolescents develop beyond this phase, they enter a new form of egocentrism; that of adolescence. While the adolescent may be able to think about his or her own thoughts and the thoughts of others, they are less likely to differentiate the object to which others' thoughts are directed (Elkind, 1967). For example, an adolescent may opt not to attend a party if they notice a stain on their shirt or pants because they feel that others will not only notice, but be unable to look away throughout the duration of the party. Since they themselves are obsessed with the stain on their pants, and cannot distinguish the object of their thoughts from the thoughts of others, they assume that others in the room will think solely about the stain on their pants, and think about nothing else.

40. **Imaginary Audience and Personal Fable Ideation.** Internal to adolescent egocentrism is the idea of the Imaginary Audience. Due to the self-consciousness of adolescents during this age, children anticipate the reactions of others on themselves (Elkind, 1967). Therefore, adolescents continually act and react to this contrived Imaginary Audience. It is important to note, though, that this is not always a critical audience; it can be admiring as well. The construction of this audience accounts for a number of actions during adolescence. Specifically, the Imaginary Audience plays a role in what is seen as the self-consciousness and exuberance of adolescence (Elkind, 1967). It should be noted here, however, that the Imaginary Audience is seen as a phenomenon which follows a certain developmental trajectory, whereas self-consciousness is a relatively stable, trait-based variable.

41. Elkind (1967) further identifies the Personal Fable as a complement to the Imaginary Audience. The Personal Fable is considered an over differentiation of a child's own internal feelings and occurs when a child comes to view him or herself as something special or unique (Elkind, 1967). By continuously reacting to the perceived Imaginary Audience, which is constantly viewing and thinking about the child, they come to feel important and perhaps omnipotent. Elkind (1967) goes on to describe this idea as a kind of perceived immortality, a

perceived uniqueness that cannot be understood by anyone other than the child. As such, this type of thinking has been linked to risk-taking behavior (Alberts et al., 2007).

42. Later research by Elkind and Bowen (1979) further clarified the Imaginary Audience and created the first Imaginary Audience Scale (IAS). Tests of this scale conducted by Elkind and Bowen (1979) found that 8th graders scored significantly higher on the IAS than 4th, 6th, and 12th graders, yielding support for the idea that construction of the Imaginary Audience is tied with the development of formal operational thought (Elkind & Bowen, 1979). In addition, as formal operational thought continued to develop within the adolescent, scores on the IAS decreased, suggesting that Imaginary Audience ideation occurs during early adolescence.

43. However, a number of recent research studies (see Rycek et al., 1998; Schwartz et al., 2008) have yielded support for the possible reemergence of egocentrism in later adolescence, a time by which adolescents should have theoretically passed through this phase. Schwartz et al. (2008) suggested that the reemergence of egocentrism in late adolescence may serve as a coping mechanism for adolescents as they prepare to leave home and go to college, a time where adolescents must forge new friendships while they are in less contact with their high school friends.

44. **Executive Functions and Self-Regulation.** Executive functions refer to the individual's abilities to plan and regulate behavior. These abilities develop across childhood, through adolescence, and into early adulthood. While more developed than young children in terms of executive functions and self-regulation, adolescents are still working to develop these capacities. Self-regulation refers to the individual's ability to organize behaviors, plan, manage emotions, and solve problems (Murray & Rosanbalm, 2017), and during adolescence, takes on three forms: cognitive regulation, emotional regulation, and behavioral regulation. Therefore, during adolescence, individuals are still developing the capacities to set goals and plan (cognitive regulation), manage strong feelings and express emotions appropriately and effectively (emotional regulation), and follow rules, control impulses, and cope effectively (behavioral regulation; Murray et al., 2015). In this way, adolescents may struggle to manage their thoughts, emotions, and time effectively.

45. **Brain Development.** Adolescence also serves as a remarkable period of brain development and is characterized by increases in brain plasticity (Backes, 2019) or the ability of the brain to change and reorganize itself over time. Structurally, one of the most important

changes to the adolescent brain is in the area of the prefrontal cortex, which is heavily involved in executive function and inhibitory control (Steinberg, 2005). Adolescents also experience increased activity in the striatum, which is the part of the brain responsible for risk/reward decisions. Because of this, adolescents tend to be more focused on the potential rewards of certain activities, at the expense of a focus on the potential risks. Further, the amygdala is also developing at this time, which makes the adolescent more likely to act impulsively in response to risks (Dreyfuss et al., 2014). Finally, increases in dopamine pathways between the prefrontal cortex and the striatum have also been linked to sensation seeking behavior among adolescents (Murty et al., 2016). Sensation seeking itself during adolescence is characterized by an increased interest in novel and strong experiences, despite any potential risks (Steinberg, 2008). Together, these changes in the brain make adolescents more susceptible for sensation seeking and risk taking behaviors, given that (1) they are still developing inhibitory control, (2) they focus more on the rewards of a particular behavior, rather than the risk, (3) they are more likely to act impulsively, and (4) they demonstrate an increased interest in seeking out novel experiences.

46. **Pubertal Development.** Finally, during late childhood and into early adolescence, individuals go through pubertal development, wherein the individual reaches sexual maturation and becomes able to reproduce. As such, there are significant changes to individuals' sexual organs. Of particular note to this report, however, the body experiences other significant changes during this time, both in the form of height and weight gain, and also through hormonal changes. Because of this, body size and type become more salient to the individual during this time. Research has found that adolescent females are more likely than adolescent males to engage in weight loss strategies during this time, whereas adolescent males are more likely than adolescent females to use strategies to increase muscle tone (McCabe et al., 2002). Other evidence suggests that females who perceive themselves to be overweight prior to entering puberty score higher on body dissatisfaction and drive for thinness, compared to those who do not perceive themselves to be overweight prior to entering puberty (Ackard & Peterson, 2001). Literature reviews suggest that adolescent females who enter puberty earlier, or who have more advanced pubertal status relative to their peers, are more at risk for eating disorders (Klump, 2013). Overall, these studies suggest that the rapid body and hormonal changes stemming from pubertal development influence body size and type salience, with implications for dieting practices (for adolescent

girls), strategies to increase muscle tone in adolescent males, body dissatisfaction, poor body image, and eating disorder risk, particularly among adolescent females.

47. **Summary.** Adolescents are developmentally different from adults. Adolescence is characterized by changes to the body, including shape, size, weight, and musculature. It is also characterized by cognitive changes, as adolescents work to establish a cohesive identity that is distinct from that of their parents. This makes social development, peer relationships, and peer group creation, maintenance, and function exceedingly important. Their cognitions are characterized by egocentrism, wherein they are able to understand that others have their own unique thoughts, but misunderstand the direction of those thoughts; in other words, adolescents think that others are thinking about them at nearly all times (Imaginary Audience Ideation). Due to this, they come to believe they are special and unique (Personal Fable Ideation). This type of thinking is linked to risk-taking behaviors of adolescence, as individuals do not think that bad things can happen to them. Finally, although more developed than children, adolescents are still developing self-regulation, meaning that they may still struggle to control impulses and inhibit urges.

48. It is my expert opinion, as explained in more detail below, that these unique aspects of adolescent development make individuals susceptible to negative mental health effects from social media use. For example, a lack of self-regulation development, coupled with design features intended to promote increased engagement and use, can lead to excessive and problematic social media use by adolescents, which is consistently noted as a contributing factor to adverse adolescent mental health. Features more tied to the social aspect of social media platforms can also contribute to excessive and problematic use. Adolescents are extremely interested in their peers, forming connections, and seeking to understand what is normative among their peers. Design features that encourage continuous scrolling allow adolescents to spend more time seeing and processing what is normative among their friend group. Design features that quantify feedback (such as public tallies of likes and comments) allow adolescents to see what material receives both positive and negative feedback, influencing their own behaviors due to identity development.

VII. What is Mental Health?

49. The APA Dictionary of Psychology defines mental health as "a state of mind characterized by emotional well-being, good behavioral adjustment, relative freedom from anxiety and disabling symptoms, and a capacity to establish constructive relationships and cope with the ordinary demands and stresses of life".[37] It is a state of well-being that allows people to cope with stressors, learn, contribute to society, and achieve their goals.[38] As such, mental health is generally seen as a state of being, where the individual is relatively free from distress, or is able to adaptively cope with life stressors. In the literature, there are many states of mental well-being and ill-being. Mental well-being refers to factors of resilience that can make a person less susceptible to experiencing mental distress. These factors can include flexibility and adaptability to cope with adverse life events, good social skills, and an ability to regulate emotions and behavior. Ill-being, however, refers to the absence of these abilities, or feelings of poor mental well-being. In the literature, well-being and ill-being are often conceptualized and operationalized in line with Diener (2006). For example, many studies on adolescent social media use and mental health measure subjective well-being in the form of individuals' happiness, self-esteem, and life satisfaction, among many others. Ill-being is often measured in the form of depression or anxiety symptoms, feelings of loneliness or a lack of social connection, poor body image or body dissatisfaction, and thoughts of suicide or suicidal ideation.

VIII. Adolescents & Social Media Use.

50. Given this review of key developmental markers of adolescence, it is not surprising that social media use is popular among adolescents around the world; social media is designed to connect users with other members of their social circle, and connect them with yet other peers and connections around the world. In this way, social media fits very well with the social developmental goals of adolescence; it allows them to form a peer group, communicate with that peer group, and help to maintain that peer group's functioning. Prior to the advent of social media, these tasks largely needed to be accomplished in person, such as at school, in clubs, in sports, and in neighborhoods. Prior to the advent of social media, technologies could be used

[37] Mental Health, American Psychological Association, https://www.apa.org/topics/mental-health.
[38] Mental Health, World Health Organization, https://www.who.int/health-topics/mental-health.

to facilitate this social development, through the use of phone calls and texting, but this was made more difficult through data caps and a lack of cell phone access among youth.

51. The development of social media, coupled with the advent and increasing access of smart devices ensured that adolescents would be able to maintain connections with peers nearly 24 hours a day. They could also develop peer relationships with individuals living in other cities, states, and countries, an ability that was difficult prior to social media and smart devices. Therefore, the draw that adolescents feel to social media in particular is not surprising when one takes their developmental stage into account.

52. Beyond this, identity development shapes adolescents' interest in using social media – it is a tool that gives them the opportunity to build and maintain social connections (perhaps the biggest single developmental goal of adolescence) while also allowing adolescents to find information about others, the world, and themselves – all important for identity development. This ability gives adolescents the opportunity to easily see the values and interests shared by their peers, shaping their own values and interests (e.g., de Lenne et al., 2020). It also allows adolescents to engage in identity experimentation (Valkenburg & Peter, 2008), a normative aspect of identity development. In this way, social media allows adolescents to test out various identities among their peers and see which receive positive attention and feedback. Other research suggests that social media can serve as a space for individuals with marginalized identities to seek and find community (Coyne et al., 2023).

53. It is therefore both logical, and to be expected, that adolescents are drawn to use social media and use it in great rates; their developmental stage makes social media especially attractive. Social media lets adolescents do what their evolution and psychology are telling them to do – maintain a close and constant connection with their friend group. Further, once one adolescent begins to use social media, use spreads throughout their peer group, as others are developmentally drawn to a space where they can communicate with their friends without time or distance constraints. But then they are taken advantage of by the social media companies through the ways in which social media is presently designed. Social media companies explicitly take advantage of this developmental period, designing their products to keep adolescents on the platform as long and as frequently as possible, promoting problematic use, with negative implications for their mental health and development.

IX. Defendants' Social Media Platforms, As Designed, Take Advantage of Adolescent Development.

54. Social media platforms take advantage of adolescents' developmental susceptibilities to keep them engaged on the platform once their developmental stage draws them there. Based on my review of the internal documents and testimony in this case, social media platforms are designed to make it difficult for children and adolescents to stop using the platforms, contributing to problematic use.

55. Children and adolescents need to practice and achieve various developmental goals during critical periods of development. Excessive time spent doing things that take away from the time that could be spent practicing these skills (self-regulation, social skills) can have negative effects on development, and subsequently mental health, due to lower functioning.

56. Further, human beings compare themselves to others in order to understand how we are doing. Social media platforms privilege positive information and offer multiple design opportunities to further perfect information and images. Adolescents readily use social media to learn about themselves and their place in the world (social and identity development). Being inundated with perfected imagery can make adolescents feel worse about themselves, their place in the world, and their body image, among other variables, with resultant effects on depression, anxiety, and body esteem, for example.

57. Indeed, social comparison processes on social media platforms have been identified as one of the most common mechanisms that explain poor mental health (Arenz et al., 2023). For example, research shows that adolescents engage in upward social comparisons on social media, meaning that they compare themselves to others that they perceive to be doing better than themselves in some way. Upward social comparisons are common on social media, given that there is a positivity bias, meaning that users often post positively-valanced material in order to receive positive social feedback (Schreurs & Vandenbosch, 2021). This material is then commonly filtered or augmented, using the features provided by the platforms, to be even more positive in nature, which has been linked to increased body dissatisfaction among adolescent females higher in social comparison (Kleemans et al., 2018). This can take the form of comparisons to others that the individual thinks are more physically attractive, more socially connected, or have more material resources, such as vacations or money for nice dinners or clothes. Upward social comparisons on social media have been meta-analytically linked to poor

self-evaluations and emotions, subjective well-being, mental health, and self-esteem (McComb et al., 2023).

58. It is my expert opinion that, as presently designed, social media platforms pose various risks of harm to adolescents including but not limited to risks coming from upward and negative social comparison. In the sections that follow, I review specific design features of defendants' platforms and explain based on research and my own expertise how they take advantage of multiple aspects of adolescent development: adolescents' less developed self-regulation, social development, brain development, pubertal development, identity development, and adolescent egocentrism. By exploiting these vulnerabilities, these design elements can contribute to excessive and problematic use of social media, again including negative social comparisons, which is linked to poor mental health among adolescents. Further, heavy use of social media can displace time that adolescents could spend building their developmental capacities, such as self-regulation. While various safety features turned on by default for adolescents could help to alleviate this issue (such as time controls), social media companies have been slow to implement such measures.

A. Infinite Scroll.

59. All four defendant platforms utilize a design feature known as infinite scroll. Facebook introduced infinite scroll in 2010 and, in 2016, incorporated the feature into Instagram.[39] Prior to the introduction of infinite scroll, a Facebook user, after viewing a fixed number of posts in their news feed, would reach the "bottom" of the page and would need to navigate to the next page by clicking a button. Infinite scroll eliminates the need for this manual navigation. Users are, instead, provided with a continuous feed of posts, which the user can scroll through indefinitely without ever reaching the "bottom" of the page.[40] This continuous feed is populated not only by posts from the user's friends, but also "recommended" posts (via algorithms) from accounts the user does not follow, which provides a virtually endless supply of posts to view. TikTok, YouTube Shorts, and Snapchat's Discovery and Spotlight features all utilize infinite scroll. Company employees discuss how this feature prompts users to scroll for

[39] Samantha Culp, There's an Alternative to the Infinite Scroll, Wired (Sept. 19, 2023), https://www.wired.com/story/lexicon-scroll-doomscrolling-mindfulness-linguistics/.
[40] Bob Leggit, How the Internet Destroyed Your Attention Span, Popzazzle (Apr. 30, 2021), https://popzazzle.blogspot.com/2021/04/how-the-internet-destroyed-your-attention-span.html.

extended periods of time.[41] For instance, one TikTok internal document explains that auto-scroll is "for users to consume videos in inconvenient situations" in order "to improve the overall playtime." However, the document also notes that "the risks of this proposal are heightened for U18 due to concerns about screen time addiction."[42]

60. Infinite scroll takes advantage of adolescents' less developed self-regulation, as adolescents find difficulty in ceasing use, not knowing what content might come next. This encourages adolescents to continue to use the platforms and consume more content, thereby contributing to social media overuse. Infinite scroll also takes advantage of adolescent brain development, particularly in the areas of risk/reward and dopamine pathways. The adolescent does not know what information might come next – yet, they know the information could be of interest, will almost certainly be novel in nature, and the novelty will continue to come as the adolescent continues to scroll.[43] Infinite scroll takes advantage of adolescents' social development, as they want to continue to consume content to keep up with what their peers are doing and saying on social media. Infinite scroll also takes advantage of adolescent egocentrism, as individuals can continue to consume content in an effort to see how their friends and peers are interacting with the individual adolescents' own content.

B. Autoplay.

61. Autoplay is a design feature that is related to the infinite scroll. Whereas the infinite scroll requires a user to engage in the act of scrolling (through a never-ending stream of content), autoplay operates by simply moving a user to another video when the currently-viewed video ends. YouTube launched an autoplay feature (which it also referred to as AutoNAV) in 2015 on the YouTube Main desktop platform in 2015, and in 2016 on the YouTube Main mobile app. Autoplay was turned on by default when it was launched.[44] In 2017, Instagram introduced autoplay, causing videos in the user's feed to play automatically when the user scrolls past them,

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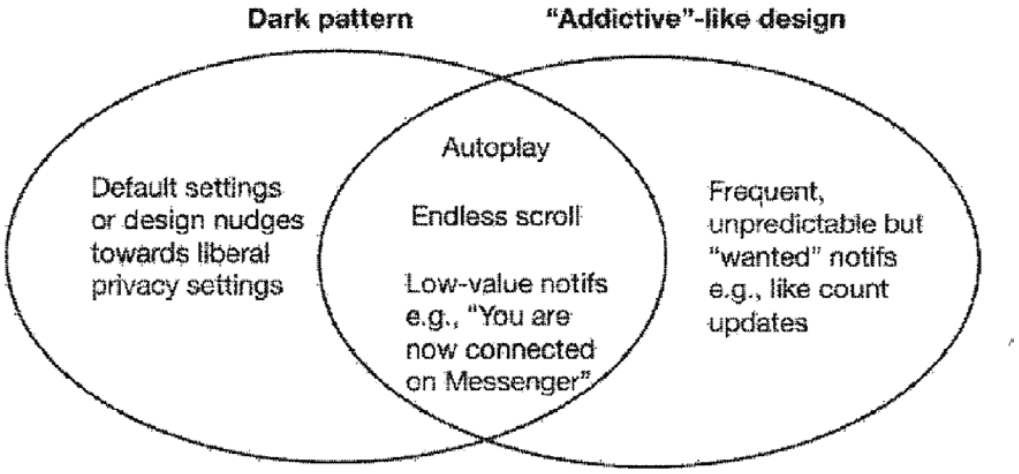
[41] Dep. of W. Kim at 234:2-35:3 (YouTube); Dep. of M. Weissinger at 119:3-123:5, 145:14-25 (Snapchat Discover); SNAP7299252 at 262-63 (Snapchat Spotlight); SNAP1157916 at -923; SNAP1188538; SNAP5059169.
[42] TIKTOK3047MDL-015-00341931 at -176.
[43] Dep. of A. Raskin at 23:12-24:6, 30:1-16, 41:12-21; 52:17-59:22; 56:1-20, 80:18-81:1, 81:5-83:16 (inventor of infinite scroll discussing how the feature impacts users by removing stopping cues).
[44] GOOG-3047MDL-04626757 at 6.

without the user needing to press a play button.[45] This feature was part of Meta's 2017 "roadmap" for increasing the time users spend on Instagram.[46] On Snapchat, both Discover and Stories employ an autoplay feature for a continuous content feed to users.[47] TikTok launched in the United States with an autoplay feature as well.[48]

62. Autoplay takes advantage of adolescents' less developed self-regulation, as videos play without adolescents choosing to start them, making it difficult for the adolescent to stop videos from playing. Adolescent brain development increases sensation seeking during adolescence, which can be achieved through novel experiences. Autoplay also takes advantage of adolescent brain development, which increases sensation seeking through novel experiences. The adolescent does not know what videos might play next – yet, they know the videos could be of interest, will almost certainly be novel in nature, and the novelty will continue to come as the adolescent continues to watch.

63. Meta's internal studies describe autoplay and infinite scroll as part of the platforms' "Addictive'-like design" and "Dark pattern[s]" contributing to "problematic use."[49]



META3047MDL-044-00108566

[45] Dep. of K. Andrews Dep. at 80:2-80:16; META3047MDL-031-00266889 at -909.
[46] *Id.*
[47] Dep. of M. Weissinger. at 110:19-113:13 115:1-11.
[48] TIKTOK3047MDL-084-LARK-03183934 at -940.
[49] META3047MDL-044-00108566; *see also* META3047MDL-044-00108564 at -564, -565 (features lead to "[l]ow-control or automatic behaviors," which contribute to "habitual" and "problematic use.").

C. Push Notifications.

64. Push notifications are used by all four social media defendants to alert a user to new posts by friends or strangers, new messages, or new interactions (likes, comments). Notifications may also remind the user that they have not visited the application recently. Both Facebook and Instagram use push notifications to encourage users who are not currently using the application to come back to it.[50] Similarly, TikTok uses a variety of notifications including Interest Push Notifications, Post Push Notifications, Ops Push Notifications, Comment/Like Push Notifications, and Live Push Notifications.[51] Like their competitors, Snapchat and YouTube utilize push notifications as well.[52]

65. Push notifications take advantage of multiple aspects of adolescent development. First, they exploit adolescents' less developed self-regulation by relying on the fact that adolescents will feel an urge to, and will be more likely to, open the app in response to a notification, in an effort to remain up-to-date with peers, contacts, influencers and celebrities. Second, push notifications take advantage of adolescents' social development, as adolescents are more inclined than adults to feel an urge to see what their peers and others have posted. Third, push notifications take advantage of adolescent brain development, particularly in the areas of risk/reward and dopamine pathways, as they provide a signal that new, novel information is available. Fourth, push notifications exploit adolescent egocentrism, including adolescent imaginary audience and personal fable ideation. Recall that adolescent egocentrism is characterized by a misinterpretation of the directions of others' thoughts, meaning that adolescents think that others are thinking about them at all times. As such, adolescents may assume that notifications concern posts about themselves, or that judge their appearance and behaviors – what is known (and explained above) as imaginary audience ideation. Fifth, push notifications take advantage of identity development, as adolescents have a desire to continuously see the beliefs, values, attitudes, thoughts, and behaviors of both their peers and those outside of their immediate social connections. Given how important identity development is to adolescents, this is likely to further contribute to excessive and problematic use. It is

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[50] Dep. of D. Kilstein at 488:2-489:15.
[51] TIKTOK3047MDL-004-00291835.
[52] SNAP1322227; Dep. of N. Yadegar at 379:6-379:24; Dep. of J. Siegel at 490:4-497:2; Exs. 44 and 45 to Dep. of J. Siegel; GOOG-3047MDL-03706722; GOOG-3047MDL-03928001; GOOG-3047MDL-03705514; GOOG-3047MDL-05263731.

noteworthy that the defendant's platforms generally lack effective time controls and/or do not have time controls set to the default. Therefore, it becomes even harder for the adolescent user to regulate their use of social media platforms.

66. Company documents and testimony indicate that the defendant companies manipulate the timing and content of notifications to increase use of their platforms.[53] For example, documents indicate that TikTok used notifications to influence users to remain active on its app.[54] Notably, TikTok changed its live push notification feature from targeting users who were not active that day to users not active within several hours. Other documents demonstrate that TikTok was actively looking into how to guide more users to turn on push notifications[55] and that TikTok saw constant notifications as a key part of their business model, "growing at the expense of their users", and benefiting "companies and advertisers more than users".[56]

67. Documents from Snap similarly discuss "experimenting" with sending notifications at a user's "predicted 'best hour'" for increasing use, acknowledging that "for most users this is at night."[57] Snap sends users notifications even when there is nothing new on the platform, such as simply noting that certain features (like Spotlight) are available.[58] YouTube likewise "target[s]" notifications "based on knowledge of interests, viewing habits, time-of-day, etc." as part of its "two-pronged approach to growth."[59]

68. The documents from Meta tell a similar story. In 2017, Meta's "roadmap" for increasing time spent on Instagram included the strategy of sending push notifications at night –

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[53] *See, e.g.*, Dep. of A. Tran at 26:6-31:2,109:15-112:24, 114:8-127:21; Abby Tran Dep. Exhibit 6 and 7; TIKTOK3047MDL-111-LARK-05821067, TIKTOK3047MDL-006-00327088.
[54] TIKTOK3047MDL-021-LARK-00014505 at -506.
[55] TIKTOK3047MDL-021-LARK-00014505.
[56] TIKTOK3047MDL-006-00327425 at -444; *see also* TIKTOK3047MDL-002-00101297 (notifications intended to "Activate & Engage users with the right content at the right time, to encourage users to open the App more and stay longer."; proposes "[f]ind[ing] the best push time and the best push count for every user to maximize dau and retention."); TIKTOK3047MDL-004-00321758 at -799 ("By optimizing the grouping arrangement of off-app push on Android in the message center, the exposure of out-of-app messages can be improved, and the overall click through rate of out-of-app messages can be improved.").
[57] SNAP1257256 at -262, -263.
[58] SNAP4742043; SNAP4227244.
[59] GOOG-3047MDL-01062790.

a time when adolescents should generally be sleeping.[60] Similarly, a 2022 document discusses a plan by Meta to "make IG [Instagram] an urgent app for US (Girl) Teens again" by, among other things, encouraging user behaviors that "generate push notifications" for friends to "bring [them] back into the app."[61] Meta summarized their strategy for teen girls by stating: "simply put, we need to 'push' them more."[62]

69. Meta acknowledges internally that these notification strategies "amplify" what the company describes as "problematic usage" of its platforms, particularly among adolescents.[63] Vaishnavi Jayakumar, Meta's former Head of Youth Policy, for example, testified that, when looking at developmental appropriateness of experiences for teenagers between the ages of 13 and 18, "we generally acknowledge that we – that notifications tend to draw them into the app repeatedly, and for more sessions and for longer time in session than we would otherwise want for young people of that age. And so notifications have been seen as a form of increasing the dependency of somebody on the app."[64]

70. Internal Meta presentations describe how push notifications "impact feelings of control" and "lead [people] to use FB [Facebook] more often than they want."[65] Meta found that notifications "make it harder for [teens] to manage the amount of time they spend on the app" and that many teens say "the number of notifications they receive can be overwhelming."[66]

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[60] Dep. of K. Andrews at 80; META3047MDL-031-00266889 at -909; *see also* META3047MDL-019-00015192 at -193 ("Optimizing the time of day that we send push notifications . . . ."); META3047MDL-047-00990649 at -666 ("This launch post Growth Notifications team shows that adding time-of-day increase engagement by better optimizing SmartScheduler. . . ."); META3047MDL-034-00123032 at -035 ("Time of day churn Notifications have higher CTR which drives increase in weekly active users"); META3047MDL-047-00242378 ("Researching the best time of day to send push campaigns reveals that noon" and "8-9pm are ideal times.").

[61] META3047MDL-019-00104380 at -381.

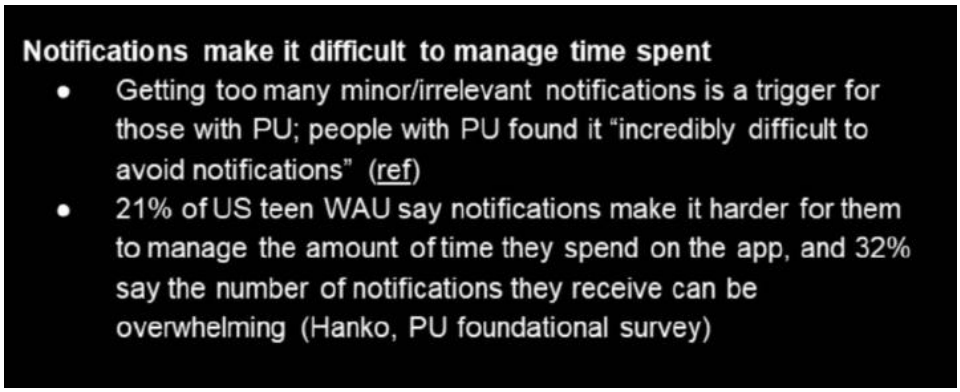
[62] *Id.* at -382.

[63] META3047MDL-003-00166569; Dep. of K. Jin at 434:6-435:25.

[64] Dep. of V. Jayakumar at 141:18-142:2.

[65] META3047MDL-044-00171360.

[66] META3047MDL-136-00013213.



META3047MDL-136-00013213

D. Recommender Algorithms.

71. Parts of defendants' platforms show adolescents content that is chosen for them by recommender algorithms. Examples include Instagram Reels, YouTube Shorts, the TikTok For You page, and Snapchat's Spotlight feature. These algorithms utilize a combination of inputs related to user behavior to determine what content to present and in what order. These inputs may include the user's previous searches, likes, other interaction behaviors. They may also include user attributes that are observed by the platforms but not expressly manifested or stated by the users themselves. This is noteworthy, as adolescents may be less likely to understand the risks of algorithms to their privacy, given their increased risk-taking behaviors coming as a function of their developmental stage (Romer, 2010; Steinberg, 2004).

72. On each of these platforms, the user is presented with content that is unpredictable and unknown to the user. Adolescents are particularly susceptible to overusing such features given their less developed self-regulation and given their brain development in the areas of risk/reward and dopamine pathways. This contributes to excessive time on the platform or other forms of problematic use.[67]

73. For example, TikTok's functionality can put young users at higher risk of being caught up in harmful feedback loops.[68] TikTok's algorithm tracks likes, comments, shares, and other details of user behavior including whether a user viewed a video in full and the kind of

[67] *See, e.g.*, GOOG-3047MDL-04918852.
[68] TIKTOK3047MDL-060-01111628 at -629.

video that was viewed, in order to use that data to recommend videos that are similar.[69] TikTok has estimated that 260 video views within the first week of the app's use will create a "habit moment" for a user, and users who reached that threshold likely would remain highly active thereafter.[70]

74. Snapchat's Discover and Spotlight features pose similar risks to adolescents given their unique stage of development. Discover features professional content from media partners, including influencers, advertisers, entertainment companies, and news outlets. Internal documents describe the Discover feature as the "silver bullet" to increase engagement and time spent on the application.[71] Discover is paired with Stories, a part of Snapchat that features content lasting for only 24 hours. When there are no more Stories by friends, Snapchat defaults to Discover, an endless scroll of videos created by other Snapchat consumers who are not friends.[72] In response to this forced auto-play content, individual Snap users report that Snap's algorithmic recommendations are addictive and have requested to get rid of them or at least make them opt-in; Voice of the Customer reports contain details of addictive use and/or requesting that they be able to toggle them on and off.[73]

75. Spotlight is Snapchat's short-form video feature, similar to TikTok and Instagram Reels.[74] Spotlight, introduced in 2020, provides a tailored endless scroll to showcase user-generated content based on an algorithm that selects Spotlight Snaps based on engagement metrics, relevance, retention, and user feedback.[75] Spotlight includes other user engagement features including a comment section, likes count, shares, saves, and the ability to follow users whose content is featured on Spotlight. In order to provide endless Spotlight content, Snap enacted the Incentive Program which offered $1 million per day to content creators who generated and posted content to Spotlight.[76]

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[69] TIKTOK3047MDL-002-00064418 at -420 through -422.
[70] TIKTOK3047MDL-001-00001985 at 2013.
[71] SNAP3760712; SNAP3760713.
[72] SNAP0307147; SNAP1393050.
[73] SNAP0308313; SNAP0321529; SNAP2727159; SNAP0307144; SNAP0373208.
[74] SNAP0188592.
[75] How We Rank Content on Spotlight. Snapchat Support. https://help.snapchat.com/hc/en-us/articles/8961653169940-How-We-Rank-Content-on-Spotlight#:~:text=We%20organize%20or%20rank%20content,our%20understanding%20of%20the%20content.
[76] Ex. 8 to Dep. of J. Brody; Dep. of J. Brody at 135:1-136:21.

76. To increase user traffic to Spotlight, Snap implemented an Always On Badge in 2023.[77] The Always On Badge is a red icon that appears on the Spotlight tab when new Spotlight content is available to view.[78] The red icon will clear once the user navigates to Spotlight. In response to the General Data Protection Regulation enacted in the European Union, Snap added the capability to hide the Spotlight button for users who were under the age of 16 based on their reported age. This option could have been made available to other parts of the world. Despite reports of problematic Spotlight use among its youngest users, this option has not been made available to users in the United States.[79] One Snapchat user wrote to Snapchat corporate with a similar such request: "Please tell me how to turn off spotlight I hate it and I don't want to see it. Theres a reason I don't have TikTok installed it's because I don't want to see this type of content."[80]

77. The YouTube Shorts model similarly considers a variety of information in generating a user's feed, such as a user's demographics, on and off platform history and duration of video watching to offer up short videos to teenagers. YouTube acknowledged in its "Teen Responsibility on Shorts 2023" document that repetitive or high volume content impacts teen wellbeing and that research shows the repetitive exposure of some content can affect teens' social and emotional development.[81]

E. Social Cues and Peer Feedback.

78. Each of the four social media platforms addressed in my report utilize various forms of social cues and peer feedback. As a general matter, these are design features that allow a user to see whether (and how many) other users have reacted to the user's post – whether through a "like," comment, or similar type of feedback response such as a virtual "gift." However, social cues and peer feedback may take other forms. For instance, Snapchat's "Snapstreaks" feature utilizes another form of social cue that is structured differently – as a one-to-one cue rather than a many-to-one cue. I explain this more below.

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[77] Dep. of M. Weissenger at 168:13-169:8; *see also* SNAP4227244.
[78] SNAP4227244.
[79] SNAP0190256 at -606.
[80] SNAP0188592.
[81] GOOG-3047MDL-01287601.

79. First, the most common form of social cue, the "like" button. All of the platforms except Snapchat[82] include a feature that allows users to "like" posts by other users by clicking a button (a feature first invented by and launched on Facebook). The number of "likes" that a post generates is visible both to the poster and anyone else viewing the post. The number of "likes" that a post generates is also a factor that the platforms' algorithms consider when determining whether a post appears in other users' feeds.[83] As a result, the posts that a user sees in their feed will typically have a much higher number of likes than a user's own posts.[84] Meta, for example, has stated that, "on average, a person will receive about 5% as many Likes on their own posts as the posts they see in their feed."[85]

80. Social cues such as "likes" can keep adolescents using social media in an effort to receive more – and more positive – feedback from their peers, while simultaneously reviewing the peer feedback received by others in order to understand what is popular among their peer group. This is particularly salient for adolescents given the importance of peers during this developmental period, giving adolescents another push toward remaining on the platform. Moreover, when positive, social cues and peer feedback can result in dopamine hits that further encourage continued use. In this way, "likes" take advantage of adolescent brain development, particularly in the areas of risk/reward and dopamine pathways. Increasing time can quickly turn into excessive use and overuse, displacing time spent building other key developmental capacities during adolescence. Further, because adolescents overestimate rewards at the expense of risks, they may see greater reward in the continuation of scrolling for new information, over the risks of spending too much time on the platform at the expense of time spent engaged in other activities.

81. In addition to taking advantage of adolescents' social development and brain development, social cues and peer feedback on social media exploit adolescents' identity development. During a time when adolescents are attempting to understand who they are, and who they are not – and the values, beliefs, and behaviors associated with each – the feedback that adolescents receive on social media can serve as a signal of what is valued among their peer

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[82] As discussed below, Snap still utilizes social cues and peer feedback to motivate use, but focuses on replies and Snapstreaks, rather than likes.
[83] Dep. of M. Burke at 206:20-212:7; META3047MDL-038-00000234 at -234, -243.
[84] *Id.*
[85] *Id.*

group, including the identity that they could (and/or should) aspire to. Finally, social cues and feedback exploit adolescent egocentrism by providing tangible proof of how adolescents' perceived imaginary audience is responding to them on the platform. This is especially important to consider, given that the outcome of imaginary audience ideation is personal fable ideation – characterized by risk-taking behaviors, as the adolescent thinks that they are special and that nothing bad can happen to them. Finally, the ability to direct message to outside contacts can exacerbate these issues, as adolescents are able to communicate with a wider array of users, receiving more communication and feedback that is of interest developmentally, while simultaneously being unaware or unconcerned with the possible risks of communicating with strangers.

82. Meta's internal presentations note that the "like" feature is one of several that "encourage teens to continue engaging and coming back on the app."[86] The presentation explains[87]:

> Approval and acceptance are huge rewards for teens and interactions are the currency on IG. DMs, notifications, comments, follows, likes, etc. encourage teens to continue engaging and keep coming back to the app.

83. Meta's internal studies have found that this set of features contributes to mental health issues among users, particularly adolescents, due to a phenomenon called "negative social comparison," which "lowers well-being (loneliness, life satisfaction, self-worth, and self-efficacy)."[88] Meta directly linked this phenomena to the "likes" feature, and in particular the feature that makes "like counts" public.[89] A 2020 study conducted by Meta, for example, found that "seeing more posts with high like counts . . . is associated with feeling worse."[90] Meta

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[86] META3047MDL-003-00191207 at -216.
[87] *Id.*
[88] META3047MDL-020-00082810 at 8; *see also* Dep. of V. Jayakumar at 166:3-166:21 (Q: "At some point did researchers at Meta determine that that feature may be exacerbating negative social comparison for kids?" A: "Yes. Researchers have put together a really compelling package of information based on their interviews and user research suggesting that -- I'm sorry -- suggesting that likes might be one way in which we could target the issue of negative social comparison").
[89] META3047MDL-038-00000234 at -392 ("I think we can be pretty confident of a causal link between Like counts and social comparison."); *see also* Dep. of M. Burke at 212:21-213:23.
[90] META3047MDL-038-00000234 at -234, 10; *see also* META3047MDL-020-00588060 at -066) (2019 study of Instagram and Facebook users finding that "People who see more likes,

concluded that negative social comparison was a "significant problem" on Instagram, with 68% of teen girls experiencing it on the platform.[91]

84. Meta researchers recommended hiding like counts. For example, [redacted] Meta's Research Scientist Director, stated: "I think that negative social comparison is endemic to our products. . . . [I]t is a specific and concrete way in which our products are negative for their lives. I believe we have a responsibility to mitigate those negative experiences as much as we can. The research shows us that like counts can lead to negative social comparison."[92] Mr. [redacted] concluded that removing like counts from posts "is one of the clearest things (supported by research) that [Meta] can do to positively impact social comparison and well-being on IG and we should ship it."[93] Jennifer Guadagno, Meta's Director of UX Research, Social Impact, similarly concluded that "[r]emoving like counts is one of, if [not] THE, most significant levers FB has to reduce social comparison. From a well-being perspective, a ship decision for both IG and FB is recommended."[94] Meta ultimately decided not to do so.

85. In addition to the common "like" button, social cues and peer feedback on social media may take other forms. Consider the gifts feature on TikTok Live, a live streaming feature. One aspect of Live is the ability for a user to give "gifts" to friends and other TikTok users. TikTok adjusted the program including making gifts easier for users to give, in spite of acknowledging that doing so was "exacerbating addictive behavior and/or harm that may already be occurring due to minor use of gifting features".[95] Reagan Maher, an employee in TikTok's Global Trust & Safety group, testified that she was "concern[ed] about this potential new feature" offered in TikTok Live.[96]

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reactions, and comments on others' posts feel more social comparison. . . . And News Feed ranking may also make this worse by prioritizing high-feedback posts."); Dep. of M. Burke at 139:19-142:23 (discussing 2019 study).

[91] META3047MDL-020-00693093 at 693093.

[92] META3047MDL-020-00216374.

[93] META3047MDL-003-00117852 at -856; *see also* Dep. of [redacted] at 441:10-443:24.

[94] META3047MDL-003-00154846 at -847.

[95] TIKTOK3047MDL-038-LARK-00192083 at -083.

[96] Maher Dep. 2/21/2025 at 65:20-23.

86. Snapchat similarly utilizes a number of gamified features including Snapstreaks, Snap Scores, and Trophies. One of Snapchat's most "retentive"[97] features for young users[98] is the "Snapstreak," which appears on the Chat page of the application. A Snapstreak occurs when two users send Snaps (photos or videos) back and forth for consecutive days.[99] To maintain a streak, users must continue exchanging messages daily, fostering compulsive behavior and making many users feel they are "in too deep" to get out of a streak.[100] Forty-seven percent of Snapstreak users are 13-17 years old.[101]

87. Snapstreaks take advantage of adolescent susceptibility to social cues by providing a key indicator that (a) an individual adolescent has social connections and (b) that they are in contact with their social connections daily. In this way, streaks indicate to others (as well as the individual user) that they have friends, and those friends want to remain in constant contact with the individual. This is vitally important to adolescents in terms of their social development.

88. The results of a May 2017 Focus Group at Snap's offices revealed younger users are more inclined to participate in Snapstreaks, that users feel "strong social pressure to maintain a streak" and that breaking a streak can negatively affect personal relationships in real life.[102] This fear of losing a long-standing streak creates social pressure, anxiety and thoughts of self-harm, making adolescents feel obligated to stay active on the application every day in order to maintain their Snapstreaks.[103] In June 2018, Snap recruited 11 – 17 year olds who use Snapchat less than they did a year ago for a Focus Group Study titled "13-17yo Decline Study."[104] There, Snap heard from a 14-year-old female Snapchat user that Snapstreaks is "what keeps a lot of

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[97] SNAP0878303 (October 2017).
[98] Exhibit 18 and Exhibit 23 of Dep. of J. Brody (SNAP1806711); *see also* SNAP3126932; SNAP2345621.
[99] Dep. of J. Brody at 261:2-261:6.
[100] SNAP0640337 at -341 (May 2017).
[101] SNAP2345620 at -621.
[102] SNAP0640337 at -341 (May 2017); SNAP0029949 at -959.
[103] SNAP0857671 (August 2016); SNAP0027607.
[104] SNAP2368981 (June 2018); *see also* SNAP0000008 (August 2018).

people on Snapchat."[105] Internally, Snap touts the success of the Snapstreak feature as seeming to "have tapped into some mass psychosis where 17 million people must keep the streaks going."[106]

89. Snap's Director of Research, Morgan Hammerstrom, elaborated on the implications of this mass psychosis in a document titled "Social Ping Theory."[107] In it, she examines how 13- through 17-year-olds engaged with Snapstreaks to connect with other Snapchat users. According to Hammerstrom, teens use Snapchat for "network acceptance" and "internal proof" that they have friends who actively keep in touch with them each day and are thinking about them.[108] Snapstreaks serve as a "social ping," prompting communication and offering validation or reassurance that they belong to a group.[109] In essence, by exploiting adolescents' need for identity development and external validation, Snapstreaks uniquely drive engagement among this user demographic and, according to Snap's CEO Evan Spiegel, reinforce "toxic behavior" among Snap users.[110] Snap's CEO Evan Spiegel has also been the recipient of direct emails from young Snap users asking for help with lost Snapstreaks because they were hurt and heartbroken by the loss.[111] Parents also emailed Snap's CEO directly to voice concerns about the influence the feature has on kids' mental health.[112]

90. Despite these harms to its most susceptible users and risk of tech addiction presented by Snapstreaks,[113] Snap has not removed the feature from its application. Instead, Snap focused on monetization and maintaining the "perceived value" of the feature.[114] Users who are willing to subscribe to Snapchat+ have the option to "freeze" Snapstreaks.[115] Streak freezing is a Snapchat+ feature that lets subscribers freeze individual streaks, allowing them to maintain their streak without sending a snap while the streak is frozen.[116] Snap also developed a Snapstreak

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[105] SNAP2368981 at -982 (June 2018). The same user explained her school blocks Snapchat on its Wi-Fi but she is able to continue using Snapchat at school by using her cell phone service data plan.
[106] SNAP6759344 (January 2017).
[107] SNAP2894057.
[108] *Id.*
[109] *Id.*
[110] SNAP6110229 at -232; SNAP6110234; SNAP0884986.
[111] SNAP0652599; SNAP0867965; SNAP1117208; SNAP1838156; SNAP0896563.
[112] SNAP1152337.
[113] SNAP3160903; SNAP0262793; SNAP0396889.
[114] Dep. of J. Brody at 333:3-333:24; *see also* SNAP0396891.
[115] SNAP5422027.
[116] *Id.*

"Restore" feature and associated pricing strategy for users to restore lost Snapstreaks for a fee.[117] Snap users are able to sign-up up for a monthly subscription[118] or pay $0.99 in order to restore lost Snapstreaks. Snap's initial projections estimated $25 million in minimum annual revenue for Snapstreak Restore.[119] Within one week of launch of the Restore feature, Snap's daily revenue was tracking towards $20 million annually.[120] In July 2023, Snap made approximately $130,000 per day and $47 million annually from Snapstreak Restore charges.[121]

91. Like Snapstreaks, a Snap Score is another "simple yet effective" engagement tool that is publicly displayed on a user's profile; it is calculated based on how many snaps a user sends and receives.[122] Snap Score quantifies "Snapping interactions"[123] which means the more Snaps a user sends or Stories a user posts, the higher their score will be.[124]

92. Similar to Streaks, Snapchat users report that having a high Snap Score is tied to popularity and is one of Snap's most well-known gamification features.[125] Internally, Snap identified the Snap Score as an inspiration for how Snap can drive engagement through gamification of social interaction, which tends to be popular among younger demographics.[126] According to Snap, not only is the Snap Score "an elegant gamification solution to keep Snapchatters engagement in Chat streaks and story posts," but it is also a potentially effective tool to drive commerce on the platform by updating the Snap Score formula to include commerce-related features.[127]

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[117] SNAP1937542; SNAP4235765.
[118] Snapchat+ subscribers get on restore per month. https://help.snapchat.com/hc/en-us/articles/7121577610900-What-is-Snapchat?utm_campaign=scp&utm_medium=lm&utm_source=sc (last accessed April 2, 2025); https://help.snapchat.com/hc/en-us/articles/18986668781844-How-do-I-get-more-free-Snapstreak-Restores-with-Snapchat (last accessed April 2, 2025).
[119] SNAP1937542.
[120] SNAP4910326.
[121] Ex. 25 to Dep. of J. Brody; *see also* Dep. of J. Brody at 343:15-343:18.
[122] Ex. 20 to Dep. of D. Boyle, (April 2, 2025); Dep. of J. Beauchere at 528:23-529:6, Ex. 26 to Dep. of J. Beauchere.
[123] Dep. of D. Boyle at 366:17-367:1 (April 2, 2025).
[124] SNAP5154720; Dep. of J. Beauchere at 529:7-529:13.
[125] Ex. 26 to Dep. of J. Beauchere; Ex. 20 to Dep. of D. Boyle.
[126] Ex. 20 to Dep. of D. Boyle; Dep. of D. Boyle at 377:11-379:11.
[127] Ex. 20 to Dep. of D. Boyle.

93. Snap Score also presents safety risks by incentivizing users to connect with strangers. According to a study, which was circulated internally at Snap, titled "Understanding and Combatting Youth Experiences of Image-Based Sexual harassment and Abuse", the Snap Score feature exacerbated issues of unknown users accessing young people's accounts because it creates an incentive for young people to "keep their privacy settings open, accepting strangers' quick adds, and participate in shout outs and streaks in order to gain more contacts and views on Snapchat and eventually increase their score".[128]

94. A prior feature, Snap Trophies, similarly gamified social interaction and gave users another variable reward.[129] Trophies allowed users to earn various badges for achieving certain milestones on the platform, such as exploring the platform and using features, completing account set up, and rewarding power users for their knowledge of the easter eggs and features hidden in the platform.[130] For example, a Snap user could earn trophies for scanning a Snapcode, watching a Live Story, sending a Snap with a Geofilter, or adding a friend on the platform.[131] Similar to Snap Score, the exact condition or formula for unlocking and earning a Trophy was unknown to Snap users, therefore playing into the gamification mindset among Snap users.[132]

F. Beauty Filters.

95. Users of Snapchat, Instagram[133], and TikTok,[134] and YouTube Shorts[135] are all able to utilize augmented reality filters to change their appearance prior to posting photos or videos, sometimes in dramatic ways but often times in subtle ways that conform to prevailing ideals of beauty – for instance, narrowing the nose, enhancing cheekbones, or slimming the waist. Notably, the platforms do not require users to identify when they have utilized such filters.

96. For example, Instagram, since its inception in 2010, has provided users with "filters" that alter the appearance of photos. In 2017, Meta added augmented reality effects for

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[128] Ex. 26 to Dep. of J. Beauchere.
[129] Ex. 10 to Dep. of J. Boniakowski; Ex. 13 to Dep. of J. Shen.
[130] Ex. 18 to Dep. of J. Boniakowski.
[131] *Id.*
[132] SNAP4954081; Ex. 20 to Dep. of D. Boyle (April 2, 2025).
[133] Guadagno Ex. 18 at 2 - META3047MDL-050-00003832 at -833.
[134] TIKTOK3047MDL-004-00141896.
[135] GOOG-3047MDL-00442481; GOOG-3047MDL-01786683.

Instagram users, which superimpose computer-generated effects on users' photos.[136] In August of 2019, Meta introduced third-party augmented reality effects known as "Spark filters," which allows third-party developers to create effects for users.[137] Since then, there has been a proliferation of "beautification" and "cosmetic surgery effects" filters on Instagram that enhance a person's appearance in the photos they post.[138]

97. Given the salience of the body during pubertal development, and in conjunction with social comparison processes that occur as adolescents consider their place, looks, and values with respect to their peers, filters and other image manipulations take advantage of child and adolescent pubertal development. As noted, body size and shape are particularly salient at this developmental time, given the rapid changes that occur to the body during puberty. Beauty filters and other image manipulations take advantage of this susceptibility by further calling attention to body shape, size, and looks, and further, do so in a way that can promote social comparison. Indeed, given the positivity bias that occurs on social media, where information with positive valence is shared more so than content with negative valence, filters can be especially harmful because adolescents are comparing themselves to already positive content that has been further perfected through beauty filters, and other filters that can call attention to body shape and size. Once again, this all comes at a time when adolescents are experiencing rapid changes in the shape and size of their bodies, and questions about body shape and type are particularly salient to the individual at this time.

98. Consider Snap as a case study. Snap, Snap users, and advertisers are able to create and post augmented-reality-based Lenses or Filters for Snap users to access.[139] These continuous updates make Snapchat an ever-evolving platform that keeps users coming back to explore the latest effects.[140] The sense of urgency created by these limitations is heightened when certain

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[136] META3047MDL-050-00003832 at -833.
[137] *Id.*
[138] Dep. of J. Guadagno at 93:3-94:5.
[139]SNAP3744792; Lens Studio. https://ar.snap.com/lens-studio; Lens Discovery https://developers.snap.com/lens-studio/4.55.1/references/guides/distributing/snapchat/lens-discovery#:~:text=Lens%20Explorer%E2%80%8B%0A%0AThe%20Lens%20Explorer%20can%20be%20accessed,mechanism%20for%20Snapchatters%20to%20find%20your%20Lenses.
[140] Why are some Lenses no longer available on Snapchat? Snapchat Support. https://help.snapchat.com/hc/en-us/articles/7012375115156-Why-are-some-Lenses-no-longer-available-on-Snapchat (last accessed April 2, 2025).

Lenses or Filters go viral or become trending.[141] Snap does not age-gate or limit the audience of Lenses or Filters, nor warn about the risks described above.[142]

99. Nevertheless, Snap has noted the negative impact its filters have on teenage girls, especially the propensity for beautification Lenses to impact user mental health and cause users to develop "Snapchat dysmorphia."[143] Despite these harms, Snap heavily relies on Lenses for user engagement[144] and targets 13 to 17 year old females.[145] In its previously mentioned 2018 "13-17yo Decline Study", Snap heard from an underage 11-year-old female Snapchat user that she only uses Snapchat for Lenses.[146] In 2020, an internal "Inclusive Camera Survey" elicited what Snap referred to as "troubling" responses from young Snap users including: "I love the filters it hides my ulgyness [sic]" and enjoying filters "because it hides blemishes and makes my face look thinner and lighter than it is."[147] This survey "underlines a key issue" with "Lens Dysmorphia", a phenomenon where users might feel confident when using Lenses but "are simultaneously left feeling bad about how they look without one."[148]

100. In August 2021, Snap's user engagement metric tracking demonstrated a decline in Lens engagement among 13 – 17 year old females in the United States.[149] In response, Snap undertook a user survey in June 2022 to identify reasons for the decline and how Snap could "facilitate product prioritization of reversing the decline."[150] Snap's survey included several reasons for the decline, including 13 to 17 year old females believing Lenses are bad for body image and mental health.[151] In May 2023, Snapchat's internal documents demonstrate continued study and business concern that these users were using Lenses less.[152] At that time, Snap

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[141] SNAP2926182 at -182.
[142] SNAP0190256 (see also for Disney & Spotlight mitigation measures that were not taken).
[143] Dep. of J. Brody at 187:7-188:23 ; SNAP0078233 at -243; SNAP0525938; SNAP0933724; SNAP0525939.
[144] Ex. 13 of Dep. of J. Brody – AB tests demonstrating beautification in Lenses bring Snap +70% of engagement and about 60% of Snap's daily new users, which come to Snapchat only because of lenses.
[145] SNAP6340758; SNAP3105001.
[146] SNAP2368981 at -984 (June 2018).
[147] SNAP3210317.
[148] *Id.*
[149] SNAP4781307.
[150] *Id.*
[151] *Id.* at -310.
[152] SNAP5996231.

internally reported that these users were using Lenses less often because, according to "tons of external research", mental health is already bad/fragile and that using a Lens can create or enhance the dysmorphia that users are trying to avoid.[153]

101. As noted, Facebook and Instagram also provide users with a variety of tools to manipulate the photographs that they post. Meta solicited feedback regarding these features from experts, who raised concerns about their impact on the mental health of adolescents. A 2019 document prepared for Meta executives provides the following summary: "Spoke with 18 experts including psychologists, researchers, body image activists, and AR professionals. We made sure to focus our outreach on experts who could provide research insights and findings about the impact of social media and internet technologies on youth identity development, body image, including Body Dysmorphic Disorder (colloquially known as 'Snapchat dysmorphia') and mental health. A large majority, including individuals in the AR field, recommended prohibiting these filters, citing known impacts to body image and mental health of other forms of media that idealize unrealistic beauty standards."[154] It goes on to state, "These extreme beauty effects can have severe impacts on both the individuals using the effects and those viewing the image. . . . Children are particularly vulnerable, however many others are vulnerable as well: those with a history of mental health challenges, eating disorders, et cetera."[155]

102. In October of 2019, Meta temporarily banned certain types of beautification/cosmetic surgery filters while it continued to evaluate the issue in consultation with experts.[156] Margaret Gould Stewart, Meta's former VP of Product Design & Responsible Innovation, testified that the feedback continued to be negative, explaining that a "significant majority" of the outside experts Meta consulted "confirmed [Meta's] hypothesis that these had the potential to be very harmful, in particular to young people."[157] The experts informed Meta that the filters would be particularly harmful to young women, who are likely to compare their natural looks to the "augmented, manipulated, affected view" provided by the beautification

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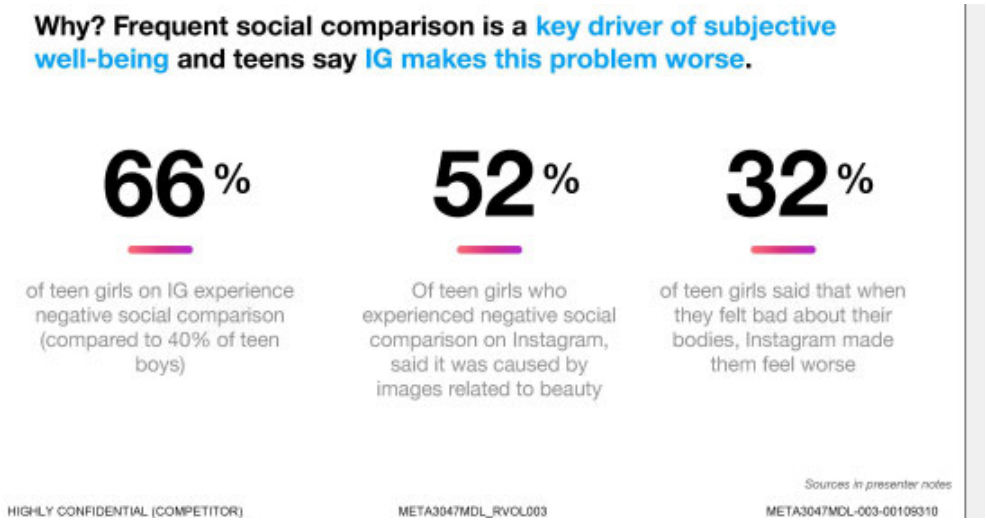
[153] *Id.*
[154] META3047MDL-040-00337135 at -136.
[155] *Id.* at -135.
[156] META3047MDL-003-00179247 at -247; META3047MDL-050-00003832 at -833; META3047MDL-003-00179481.
[157] Dep. of M. Stewart at 46:2-47:8.

filters, which "would feed into anxiety, body dysmorphia, [and] depression related to one's appearance."[158]

103. Meta's own surveys conducted around this time found that ~30% of teen girls felt Instagram made body dissatisfaction worse.[159]



META3047MDL-014-00255333 at slide 32

104. Despite these concerns, in May of 2020, Mark Zuckerberg (Meta's CEO) decided to lift the ban on beautification and cosmetic surgery effects.[160] Documents indicate that one of Meta's "Key Considerations" in making this decision was "competitiveness/growth" – specifically, a concern that a ban on such filters would have a "negative growth impact, simply because any restriction is likely to reduce engagement if people go elsewhere."[161] Ms. Stewart, Meta's former VP of Product Design & Responsible Innovation, acknowledged during her deposition that the decision "didn't prioritize or put first the well-being of teenagers and kids."[162] Vaishnavi Jayakumar, Instagram's former Head of Safety & Wellbeing, similarly acknowledged that Meta leadership did not act in accordance with the expert feedback they solicited.[163]

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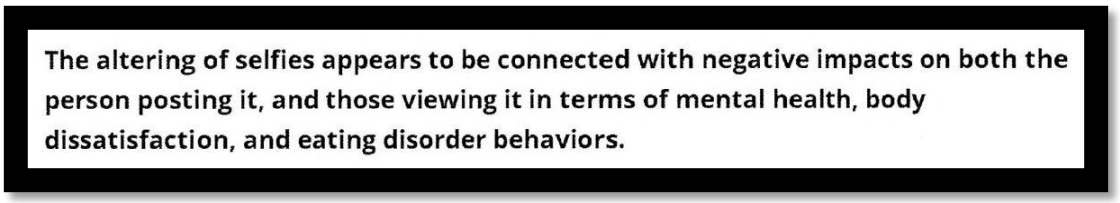
[158] *Id.*
[159] Hendrix Ex. 2 at 3; Dep. of K. Hendrix at 98:13-98:24.
[160] Dep. of M. Stewart at 107:14-107:21.
[161] META3047MDL-050-00003832 at -833.
[162] Dep. of M. Stewart at 138:10-138:24.
[163] Dep. of V. Jayakumar at 161:6-161:21.

105. Research conducted by Meta after the decision to lift the ban continued to show negative effects on adolescents. In November of 2020, for example, Meta reported, based on its own internal studies, that "[t]he altering of selfies appears to be connected with negative impacts on both the person posting it, and those viewing it in terms of mental health, body dissatisfaction, and eating disorder behaviors."[164] Meta noted that this issue was "especially sensitive for its potential impact on younger users, who are the biggest demographic using our Spark effects."[165]



META3047MDL-020-00609932 at 9941

106. Karina Newton, Instagram's former Head of Policy, similarly explained: "As you know, these Spark filters primarily live on IG right now and are overwhelmingly used by teen girls. . . . we're talking about actively encouraging young girls into body dysmorphia and enabling self-view of an idealized face (and very western definition of that face by the way) that can result in serious issues."[166]

107. Meta ultimately shut down Spark filters permanently in January of 2025.[167]

G. Ephemeral Content.

108. Certain social media platforms permit users to transmit content that disappears after a pre-set amount of time – known as "ephemeral messages" though the content may be images or videos in addition to text. Consider for instance Snapchat. At launch, Snaps and Chats were only available for 24 hours, requiring users to check their Chat feed on a daily basis so as to not miss a Snap from another user. Over time, Snap has increased the time allotted to view a

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[164] META3047MDL-020-00609932 at -941.
[165] *Id.* at -932.
[166] META3047MDL-003-00178107 – 117.
[167] A Meta Spark Update (Aug. 27, 2024), https://spark.meta.com/blog/meta-spark-announcement/ ("Following a thorough assessment, we have made the decision to shut down Meta Spark's platform of third party tools and content, effective Tuesday, January 14, 2025.").

Chat but the ephemeral nature still remains.[168] Once a Chat is viewed, the Chat disappears or vanishes from the Chat feed.[169] This vanishing aspect, as well as the frictionless nature of sharing on Snapchat, encourages real-time interaction and frequent checking of the application to avoid missing content. This creates potential risks to younger users who are developmentally susceptible (and who may not fully grasp the implications of sending personal content to unfamiliar, anonymous individuals).

109. In this way, ephemeral content can be seen as taking advantage of multiple aspects of adolescent development. First, ephemeral content takes advantage of social development. Given adolescents' need to build and maintain social connections, the risk of missing content – due to its ephemeral nature – can result in continuous use of platforms with this feature. Indeed, an adolescent may feel pressure to use these platforms excessively in an effort to ensure that they do not miss out on key information that their friends are posting. In this way, the adolescent can stay up-to-date with what is happening within their friend group. Second, ephemeral content can take advantage of adolescents' brain development, as adolescents are likely to perceive greater rewards to sending content to others, while minimizing the potential risks of sending sensitive information to others that can take screenshots in order to preserve the information. This comes in conjunction with the third area of adolescent development that ephemeral content exploits – Personal Fable ideation. Recall that adolescents experiencing this type of ideation believe that they are special, and as such, that nothing bad can happen to them. Thus, if they see a potential reward with sharing information with others (minimizing risk) and also think that nothing bad will happen to them by doing so, they may share content that is sensitive and personal in nature.

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[168] Snapchat.com, https://help.snapchat.com/hc/en-us/articles/7012334940948-When-does-Snapchat-delete-Snaps-and-Chats#:~:text=Chats%20With%20Friends%20%F0%9F%92%AC&text=Chats%20in%20Group%20Chats%20are,everyone%20has%20viewed%20the%20Chat. (last accessed April 1, 2025).
[169] Snapchat.com, https://help.snapchat.com/hc/en-us/articles/7012334940948-When-does-Snapchat-delete-Snaps-and-Chats#:~:text=Chats%20With%20Friends%20%F0%9F%92%AC&text=Chats%20in%20Group%20Chats%20are,everyone%20has%20viewed%20the%20Chat. (last accessed April 1, 2025).

H. Location Sharing.

110. In 2017, Snap launched SnapMap, a feature that allows users to share their real-time locations, view public snaps around the world and "stalk their friends".[170] Almost immediately, Snap users and the public raised concerns related to sharing locations of minors, including reports of primary school children posting public Snaps showing where they go to school.[171] Beyond safety and privacy concerns, SnapMap also encourages users to check their friends locations, which can contribute to feelings of social comparison, anxiety, and negativity.[172]

111. This design feature takes advantage of adolescents' social and identity development. First, it takes advantage of social development as it provides a geographical reminder of where one's friends and peers are in the world. This could be problematic in two ways. First, it could remind the adolescent that they are not spending time with their friends and peers, particularly if they see that their friends are spending time together without the adolescent. Second, it could remind the adolescent that they are not in the fun, exotic locations of their friends, particularly if their friends are on vacation. This is problematic from a social comparison standpoint. These aspects are also important in terms of identity development. SnapMaps can show the adolescent the places and activities that are important to their peer groups. In this way, adolescents may pay special attention to this feature, as it provides information about the places and spaces that are important to their friends and peers, all at a time when knowing this information is important for identity development.

I. Summary.

112. The figure below demonstrates how these design features each take advantage of multiple developmental susceptibilities that are unique to adolescents, making it difficult for adolescents to stop using social media.

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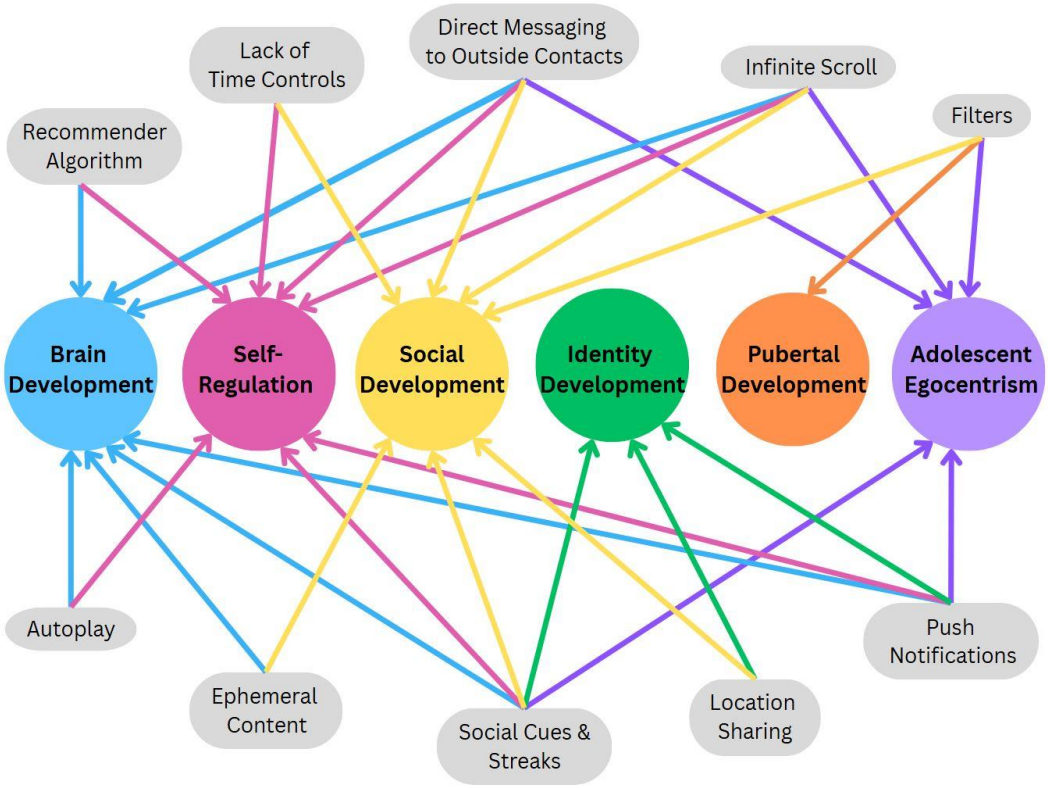
[170] SNAP5468295; SNAP0031809; SNAP4375475.
[171] SNAP0032181; SNAP3764816; SNAP2350850; SNAP3721616.
[172] SNAP1941838.



X. Studies Demonstrate the Negative Effects of Social Media on Children and Adolescents.

A. Executive Summary.

113. As evidenced above, social media design features take advantage of known developmental susceptibilities of adolescents. Below, I review and synthesize the research in the area of adolescent social media use and mental health over the past fifteen years. I show that research has moved from considering time-based measures of adolescent social media use to more nuanced considerations of the context of adolescents' use, as well as the individual differences that shape adolescents' use. It is notable that this research is consistent over time, and over different measures, contexts, and individual differences: Many adolescents are susceptible to negative mental health effects coming from social media use, indicating that social media contributes substantially to adverse adolescent mental health.

114. Research has considered the mental health correlates and effects of social media since the early 2000's, approximately 5-10 years following the advent of what came to be known as social media. Given that social media were, in those early days, described by their creators as an opportunity to connect people around the world, many early studies focused on how social media related to aspects of social connection or loneliness. For example, Ellison et al. (2007) found associations between Facebook use and social capital (or the value of one's social connections), indicating that users might feel more socially connected through using Facebook. Steinfield et al. (2008) largely replicated this initial finding in a longitudinal[173] survey study, finding that Facebook use related to increased social capital among college students, particularly for those lower in self-esteem.

115. Researchers quickly began to study the links between social media use and other aspects of mental health. This came largely due to immense growth in the amount of time spent using social media and corresponding concerns that social media may be displacing other key behaviors or developmental opportunities that contribute to child and adolescent well-being. Review articles noted that, while social media may have benefits to user social capital, it also may contribute negatively to subjective well-being through online social comparisons and envy (Verduyn et al., 2017). Indeed, use among children and adolescents had skyrocketed from 2000 to 2010. Shortly thereafter, scholarly research began to note downward trends in adolescent mental health. For example, the incidence rate of diagnosed mental/behavioral health disorders among 12-17-year-olds increased 35% from 2016 to 2023 (Sappenfield et al., 2024).

116. Many of the early studies on social media use and the mental health of young people focused on time-based measures of use, commonly asking participants to report on the amount of time they spent on social media on average per day (Ellison et al., 2007), or in the last week (Steinfield et al., 2008), or each day in the last week (Pempek et al., 2009). Many studies were cross-sectional in nature and between-subjects in design (e.g., Ellison et al., 2007; Kalpidou et al., 2011; Niera & Barber, 2014; Pempek et al., 2009). These are discussed in the next subsection.

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[173] A longitudinal study is one in which researchers take measurements of the same variables from the same participants at multiple points over the course of days, weeks, years, or even decades. In this way, longitudinal designs are relevant to causation, as they allow researchers to establish the time ordering of variables within their statistical models.

117. As research into social media grew in focus, researchers began to focus on a multitude of indicators of mental health. For example, researchers have linked adolescent social media use to physical symptoms of anxiety (Thorisdottir et al., 2020), social anxiety (Thorisdottir et al., 2020), psychological distress (Fung et al., 2021), depressive symptoms (Boers et al., 2021; Raudsepp, 2019), decreased life satisfaction (Boers et al., 2021), stress (Fung et al., 2021), lower positive affect (Neirem et al., 2020; Neirem et al., 2022.), and negative mood (Politte-Corn et al., 2024). Researchers have also linked adolescent social media use to decreased body image, including appearance comparisons (Skowronski et al., 2021), thin-ideal internalization (Skowronski et al., 2021), increased valuing of appearance (Skowronski et al., 2021), body surveillance (Skowronski et al., 2021), body dissatisfaction (Kleemans et al., 2018), muscle dissatisfaction (Yee et al., 2020), facial dissatisfaction (Yee et al., 2020), increased urge to reduce body fat (Yee et al., 2020), and a greater likelihood of meeting the criteria for one or more eating disorders (Lonergan et al., 2020). Importantly, social media does not associate with, or affect, just one aspect of mental health; it has been consistently linked to poor mental health among children and adolescents across a multitude of indicators. This is particularly noteworthy, as it is not just one aspect of adolescent mental health that is affected through the use of social media.

118. During this time, researchers increasingly became interested in determining whether social media use was harmful among younger populations. Research often does not sample wide enough age ranges to explore age effects, or if the relationship between social media use and mental health strengthens or weakens at a certain age. This is at least somewhat attributable to the difficulties in sampling child and adolescent populations. Typically, researchers will sample from a particular school or school district, thus limiting the age of participants to middle school (e.g., 12-14 years) or high school (e.g., 14-18). Further, when studying social media, researchers typically do not sample participants younger than age 13 (as this is the age at which the stated policies of most social media platforms permit an individual to create a social media profile), even though large minorities of children younger than age 13 do indeed use social media.[174]

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[174] Rideout et al., 2022 (finding that 40% of 8-12yos use social media); SNAP0227853 at -854 (“Children are using major platforms in large numbers long before they turn 13: 45 percent of

119. Social media has been more consistently linked to poor mental health outcomes among young people than any other form of media, including television and video games. This is particularly noteworthy, given that television has received more than 80 years of research attention, video games approximately forty years of research attention, and social media just twenty. Relatively few studies have linked these forms of media with mental health, much less the multitude of mental health indicators like social media.

B. Cross-Sectional Surveys Show Significant Associations of Social Media Use on Adverse Mental Health.

120. Although there are limitations to cross-sectional designs, they are still valuable, as they can speak to the consistency of findings between social media use and adverse mental health outcomes. Between-subjects designs are characterized by a comparison of the individual in the sample to the group. For example, is an above-average social media using adolescent's depression higher than a below-average social media using adolescent? However, because one is statistically comparing to a group average, individual differences and individual-level effects can become masked, thereby leading to low statistical effect sizes. Researchers have long understood that media effects of all types – not just social media effects on mental health – are variable, meaning that not all individuals are affected in the same way or through the same processes (Valkenburg & Peter, 2013). Indeed, even from the early stages of research on social media and mental health, researchers began to note that social media correlates and effects on mental health were variable, differed from individual to individual (Krasnova et al., 2015), and depended on how the individual used social media (Schivinski et al., 2020).

121. Nonetheless, researchers can still glean many insights from such studies, particularly in terms of the consistency of relationships. Much of the literature examining the relationship between social media use and mental disorders among adolescents has operationalized social media use broadly, most commonly as a measure of overall frequency of use (Schønning et al., 2020), with the majority of research suggesting a relationship between social media use and increased mental disorder symptomatology (e.g., Keles et al., 2020; Vidal et al., 2020).

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children ages 9-12 say they use Facebook daily; 40 percent use Instagram; 40 percent use Snapchat; 41 percent use TikTok; and 79 percent use YouTube").

i. Depression.

122. Depression is the most studied mental disorder in relation to social media use (Schønning et al., 2020). Increases in depression diagnoses and suicide rates among adolescent populations are often attributed to increasing rates of social media use (Twenge, 2019; Vidal et al., 2020). Depression is commonly studied in conjunction with anxiety, as the two disorders are comorbid and the most prevalent disorders in adolescents (Keles et al., 2020).

123. For example, among a sample of British 14-year-olds (N = 10,904), the number of hours spent using social media daily was related to higher depressive symptoms (Kelly et al., 2018). Frequency of social media use and increases in both depression and anxiety have been demonstrated in a sample of adolescents from six diverse European countries (Spain, the Netherlands, Poland, Iceland, Romania, and Greece; Tsitsika et al., 2014); as well as in a sample of 467 Scottish adolescents aged 11–17 (Woods & Scott, 2016). Additionally, the number of social media accounts (i.e., Facebook, Twitter, and Instagram) was linked to increased anxiety, depression, and other externalizing problems (i.e., ADHD and Conduct Disorder) among a sample of US adolescents (Barry et al., 2017). Thus, when measured at an aggregate level, several studies have linked social media use to increases in depression among adolescents around the world, including a diverse set of both high- and low-income countries.

124. The number of studies showing similar associations between social media use and adverse mental health among adolescent populations around the world speaks to the consistency of these relationships among between-subjects designs. Indeed, multiple meta-analyses conclude that there is a significant meta-analytic association between adolescent social media use and depression (Fassi et al., 2024; Ivie et al., 2020; McCrae et al., 2017). For example, Liu et al. (2022) found a significant meta-analytic effect of time spent on social media and adolescent depression, with the effect being stronger among adolescent females. Overall, the authors concluded that each additional hour spent on social media by an adolescent increased risk of depression by 13%. This is a similar finding to that of Boers et al. (2021) in a longitudinal, within-person analysis, described below. Other meta-analytic reviews show that, while time on social media is weakly related to depression, other indicators of social media use are more strongly associated. Indeed, Cunningham et al. (2021) found that problematic social media use was more strongly related to user depression, compared to both intensity of social media use and

time spent using social media. This indicates that a specific context of social media use may make users more at risk for increased depression.

125. Further, multiple systematic reviews of the literature conclude that the majority of studies included in the sample find a positive association between at least one aspect of social media use and adolescent depression (Keles et al., 2020). It is important to note, too, that some studies show small and/or null effects (Kreski et al., 2021; Ivie et al., 2020; McCrae et al., 2017). Taken together, many of these studies note relatively high heterogeneity across studies, meaning that comparing across studies, some show relatively strong statistical effects of social media on depression, others moderate, and others small. Most studies conclude that this is due to individual differences and susceptibility factors, differences in the use of social media, and/or differences in the affordances and features provided by different social media platforms. I describe these differences in detail below. Very few studies suggest that social media is associated with better mental health among adolescent users.

126. **Summary.** Many studies of adolescent social media use and depression show significant between-subjects relationships. This is underscored by meta-analytic findings and findings from systematic reviews of the literature. Some studies find that, while time spent on social media is associated with increased depressive symptoms among adolescent populations, problematic social media use is more strongly related. Other studies suggest that there is heterogeneity in these effects. Together, these results are consistent; there is generally a between-subjects effect of social media use on adolescent depression, but there are individual differences and use patterns that serve to strengthen or weaken this overall effect. Thus, it is likely that some adolescents, based on their unique differences and use patterns of social media, are more and less susceptible to social media effects on depression. Once again, it is noteworthy that very few studies show that social media use contributes to less depression or depressive symptoms among individuals.

ii. Suicide and Suicidal Ideation.

127. Reviews demonstrate small but positive associations between specific social media use forms and self-injury, particularly among adolescents. Scherr (2022) concludes that studies that measure intensive, addictive, or problematic social media use generally find small to moderate statistical effects with self-injurious thoughts and behaviors among users. Other

reviews conclude that there are "clear associations" between some types of social media use and suicide risk (Jaycox et al., 2024). Another review of 46 studies, including those featuring adolescents and also young adults, found that the frequency of social media use generally was associated with suicidal thoughts and behaviors (Macrynicola et al., 2021). Yet another review of 61 studies found a moderate effect size between each of the following variables and self-injurious thoughts and behaviors: cybervictimization, suicide content related social media use, and problematic social media use (Nesi et al., 2021). In other words, cybervictimization, suicide content related social media use, and problematic social media use were each independently related to self-injurious thoughts and behaviors.

128. Other studies note the potential for suicidal contagion, as exposure to suicide-related social media is related to both self-injury and suicide attempts (Swedo et al., 2021), and other studies show that adolescents do share suicidal content on social media (Pourmand et al., 2019). Hashtags (as a design feature of social media platforms) can be explicit (e.g., #suicide), implicit (e.g., #sad), or seemingly ambivalent (e.g., #cat),[175] but all can be used to search and interconnect between suicidal or suicide-related posts.

129. **Summary:** There are relatively consistent links between social media use and adolescent suicidal ideation. Problematic social media use is more consistently linked to self-injurious thoughts and behaviors among users, compared to more global measures of screen time. Studies do not show that social media use is associated with reduced suicidal ideation among users.

iii. Anxiety.

130. Similar to other indicators of mental health, systematic reviews show consistent associations between social media use and adolescent anxiety. For example, Kerr et al. (2025) systematically reviewed 32 studies on adolescent social media and anxiety, showing that over half of the studies found a positive association between social media use and anxiety, and three quarters reported positive associations between problematic social media use and anxiety. In another review of the literature involving 27 studies, Saleem et al. (2024) concluded that

[175] As Moreno et al. (2016) and Arendt et al. (2019) note, #cat could overlap with #cutting to show the same type of suicide-related content to users both searching for such content, but also users searching for images of cats on social media platforms.

problematic social media use was consistently related with anxiety symptoms, and that the relationship between duration of social media use and anxiety was more consistent among girls compared to boys. Similarly, a study among Chinese adolescents ($N = 2,625$) found that the number of hours spent on social media was associated with increased anxiety (Yan et al., 2017).

131. **Summary.** As with depression (another internalizing symptom), anxiety is consistently linked with adolescent social media use, and once more, problematic social media use tends to show stronger associations with anxiety, suggesting that a particular context of social media use may be more deleterious to adolescent well-being. In addition, there is some evidence that adolescent females are more at risk for anxiety stemming from their social media use relative to adolescent males. Studies do not show that social media is associated with reduced anxiety among users.

iv. Self-esteem.

132. In terms of self-esteem, cross-sectional studies have long shown associations between measures of social media use and self-esteem, a conclusion supported by a recent meta-analysis (Saiphoo et al., 2020). For example, general social media use is associated with lower self-esteem among young adults (Tibber et al., 2020). Research with specific measures of social media use have yielded similar results, with multiple studies finding a negative association between addictive social media use and self-esteem among large samples of adolescents, young adults, and older adults (Ahmed et al., 2019; Andreassen et al., 2017; Kircaburun et al., 2019)

133. Other research has considered specific platforms. For example, addictive Facebook use (Blachnio et al., 2016) and both general Facebook and Twitter use associate with lower self-esteem among college students (Errasti et al., 2017). A systematic review concluded that the majority of existing studies found a negative link between Instagram use and self-esteem (Faelens et al., 2021), with other work suggesting this link may be stronger among women (Barthorpe et al., 2020). Further, self-esteem was significantly lower among YouTube, VSCO, and WhatsApp users compared to non-users (Chen et al., 2019). There are exceptions, however, with some researchers finding no experimental effect of exposure to Instagram images on self-esteem (Sherlock & Wagstaff, 2019). Given these sometimes-contrasting results, researchers have considered other types of cross-sectional relationships between social media and self-esteem. For example, (Cingel & Olsen, 2018) found a negative, linear relationship between

Facebook use and adolescent self-esteem, but also evidence of an inverted-U curvilinear relationship, which was dependent on how adolescents reported using Facebook.

134. Consistent with other between-subjects findings, these are generally small in nature, a conclusion supported by recent meta-analytic work. For example, across 84 studies and over 90,000 participants, the relationship between social media use and self-esteem was r = -.079 (Saiphoo et al., 2020). This analysis indicated a stronger negative relationship between problematic (often measured as excessive or addictive) use and self-esteem (Saiphoo et al., 2020), suggesting that it is a certain type of use that is linked to self-esteem disturbance. This underscores, however, that it is a specific type of social media use, but still social media use, that is linked to adverse mental health.

135. **Summary.** Studies, including reviews and meta-analyses, tend to show consistent links between adolescent social media use and decreased self-esteem. Once again, problematic social media use is implicated more in the association with decreased self-esteem, and studies generally do not show that social media use contributes to increased self-esteem.

v. Body Image.

136. Beyond depression and self-esteem, researchers have also considered relationships between social media use and aspects related to users' body image, or the thoughts and feelings one has about their body. Similar to depression and self-esteem, findings are fairly consistent among children, adolescents, and young adults around the world. For example, Rousseau (2021) found that appearance-related social media use was related to increased selfie-taking and posting via increases in internalization of the thin-ideal and social media self-comparison. This is an important finding, as other studies have shown that exposure to others' manipulated images is associated with a variety of eating disorders among Australian adolescents (Lonergan et al., 2020). Further, among Australian adolescents and young adults, manipulating one's own images on social media was related to more positive attitudes toward cosmetic procedures and intentions to have a cosmetic procedure (Beos et al., 2021). While not directly related with participants' facial distraction, the authors did find that manipulating one's images was associated with lower facial dissatisfaction among those whose sense of their actual body differed greatly from their perceived ideal body. Kleemans et al. (2020) also found, in an experimental design among Dutch adolescent females, that exposure to manipulated Instagram

images (i.e., images that were filtered and/or changed to emphasize thinness) caused lower body image, and this was particularly the case for adolescents higher in trait-like social comparison. In addition, participants rated manipulated images more positively (compared to non-manipulated images), and found manipulated images to be realistic.

137. Taken together, these findings suggest reciprocal relationships, where the ability to manipulate one's photos (which is clearly prompted when using Instagram and Snapchap, for example) leads to increased taking and posting of appearance-related content (Rousseau, 2021). Manipulating one's own images relates to poorer body image among some adolescents and young adults (Beos et al., 2021), and viewing others' manipulated images causes poorer body image immediately following exposure (Kleemans et al., 2020), and is also related to some eating disorders (Lonergan et al., 2020). As noted, the defendants' platforms lack any design feature that would identify which images are altered. This has resulted in billions of manipulated images without any indication that they have been altered or manipulated, with resultant effects on body image.[176]

138. A recent review article of 58 studies draws similar conclusions (Vandenbosch et al., 2022). The authors conclude that visual platforms (e.g., Instagram) are more conducive to poor body image among users (including children, adolescents, and adults) compared to more textual platforms (e.g., Facebook). Instagram and Snapchat relate more consistently, and negatively, to body image, compared to Facebook and Twitter. Taking and editing (but not posting) selfies results in negative effects on body image (platform design features), and receiving positive comments on this posted content exacerbates these negative effects (another design feature). These features increase the opportunities for upward social comparisons (where the user compares themselves to another person they consider to be better, with negative implications for body image). Indeed, Choukas-Bradley et al. (2022) conclude that features of social media use, including social feedback and image-editing, coupled with adolescent development and socialization processes, create a "perfect storm" for decreasing body image and

[176] Research released by Instagram indicates that posting and editing images is a very popular activity: as of 2017, 34.7 billion images have been posted, with 52 million added each day. Further, a majority of posted images (64%) are edited, using a number of different types of photograph filters (Statistic Brain Research Institute, 2017). Statistic Brain Research Institute, *Instagram company statistics* (2017), https://www.statisticbrain.com/instagram-company-statistics/.

body satisfaction among adolescent females. Many studies also note that filtering and other image augmentation contribute to the positivity bias of social media, a well-known phenomenon where the people and lives as shown portray more positivity than in real life (Schreurs & Vandenbosch, 2021).

139. In the area of social media and body image, this review by Vandenbosch et al. (2022) concludes a link between social media use and negative body image (in line with multiple previous review articles). The authors argue that it is the taking and editing of images that causes negative body image, and this is exacerbated by positive comments received on these edited images. I note that all of these are design features of social media unique from content.

140. **Summary.** As with depression, suicidal ideation, anxiety, and self-esteem, there are consistent links between social media use and poor body image, again with young females showing stronger effects. Many of the negative outcomes associated with social media use and poor body image are attributable to specific, social media design features, including filters, other forms of image perfection and manipulation, and comments. I once again note that few studies show that social media is associated with positive body image among adolescent samples.

vi. General Mental Health.

141. Although many studies focus on a specific indicator of adolescent mental health, others measure multiple indicators at once, thereby demonstrating how adolescent social media use might relate to multiple aspects of an individual's mental health. As an example of this, Barry et al. (2017) found that the number of adolescent social media accounts was related to parent reports of adolescent inattention, hyperactivity, impulsivity, Oppositional Defiant Disorder, anxiety, and depression, and was additionally related to adolescent reports of Fear of Missing Out (FoMo) and loneliness. A large-scale survey of British adolescents shows similar findings; social media use was related to online harassment, poor sleep, lower self-esteem and lower body image, and these negative relations were stronger among adolescent females (Kelly et al., 2018). Yet other studies have shown particularly adverse outcomes for adolescent females, with Barthorpe et al. (2020) finding positive relationships between social media use, self-harm behaviors, and depression, and a negative relationship with self-esteem among females only. It is worth noting that some studies suggest that it is certain types of social media use, rather than just time spent on the platform, that correspond with adverse mental health.

142. Qualitative data suggests complementary findings (O'Reilly et al., 2018a). Indeed, focus group data collected from British adolescents showed themes of perceptions that social media was a threat to mental health. The authors described three key themes: (1) adolescents perceived that social media use could contribute to anxiety and depression symptoms among at least some adolescents; (2) that it can serve as a platform for cyberbullying; and (3) social media could be seen as addicting. Other qualitative results show that adolescents do also see potential positives of social media use, including that it can be used to seek information about aspects related to mental health. However, these authors also note multiple risks associated with social media use and adolescent mental health (O'Reilly et al., 2018b).

143. Systematic reviews further back up these findings. For example, Blanchard et al. (2023) reviewed 21 studies published on social media and adolescent mental health between 2019 and 2023. Together, the findings suggest positive relationships between adolescent social media use, depressive symptoms, eating disorder symptoms, body dissatisfaction, and anxiety. Other reviews do recommend that studies include more positive mental health outcome variables (Schonning et al., 2020). However, it is important to note that, while negative outcomes are indeed considered more in the literature, when findings are significant, very few find that social media is contributing to *better* mental health among adolescent users, as I note throughout this section of my report. Finally, Keles et al. (2020) conducted a review of 13 studies, breaking apart social media use in terms of time, types of activities, investment in social media use, and addiction. They found that each of the four types of measurement were correlated with adolescent depression, anxiety, and psychological distress.

144. **Summary.** Once again, this speaks to the consistency of findings – across the world, in diverse countries with diverse populations and diverse cultures, a multitude of studies on adolescents have showed similar patterns of relationships between social media use and psychological disorders, including depression and anxiety. While the majority of research finds a positive relationship between frequency of social media use and mental disorders, it is important to note that some studies have found no relationship with depression (Blomfeld Neira & Barber, 2014 in Australia; Kreski et al., 2021 in the United States; Puentes & Parra, 2014 in Colombia) or even opposite relationships suggesting that social media use in some cases may improve mental disorder symptomatology through mediators such as increased social support and connectedness (Erfani & Abedin, 2018; Keles et al., 2020). Once again, though, the bulk of the

research in this area, particularly cross-sectional studies with between-subjects analysis, demonstrates support for a relation between social media use and adverse mental health among children and adolescents. In totality, more studies show a negative association between adolescent social media use and adverse mental health than a positive, or even a null, association.

145. The number of mental health outcomes, and the relative consistency of relationships between social media use and adolescent mental health is noteworthy. Additionally noteworthy is that adolescents themselves, when asked, cite social media as a negative contributor to their mental health – even when also noting the potential benefits. [177] Clearly, a consistent set of studies demonstrated a link between social media use and poor mental health in young people, and these studies began to appear from the advent and rapid adoption of social media among children and adolescents.

146. A large-scale review article of meta-analyses and other reviews in this area has concluded that most studies examining adolescent social media use and mental health are cross-sectional in nature, between-subjects, and do not assess different indicators of social media use (beyond time spent on platforms; Orben, 2020). This article concludes that the overall association is small.

147. Importantly, however, between-subjects designs can mask larger effects among individuals within the sample – in other words, sizable numbers of adolescents included in these samples can be negatively affected by social media use in terms of their mental health, but their effects are masked by comparing them to the average participants, who may be less affected. It is remarkable, then, that this research shows such a relatively consistent pattern of negative associations with multiple aspects of adolescents' mental health. Lower quality research is marked by 'noise' – this noise (that may come from poor measures, poor designs, poor samples) interferes with the ability for researchers to detect signals in the collected data. Yet, the relative consistency with which studies around the world linked social media use to adverse adolescent mental health, particularly from the relative early days of social media through today, at the same time internal documents from social media companies were showing the exact same thing, is rather noteworthy. Indeed, if there was no link between social media use and adolescent mental

[177] META3047MDL-003-00091414 at -420 ("Teens talk of Instagram in terms of an 'addicts narrative' spending too much time indulging in a compulsive behavior that they know is negative but feel powerless to resist.").

health, one might expect far more inconsistent findings – a relatively equal mixture of findings where social media relates positively, negatively, and null, to adolescent mental health. That is not the case. Across many indicators of mental health, including depression, suicidal ideation, anxiety, self-esteem, and body image, a multitude of between-subjects, cross-sectional studies find that social media consistently relates to worse mental health among adolescent users, and once more, this is further consistent with what social media companies were finding in their own internal studies and analyses, which, I note, were not communicated to the public.[178]

148. Further, it is not just between-subjects, cross-sectional designs that find relations with adverse mental health among adolescent social media users.

C. Longitudinal, Within-Subjects Designs Begin to Show Effects of Social Media on Mental Health for Some Users as Well.

149. Beyond cross-sectional, between-subjects designs, researchers began to consider within-subjects, longitudinal designs, which can speak to both causal effects and compare the individual to themselves. For example, does an individual's mental health drop when they use social media above their own average? Additionally, does an adolescent's mental health at time 1 relate to social media use at time 2, or vice versa – or both, suggesting reciprocal effects?

i. Depression and Anxiety.

150. Although fewer in number, longer-term longitudinal designs (often with a lag in data collection points over one year) increasingly have found negative associations between social media use and adolescent mental health, similar to between-subjects designs. For example, Thorisdottir et al. (2020) found that Icelandic adolescents who overused multiple social media platforms (which may be brought about by social media design, as I have described) were more likely to experience depressive symptoms and panic disorder over the course of the following two years. General physical anxiety symptoms worsened over the time period with excess use of social media as well. Similarly, Boers et al. (2021) found that as social media use issues

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[178] *E.g.*, META3047MDL-044-00171345 (2017 Time and Control Survey); META3047MDL-039-00000058 (2018 Problematic Use Survey); META3047MDL-143-00000002 (2018 Suicide and Self Injury Survey); META3047MDL-047-00058006 (2019 Facebook Deprivation Study); META3047MDL-003-00144417 (2019 Well-Being Research 10,000 Foot View); META3047MDL-059-00000216 (2019 NETS Survey); META304/7MDL-003-00109173 (2020 Teen Mental Health Deep Dive); META3047MDL-004-00015029 (2021 BEEF Survey);

increased, so did depressive symptoms as well as life satisfaction decreases over the course of a year among Dutch adolescents. Some studies also show reciprocal relationships between adolescent social media use and depression over time. For example, Nesi et al. (2022) found that initial levels of depression were associated with negative emotional outcomes of social media use, but also, that initial positive emotional outcomes of social media use were related with depression one year later. Yet other studies find that a high level of social media use during adolescence was predictive of suicidal risk among young adults (Coyne et al., 2021). Once again, it is important to note that not all studies find a consistent longitudinal association, including the work of Kurten et al. (2025).

151. Other longitudinal studies have found some support for a direct association between the frequency of social media use and depression, although the effect is at times inconsistent (Coyne et al., 2018; Hefer et al., 2019; Houghton et al., 2018). However, these studies did find an effect for certain groups of individuals. Among a sample of 457 US adolescents, increasing hours spent on social media across time points predicted greater depression at the final data collection point (six years later; Coyne et al., 2018). Additionally, adolescents who reported increases in daily use of social media that peaked and then declined until final data collection also showed greater depression, whereas adolescents who reported consistent moderate use (30–60 minutes per day) had significantly lower depression. Similarly, Houghton and colleagues (2018) found no association between daily hours spent on social media and depression in a sample of Australian adolescents (N = 1,749, 10–15 years old at Time 1); however, when grouping the sample by gender, they found small, positive effects on depression among males at subsequent time points. Additionally, Raudsepp and Kais (2019) found longitudinal associations between problematic social media use and adolescent female depression.

ii. Body Image.

152. Finally, longitudinal studies have also found significant relations between social media use and body image. For example, exposure to sexualized images on Instagram predicted body surveillance in a sample of German adolescents (Skowronski et al., 2020). Other longitudinal studies, however, do not show this link and conclude that effects of social media use on body image may be indirect (Ferguson et al., 2014).

153. **Summary.** In summary, many longitudinal studies, following individual adolescents over time, also find relations with adverse mental health among youth. Some studies do not find a direct effect; yet, when considering certain moderators such as gender, however, even those studies that do not find a direct effect of social media use on mental disorders do find an effect among certain individuals within the sample, suggesting that the relationship between social media use and mental disorders is complex and nuanced. As such, researchers have increasingly moved toward understanding the context of an individual's social media use, rather than simply (or only) measuring time spent using social media. I demonstrate this in the sections following meta-analytic research.

D. Meta-Analyses Show Significant Pooled Effects of Social Media Use on Adverse Mental Health while Researchers Move Toward Considering Different Contexts of Social Media Use.

154. As noted, although certainly not every study shows a link between social media use and adverse mental health, a majority in multiple different areas do, suggesting a consistency across studies and across indicators of mental health. As such, multiple meta-analyses and reviews have shown a significant meta-analytical effect of social media use on aspects related to mental health.

155. Together, these studies indicate that it is a context of social media use characterized by a difficulty stopping use, using before bedtime, and/or using to the point when such social media use is causing conflict with parents and/or friends, and generally diminishing day-to-day functioning that is more strongly related to adverse mental health outcomes; yet, it is important to note that time on social media has been consistently linked with adverse mental health outcomes as well (Cunningham et al., 2021; Yoon et al., 2018).

156. Indeed, in a review of the literature, Keles et al. (2020) also showed that time spent on social media, investment in social media, and addiction to social media (an indicator some researchers use in place of problematic social media use) were each consistently correlated with depression, anxiety, and psychological distress among samples of adolescents. Another systematic review found that, of nine included studies, seven showed associations between heavy social media use and suicide attempts among children and adolescents (Sedgwick et al., 2019). In yet another meta-analysis, Fassi et al. (2024) found, among 143 studies with over 1 million adolescents, a positive association between time spent on social media, as well as engagement on

social media, on internalizing symptoms (depression and anxiety), including both clinical and community-based samples. Other meta-analyses, including those covering fewer studies and participants, do find null effects (Ferguson et al., 2025). What this points to, however, is that social media use is diverse, as are adolescents. Some researchers have begun to argue for more nuanced considerations of social media use and adolescents, arguing that it might be certain adolescents, using certain features and functions of social media, that are most at risk for harm (Maheux et al., 2024). I will review this more recent research in the section below.

i. Depression.

157. There are multiple meta-analyses on the relationship between social media use and depression symptoms, although not all focus on adolescent samples.

158. Cunningham et al. (2021), in a study involving 62 studies and more than 450,000 participants found a meta-analytic relationship between social media time and depression, social media intensity of use and depression, and problematic social media use and depression. All associations were significant; however, the statistical effect was significantly stronger for problematic social media use and depression, suggesting that one's context with social media (e.g., does the individual have a problematic relationship with social media) may be more strongly related than time measures. This is consistent with Boers et al. 2021, a longitudinal study showing that problematic social media associates with poor mental health one year later.

159. Yoon et al. (2018), in another meta-analytic review of social media use and depression featuring 33 studies and a total sample of more than 15,000 individuals, found that both time on social media and social comparisons on social media were significantly related to increased depression, and the relationship was stronger for social media social comparison.

160. Yoon et al. (2019) also found a small link between Facebook use and depression, although the effect was stronger when measuring social comparisons rather than time use.

161. Yin et al. (2019) found that social media use was correlated with both positive (life satisfaction, well-being, self-esteem, and positive affect) and negative indicators (depression, loneliness, anxiety, envy, and negative affect) of mental health; again, age did not moderate these associations (although it was slightly larger among adolescents compared to adults for negative associations with mental health).

162. Vahedi and Zannella (2019) found a small to moderate effect of social media use on depression. Similar to Cunningham et al. (2021) there was a stronger effect for problematic social media use on depression compared to general time use measures of social media. There was no effect of age.

163. Ghai et al. (2023) found a significant meta-analytic association between social media use and depression, but only among adolescents in the Global North; however, their conclusion was that more studies are needed in the Global South to determine this effect.

ii. Self-esteem.

164. Interestingly, one longitudinal study using a cross-lag model (model considers both directions of relationships over time) implicated that certain types of social media use may differentially effect appearance self-esteem (a more specific form of self-esteem characterized by feelings of self-worth that are contingent on one's perceptions of their physical appearance) between late childhood and early adolescence (Steinbekk et a., 2021). Other-oriented (rather than self-oriented) social media use at age 10 negatively associated with appearance self-esteem at age 12, with the strength of this effect increasing from age 12 to age 14. Further, the rate of other-oriented social media use appeared to compound over time (Steinbekk et al., 2021), suggesting that engagement in particular types of social media use at younger ages may have a greater overall impact on the trajectory of youths' self-esteem development through their intensification over time. I note, however, that multiple studies do not show an effect of age on these relations (Schmuck et al., 2019; Triệu et al., 2021) and age showed no significant effect in metanalytic work (Saiphoo et al., 2020). This could suggest that age may impact specific types of self-esteem, such as appearance self-esteem during adolescence (Steinbekk et al., 2021) rather than global self-esteem (Saiphoo et al., 2020).

iii. Body Image.

165. A recent meta-analysis on social media use and body image found that age was a significant moderator, such that the relationship weakened as the mean ages of the included samples increased (Saiphoo & Vahedi, 2019). However, it is important to note that samples of adolescents, young adults, and older adults were included in the meta-analysis; thus, these results could simply suggest that adolescents are more susceptible to these effects than younger and

older adults, and not that younger adolescents are more susceptible relative to older adolescents. However, the key point is that social media was negatively related to body image, particularly among adolescents.

iv. General Mental Health.

166. Keles et al. (2020), in a systematic review, reported that time spent on social media, specific activities on social media, investment in social media, and social media addiction were all related to depression, anxiety, and psychological distress among adolescents. Of the studies included in the sample, one suggested that effects were stronger among younger adolescents, while the other found no age effects. In a study of adolescent life satisfaction, Orben et al. (2022) found different developmental windows for susceptibility to longitudinal negative effects of social media use. Although slightly different for adolescent men and women, the analysis did show, generally, that younger adolescents were more at risk for negative life satisfaction outcomes relative to older adolescents and young adults.

167. **Summary.** Over the past decade, meta-analyses and systematic reviews have consistently demonstrated significant statistical effects of social media on multiple aspects of adolescents' mental health, and systematic reviews generally show that a majority of included studies find similar patterns of relationships, where social media use is linked to poor adolescent mental health. Most individual studies do not consider age effects, due to relatively small age ranges. This likely comes for practical reasons; when recruiting participants, it is easier for researchers to select participating high schools (yielding participants generally between the ages of 12-18) or to sample from college-aged students (yielding participants generally between the ages of 18-25). Further, those who study children and adolescents as a population tend to use a developmental perspective, as I have in this document, thus necessitating a smaller age range in order to home in on those aspects of adolescent development. Researchers who study younger or older adults tend not to use a developmental perspective, allowing these researchers to sample from wider age ranges. Some meta-analyses do explore age effects at the aggregate level, but in general, while they conclude there are effects of social media use on body image, self-esteem, depression, anxiety, and psychological distress, age plays a minimal role. However, it is important to note that when studies do find age effects, younger adolescents do seem to be more strongly and negatively affected, consistent with their heightened developmental susceptibilities.

I also note that multiple meta-analyses do show stronger effects when considering problematic social media use, relative to other measures of use like general time.

E. Objective Social Media Use Data.

168. The majority of research studies cited above use self-reported data for both social media use and mental health. This could lead to questioning about why the wealth of back-end user data has generally not been used in this field. The general answer to this question is that it has been historically difficult to obtain back-end user data from the defendant social media companies (and others).

169. It is important to note, however, that individual users can request their own back-end data, and then share this data with researchers (this began due to regulations in Europe in 2018). There are benefits and drawbacks to this, explained below, which limits this as a methodological option in the study of adolescent social media use and mental health (see van Driel et al., 2022; Zhao et al., 2023).

170. These authors note that having participants donate data is a better approach than passive-tracking apps on smartphones, given that these only track time on social media on smartphones and do not provide nuanced data of what adolescents are doing while they are using social media apps on their phones. These apps also work better on Android phones, although the vast majority of adolescents use iPhones.

171. However, there are concerns with these donations.

172. First, both studies struggled to get participants to donate their data (van Driel et al. = 102/388 [26.28%] participants donated; Zhao et al. = 192/436 [44.03%]). There are significant privacy concerns for users sharing the entirety of everything they have done on a particular social media platform with scientists, limiting participation. This also calls into question whether the relationships between social media and mental health would differ between participants comfortable sharing their data with those who are not.

173. Second, obtaining these data requires a series of steps (and time) which must be followed correctly. Therefore, this encourages drop out, as individuals learn that this is more difficult and time intensive than simply taking a survey, for example.

174. Third, the structure of the data differs markedly across time (depending on when users opened their accounts), as new data and folders are added when new features are added to

the platform. This makes processing the data and readying it for analysis challenging and time intensive.

175. Fourth, given the sheer amount of data, it becomes very difficult to determine (a) which data from the donation to use, (b) how to assign frequencies to that data (e.g., stories might have different timestamps, even though they are one story), (c) and what the data actually mean (e.g., there is so much data in the file that is vaguely labelled, calling into question what it actually is).

176. Together, these challenges can help to explain why researchers have been slow to take advantage of participant data donations. While they provide more objective data, they are associated with increased participant attrition, and require far more time to clean and make sense of the data than subjective social media measures.

177. **Summary.** There are a number of studies that employ objective measures of adolescent smartphone and/or social media use. However, as noted by van Driel et al. (2022), these are limited because they focus solely on time spent on social media, while many of the reviews described above as well as my own analysis note that it is generally specific types of use, including pathological use, stemming from specific design choices made by social media companies, that are most consistently linked to adverse mental health in child and adolescent samples.

F. Ecological Momentary Assessment Studies on the Relationships between Adolescent Social Media Use and Mental Health.

178. As noted, longitudinal (generally over the course of years) and short-term longitudinal designs (generally over the course of weeks) can also make causal claims (Parry et al., 2022). Short-term longitudinal designs typically make use of Ecological Momentary Assessment (EMA) designs, wherein researchers send short surveys (approximately 1-5 minutes each) multiple times a day over the course of a few weeks. While relatively short in total time, this intensive form of data collection allows for unique statistical analyses (e.g., Dynamic Structural Equation Modeling; DSEM) that can provide additional nuance into the relationship between adolescent social media use and mental health. DSEM allows researchers to untangle the heterogeneity that exists in social media effects on mental health across participants, heterogeneity that has been documented in meta-analyses (e.g., Schnauber-Stockmann et al., 2024). Overall, DSEM allows researchers to calculate effects sizes for each person in the sample,

thereby showing which individuals are susceptible to positive and negative effects, and which are not affected at all. It does so by merging multiple level analyses and structural equation modeling, which can compute time-lagged, longitudinal analyses for each participant in the sample. In other words, the analysis allows researchers to determine if social media use in the last hour (for example) relates to mental health, while controlling for the previous level of mental health. In this way, the analysis can determine whether mental health changes as a function of social media use, as it controls for where the adolescents' mental health was in the previous measurement moment.

179. A recent meta-analysis (Schnauber-Stockmann et al., 2024) compared between-person and within-person designs in social media use. Between-person designs compare person-specific variation (e.g., one participant to another participant) whereas within-person designs compare participants to themselves (e.g., one participant at one moment in time to the same individual at a different moment in time). EMA designs allow for both types of analysis. This meta-analysis (Schnauber-Stockmann et al., 2024) found that approximately two-thirds of the variance in media use is situation-specific, indicating that within-subjects analyses are more beneficial in this domain. They conclude by calling for repeatedly measuring (social) media use across time, as Parry et al. (2022) also notes.

180. Beyens et al. (2020) served as one of the first studies in the area of adolescent social media use and mental health to use EMA and adopt a person-specific ($N = 1$) analysis, using a sample of 63 adolescents (ages 14-15). There was significant heterogeneity in the models, indicating that findings differed markedly from adolescent to adolescent. This high level of heterogeneity is consistent with research on adolescent smartphone use and well-being (Marciano et al., 2022). They found that a sizable group of adolescents (~10%) reported feeling worse after using social media (Beyens et al., 2020).

181. Valkenburg and colleagues (2021) ran a similar study with a larger sample of nearly 400 Dutch adolescents (ages 13-15), examining short-term longitudinal effects of social media use on adolescent self-esteem. Once again, there was substantial heterogeneity in the model, with most individuals showing no effects on self-esteem but ~8% showing negative effects. This is an example of differential susceptibility – only certain individuals are susceptible to media effects, not the entire population or audience. These findings were similar across adolescents' use of WhatsApp, Snapchat, and Instagram.

182. A subsequent analysis of the same dataset examined differences in types of social media use (active public, passive public, passive private) on affective well-being (Beyens et al., 2023). They found that many adolescents in the sample experienced no statistical effect of social media on their affective well-being; however, 28% experienced a decline in affective well-being as a function of their social media use. They concluded that, overall, there were few changes in adolescent well-being as a function of different types of use. Rather, those who were susceptible were susceptible regardless of how they used the platform. Once again, it is important to note that *average* within-person effects showed very small relations with affective well-being; it was only the $N = 1$ analyses that showed a significant number of adolescents experiencing negative effects of social media use on affective well-being regardless of how they used social media.

183. Even more recent research has examined $N = 1$ effects in the context of body image. Van Alfen et al. (2024) used data collected from 183 American adolescents between the ages of 12 and 17. Similar to above, they found that ~10% experienced a negative effect on weight satisfaction, while most were unaffected. Coyne et al. (2025), using the same sample as van Alfen et al. (2024) found that 36% of the sample was susceptible to poorer body esteem after being on social media, and 32% were susceptible to negative effects on body positivity. To my knowledge, this is one of the first studies to also predict group membership (i.e., which types of adolescents are more likely to be in the negative susceptible group, for example). Compared to the other two groups (null and positive susceptible), adolescent females, those higher in perfectionism, and those with problematic social media use were more likely to be susceptible to negative effects on body esteem. For body positivity, females were more likely to be represented in the negatively susceptible group. The findings pertaining to the negative effects, primarily for females and those with problematic social media use, are consistent with a multitude of evidence suggesting that females (Choukas-Bradley et al., 2022) and those experiencing problematic social media use (Cunningham et al., 2021) are more at risk of negative outcomes on mental health stemming from their social media use.

184. Although not directly related to adolescent mental health, Siebers et al. (2022) found weak between- and within-subjects effects for the relationship between social media use and distraction. At the individual level, however, nearly 83% of adolescents experienced increased distraction.

185. Finally, as noted above, some have argued that social media may serve as a place for adolescents to grow their mental health, while others suggest that adolescents struggling with their mental health may be uniquely drawn to using social media. Findings from a recent study seem to refute these arguments. For example, Janssen et al. (2025) used data collected from a sample of clinically depressed and non-clinically depressed adolescents. Participants completed daily diary measures for 100 days. Interestingly, there were few differences in terms of how depressed and non-depressed adolescents used social media. Yet, depressed adolescents reported feeling twice as insecure, nearly twice as rejected by their peers, and significantly more preoccupied by peer feedback, relative to their non-clinically depressed peers. This finding would indicate that social media does not serve as a safe space for depressed adolescents, that they do not use social media differently from their non-depressed peers, yet when they use social media in a similar way, they are even more at risk for negative outcomes.

186. A question from these findings is whether the *same* adolescent is susceptible to multiple different mental health outcomes (i.e., one adolescent is susceptible to negative effects of social media use on depression and anxiety, for example, while a different adolescent is not susceptible to a negative effect for either of these variables), or different adolescents are susceptible to different mental health outcomes (i.e., one adolescent is susceptible to negative effects of social media use on depression, but not anxiety, while a different adolescent is not susceptible to negative effects on depression, but rather, to anxiety). If the former is the case, a summary of the cited studies in this section would suggest that 8-35% of adolescents are uniquely susceptible to negative social media effects on mental health. If the latter is the case, then this percentage could be far higher for social media negatively affecting at least one mental health outcome variable.

187. There is currently one known study that can address this latter idea. Van der Wal et al. (2025) conducted a daily diary study among a sample of nearly 500 Dutch adolescents, measuring social media use, well-being, self-esteem, and closeness with friends. Overall, they found significant, within-person effects, meaning that on days when adolescents spent more time on social media than normal, they reported lower well-being, self-esteem, and connection with friends. Similar to the person-specific findings presented above, they found large groups of adolescents that experienced negative effects on well-being (64.3% of sample), self-esteem (71.8%), and friendship closeness (58.0%). Notably, however, this study examined whether

adolescents experienced negative, null, or positive effects *across* the three variables of well-being measured. They found that 60% of the sample only experienced negative effects of social media use on these three outcomes; only 5% experienced positive effects across the three variables, and just under 14% experienced a mixture of both positive and negative effects. Overall, 72.2% of the sample experienced only negative effects of social media use on at least one of the three measured variables, while only 10.6% of the sample experienced only positive effects on at least one of the three variables. In addition, they found that negative effects stemmed largely from adolescents' use of TikTok, Instagram, and YouTube.

188. Although one study, this does suggest that the $N = 1$ findings presented in this section (i.e., Beyens et al., 2020; Beyens et al., 2023; Coyne et al., 2025; Siebers et al., 2022; van Alfen et al., 2024; Valkenburg et al., 2021) may be even more concerning than meets the eye. Indeed, as noted, between 8-35% of adolescents in those studies, coming from two countries and three unique samples of adolescents, are susceptible to negative effects of social media use on at least one variable related to mental health and/or well-being. The results of van der Wal et al. (2025), however, suggest this negatively susceptible group may be far higher when multiple well-being and mental health variables are considered. For example, one adolescent may be susceptible to negative effects on depression, while their friend is susceptible to negative effects on anxiety, and their other friend is susceptible to negative effects on body image. It is also worth noting that, of the papers I reference in this section, six out of seven find that that the group of adolescents susceptible to negative mental health effects (examining just one variable of mental health) stemming from their social media use is larger than the group susceptible to positive effects on their mental health.

189. If this is indeed the case, then a vast majority of adolescents, nearly three-quarters as suggested by the findings of van der Wal et al. (2025) are susceptible to at least one negative effect of social media on their mental health. Given that there are 43 million adolescents in the United States between the ages of 10-19, and 1.3 billion adolescents in the world (the largest cohort of adolescents in history), these numbers indicate a clear and present crisis, particularly given that best estimates suggest that up to 95% of adolescents use at least one social media platform daily, and more than a third reporting that they use social media constantly (Vogels et

al., 2022).[179] Even if just 8% of adolescents are susceptible to negative effects of social media on self-esteem (as evidenced by Valkenburg et al., 2021), this would indicate that nearly 4 million adolescents are at risk for negative mental health effects by their social media use in the United States (assuming 90% of American adolescents use social media, as evidenced by Rideout et al., 2022), and this number would increase to nearly 28 million adolescents at risk of at least one negative mental health outcome, using the numbers of van der Wal et al. (2025).

190. **Summary:** Seven studies, from two countries, using three different adolescent samples, and exploring relations on six different variables, find remarkably similar findings: Adolescents in significant numbers are susceptible to negative effects of social media use on self-esteem, affect, distraction, weight satisfaction, muscularity importance, body esteem, and/or body positivity. Statistically, if the data from these adolescents is included in between-subjects designs, such as those typically done on cross-sectional data, the negative effect on this group of adolescents will be suppressed, resulting in small and possibly inconsistent effects. However, other findings suggest the concerns may even be larger, with nearly three-quarters of the adolescent sample susceptible to at least one negative mental health and/or well-being outcome. Given the number of adolescents in the United States and around the world, this suggests the potential for a major mental health concern from adolescent social media use.

191. In my expert opinion, research using general measures of time spent on social media show a relatively consistent link to adverse mental health, and yet, more nuanced measures of a type of social media use, problematic use, shows a stronger link with poor mental health – and social media is designed to promote this type of use. Additionally, when considered with more nuanced analysis, a sizable group of adolescents are susceptible to negative effects – and this group increases when we consider multiple outcomes of mental health – and increases further when we consider that different adolescents might be susceptible to different negative effects on mental health.

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[179] Vogels, E., Gelles-Watnick, R. & Massarat, N. (2022). Teens, Social Media and Technology 2022. Pew Research Center: Internet, Science & Tech. United States of America. Retrieved from https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/.

G. Problematic Social Media Use Linked to Adverse Mental Health Among Adolescents.

192. As noted throughout, time spent on social media is rather consistently linked with multiple different aspects of adolescents' mental health. This evidence comes from many cross-sectional, longitudinal, and short-term longitudinal designs featuring ecological momentary assessment. This evidence comes from researchers around the world, using samples from multiple countries and further replicated in yet other countries. Further, this evidence is supported by multiple meta-analyses, systemic reviews, and narrative reviews.

193. One other consistent finding is that problematic social media use is linked to adverse mental health among adolescent samples. Often, the effect size is stronger than that of general social media use (Cingel et al., 2024; Scherr, 2022), although both are significantly related (Cingel et al., 2024; Cunningham et al., 2021; Saiphoo et al., 2020). Problematic social media use refers to a context of social media use, one characterized by a relationship with social media that involves displaced sleep due to use, a feeling of inability to cease social media use, impaired relationships with parents and/or peers due to over-use, among others (Banyai et al., 2017).

194. As such, it is important to explicitly review the research on problematic social media use as it relates to adolescent mental health. As above, these studies feature cross-sectional, longitudinal, and meta-analytic designs. In terms of longitudinal designs, Boers et al. (2021) found that Dutch adolescent problematic social media use was longitudinally associated with increased depression and decreased life satisfaction one year later. Raudsepp (2019) reported similar findings among Estonian adolescents; when problematic social media use was high or increasing, this was associated with increased depressive symptoms. This was replicated by Raudsepp and Kais (2019), who found that changes in problematic social media use related to positive changes in depression among Estonian adolescent females. Fung et al. (2021) also found, longitudinally, that problematic social media use was associated with depression, anxiety, and stress among Chinese adolescents. Thorisdottir et al. (2020), among Icelandic adolescents, found longitudinal associations between overuse of social media platforms and depressive symptoms. With regard to adolescent developmental susceptibility, Boers et al. (2022) found that adolescent problematic social media use was longitudinally related to lower subjective well-

being, and those adolescents with high social media use were low in terms of their self-control (an aspect of development linked to self-regulation).

195. Cross-sectionally, Boers et al. (2020), in a study featuring more than 150,000 adolescents in 29 countries, found that problematic social media use was associated with lower life satisfaction, psychological complaints, lower school satisfaction, lower family support, and lower levels of friend support. Shawcroft et al. (2024) found that problematic social media use was associated with decreased life satisfaction among nearly 231,000 adolescents from 39 countries, and the association was stronger among female adolescents in 37 of those countries. Among a nationally-representative sample of adolescents from Hungary, Banyai et al. (2017) found that individuals with problematic social media use reported lower self-esteem, higher levels of depression, and greater social media use in terms of time than those in the non-at-risk group. This is a similar finding to that of Paakkari et al. (2021), who found that moderate and high problematic social media users reported significantly worse mental health, using nationally-representative data from Finnish adolescents. Finally, Kircaburun et al. (2018) also found cross-sectional associations between problematic social media use and depression in two adolescent and young adult samples from Turkey.

196. In terms of meta-analyses and reviews, Shannon et al. (2022) found that, across 18 studies and over 9,000 adolescent and young adult participants, problematic social media use was moderately related with depression, anxiety, and stress, with few differences as a function of participant age or gender.

197. **Summary.** While research on time spent on social media is a relatively consistent predictor of adverse adolescent mental health, studies on problematic social media use in particular show a stronger and even more consistent association with poor mental health among young people.

XI. Defendants' Acknowledgement of Negative Mental Health Effects and Subsequent Response.

198. In their internal documents, defendants acknowledge adolescent developmental susceptibilities and the risk of problematic use on their platforms. Based on the evidence that I reviewed, my expert opinion is that the defendant companies designed their products to take advantage of multiple aspects of adolescent development, to keep them engaged (at the expense of other activities) in the platform. These design features each take advantage of multiple

susceptibilities of adolescent development. When employees of the defendants noted concerns with the platforms' designs and their effects on user mental health (adolescent mental health in particular), the defendants consistently made choices that promoted increased engagement and time spent on the platform (with implications for company revenue) rather than adolescent mental health. The defendants' own studies and analyses of the harms of their products to adolescent mental health are consistent with the literature that I have reviewed above and provide further support for my opinions.

199. Additionally, defendants' responses to these harms on adolescents were delayed, inefficient, flawed, and/or otherwise lacking. Based on the evidence I have reviewed, it is my expert opinion that the focus by the defendant companies on increasing user engagement, while ignoring growing concerns of negative effects on mental health, created a context where adolescent users may develop a problematic relationship with social media, which is itself associated with poor mental health. Internal documents show an emphasis on increasing user engagement, although overuse of social media is consistently cited by adolescent users as a problem.[180] Once again, as described in detail below, internal documents also showed a growing concern within the companies regarding adolescent problematic social media use. Beyond designing based on adolescent development and susceptibility, documents also note that proposed fixes were ignored or manipulated in order to maintain and grow social media companies' user bases.

A. Meta.

200. In 2017, Jennifer Guadagno, Meta's former Director of UX Research, Social Impact, explained the issue of problematic use: "People are using FB [Facebook] more than th[ey] ideally want to and can't easily stop[.] It's become an ingrained habit[.] People are aware they want to stop but don't have the self-control to help themselves do that[.] FB [Facebook] features enable mindless usage/ignite urge for people to come back (endless scrolling, push

[180] META3047MDL-003-00091414 at -420 ("Teens talk of Instagram in terms of an 'addicts narrative' spending too much time indulging in a compulsive behavior that they know is negative but feel powerless to resist.").

notifications, likes)[.]"[181] Meta engineers refer to this inability to stop scrolling through the platforms' feed, despite its negative effects, as "doom scrolling."[182]

201. Meta's internal studies concluded that these effects are strongest among adolescents. A 2018 study, for example, notes that "Teenagers experience higher rates of problematic use than any other age group."[183] In 2020, Shayli Jimenez, a Senior UX Researcher at Meta, explained in an internal company presentation titled "What Makes Teens Tick"[184]:

> **Teen brains are much more sensitive to dopamine**, one of the reasons that the risk of drug addiction is higher for adolescents and it's the same thing that keeps them scrolling and scrolling. Due to the immature brain, **they have a much harder time stopping** even though they want to -- our own product foundation research has shown teens are unhappy with the amount of time they spend on our app.

202. A 2019 survey by Meta of teens in the U.S. and United Kingdom similarly found that teens know they are "spending too much time indulging in a compulsive behavior that they know is negative but feel powerless to resist."[185]

203. Rather than discuss how to ensure adolescents do not overuse Meta products due to their less-developed self-regulation and brain development, these same documents propose ways that Meta can take advantage of adolescents' susceptibilities. For example, Meta proposes, as a solution to waning teen engagement, increasing novel content to increase adolescent brain stimulation – a proposal that would likely exacerbate problematic use.[186] And while Meta acknowledges that adolescents are at risk from social media use due to brain development

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[181] Dep of J. Guadagno at 188:23-192:7, META3047MDL-020-00251106 at -106.
[182] Dep. of S. Bhutada at 165:18-166:12.
[183] META3047MDL-039-00000058 at -061. As I explain later in this report, self-regulation is a key developmental factor in adolescence that makes individuals uniquely susceptible to social media overuse and excessive use, contributing to negative mental health outcomes. As this quote indicates, social media are explicitly designed to take advantage of adolescents' less developed self-regulatory capacities, ensuring that they spend more time using the product at the expense of other activities that could positively contribute to mental health.
[184] META3047MDL-003-00191207 at -215.
[185] META3047MDL-003-00091414 at -420, -428; Dep. of W. Gross at 76:13-81:25. As I show later in this report, this finding is consistent with other scholarly independent research – adolescents often comment that they wish they could use social media less than they do.
[186] *Id.* at -210.

(particularly due to risk/reward decisions), the majority of the document is about ensuring that adolescents feel rewards.[187]

204. In another document titled "Teen Fundamentals," Meta discusses proposals to address the loss of their user base to competitors (in this case, Snapchat).[188] Meta acknowledges that "teens are unhappy with the amount of time they spent on IG [Instagram]" (slide 45), and that, due to aspects of brain development, teens may be susceptible to both overuse of the product and risky behaviors on the product, including 'engaging with predators, consuming dark content, sharing nude photos, or copycat self-harm' (slide 46). Despite these noted concerns, the document mainly focuses on ways to promote engagement (slide 50) and drive ***more*** time spent on the platform (slide 78). [189] Significantly, as demonstrated above, time spent on social media platforms is a common measure that has been consistently associated with poor adolescent mental health in the academic literature.

205. Similarly, in the "What Makes Teens Tick" document referenced above, Meta discusses in detail the ways in which teens are susceptible to negative effects of social media; yet, the main message of the document is how to take advantage of adolescents' brain development and less developed self-regulation to get adolescent users to spend more time on the platform.[190]

206. In yet another document, Meta acknowledges that "No one wakes up thinking that 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."[191] Other documents indicate that anytime Meta employees considered strategies to improve well-being, those strategies had to be evaluated to determine their "Impact on IG Critical Ecosystem Metrics."[192] As discussed above, this type of analysis led Meta to abandon plans to hide like counts, despite potential benefits to adolescent user well-

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[187] *See generally id.*
[188] META3047MDL-003-00011737; Dep. of D. Kilstein at 265:6-265:13.
[189] *See also* META3047MDL-014-00359270; META3047MDL-074-00027496 (acknowledging that many aspects of Facebook use can cause poor psychological functioning among users and may make self-regulation difficult).
[190] META3047MDL-003-00191207.
[191] META3047MDL-003-00161686.
[192] META3047MDL-035-00001018 at slide 12.

being.[193] Similar considerations led Meta to lift the ban on beautification and cosmetic surgery effects in 2020.[194]

207. Meta's internal research found the impacts of its product features on adolescents to be significant. As one Meta presentation on "youth" effects explains, "Product features that are designed to exploit insecurity, or provide a dopamine rush (likes, notifications, the pull-down-to-see, the infinite scroll, etc), to increase time spent, are inherently at odds with well-being and take away from people's ability to consciously focus on activities that add value to their lives."[195] Meta's internal documents identify numerous negative effects to teens, including the following:

208. ***Addiction***. Adolescents are far more likely than adults to engage in extreme levels of use. A survey that Meta conducted in 2020 found that more than 400,000 teens in the U.S. use Instagram 28 or more hours a week (i.e., more than 4 hours a day); with an additional 400,000+ teens using Instagram 21 to 28 hours in a week (*i.e.*, more than 3 hours a day).[196] The survey concluded that "Teens make up 15% of DAP [daily active people] in the US, but they make up 63% of people who spend more than 28 hours a week on IG [Instagram]."[197] Teens themselves attribute this to the platforms' addictive nature.[198] A former senior Meta executive has explained that this was intentional, and that Meta understood it was exploiting human psychology by giving users "a little dopamine hit every once in a while" to keep them engaged as long as possible.[199]

209. ***Sleep Disruption.*** Adolescents likewise have high rates of use late at night, during hours when they should be sleeping. A 2022 "Mental Well-being Team" presentation on "Late Night Use" states that 43.3% of teen weekly active users have at least one session per week during late night hours (between midnight and 4 a.m.), and 4.6% of teen weekly active users

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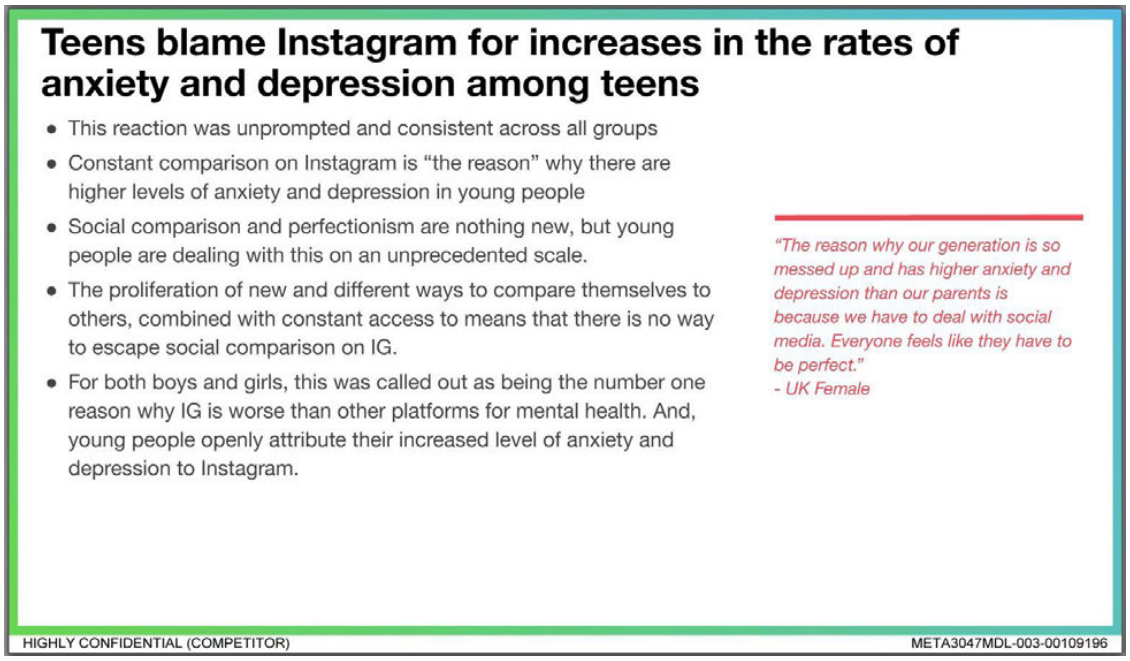
[193] *Id.* at slide 13.
[194] META3047MDL-050-00003832 at -833 (citing as a concern that a ban on such filters would have a "negative growth impact, simply because any restriction is likely to reduce engagement if people go elsewhere").
[195] META3047MDL-044-00026826.
[196] Kilstein Ex. 43 - META3047MDL-003-00011737; Kilstein Dep. at 260-265.
[197] META3047MDL-020-00342286 at -290.
[198] META3047MDL-003-00091414 at -420 ("Teens talk of Instagram in terms of an 'addicts narrative' spending too much time indulging in a compulsive behavior that they know is negative but feel powerless to resist.").
[199] Dep. of M. Zuckerberg at 53-54, 78-79; *see also* Exs. 2 and 4 to Dep. of M. Zuckerberg.

have one or more late-night session per day.[200] As Meta acknowledges internally, this late-night use, which its platforms encourage, is harmful to adolescents' mental health: "**The bad:** Nighttime social media use is associated with poorer mental health in teens due to displacing sleep []; this is the most direct relationship between social media use and teen well-being."[201] Other Meta documents explain: "Sleep is essential to well being, and late night use is a huge issue among teens (in fact, sleep experts would say not to do any screentime before bed, not just late night use). Sleep is tied to so many aspects of health, even heart functioning."[202] Notably, published research has found that smartphone use during the day was not associated with the quality of adolescents' sleep; however, social media use before bedtime was negatively associated with adolescents' sleep quality (Valkenburg et al., 2024).

210. ***Anxiety and Depression.*** In 2019, Meta conducted a "Teen Mental Health Deep Dive," which combined results of Teen Mental Health qualitative research of teen Instagram users. The surveyed teens consistently "blame[d] Instagram" for the increase in anxiety and depression among them and their peers: [203]



[200] Dep. of G. Volichenko at 127:5-127:14, Ex. 6 of Dep. of G. Volichenko at 10.
[201] META3047MDL-003-00089142 (emphasis in original).
[202] META3047MDL-020-00651532.
[203] META3047MDL-003-00109173 at -196, -197.

META3047MDL-003-00109173 at -196

211. The survey further found that "Teens who struggle with mental health sa[id] Instagram makes it worse."[204] Approximately "one in five teens sa[id] that Instagram makes them feel worse about themselves."[205] "Instagram was ranked [by teens] as the worst social media app for mental health and well being, particularly for its impacts on anxiety and depression."[206]

212. An experimental study conducted by Meta in 2019 on Facebook users further found that study participants who stopped using Facebook for a week reported lower feelings of depression, anxiety and social comparison.[207]

213. ***Self-Harm.*** For some teen users, the impacts reported from Instagram use were extreme: "9% of teens who said that they felt that they wanted to hurt themselves said that it started on Instagram," while "6% of teens who said that they felt that they wanted to kill themselves said that that feeling started on Instagram."[208] Other documents describe how "social media 'addiction'" can lead to "suicide and self-harm," by causing sleep deprivation and lack of in-person time, which can lead to loneliness and depression.[209] In 2019, Adam Mosseri, the head of Instagram, acknowledged that Instagram is "not where we need to be on the issues of self-harm and suicide."[210]

214. These harms were brought into stark relief in a 2021 survey conducted by Meta on approximately 230,000 Instagram users. A resulting report, titled "Bad Experiences and Encounters Framework" or "BEEF,"[211] noted that approximately 10% of Instagram users ages 13-15 had observed someone harm themselves (or threaten to harm themselves) on the platform in the last 7 days.[212] Approximately 20% of 13-15 year old users had seen unwanted nudity or sexual images on the platform in the last 7 days.[213] Approximately 13 percent of Instagram users

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[204] META3047MDL-003-00109173 at 196-197.
[205] META304/7MDL-003-00109193.
[206] META3047MDL-003-00089823.
[207] META3047MDL-047-00058006 at pp. 2, 5, 8, 16.
[208] Dep. of W. Gross at 108:15-109:2; *see also* META3047MDL-003-00109173 at -187.
[209] META3047MDL-037-00068917 at slide 30.
[210] Ex. 21 to Dep. of Jayakumar.
[211] META3047MDL-004-00015029 at -035.
[212] *Id.*
[213] *Id* at -033, -048.

ages 13-15 had an unwanted sexual advance on Instagram in the last 7 days.[214] The vast majority of these bad experiences involved interactions with strangers.[215] Meta initially collected data on the emotions reported by teens who experienced these harms, but Meta's legal and policy team instructed researchers to delete the data.[216] Meta did not disclose these results publicly.[217] These results track a similar study of Instagram users from 2019 known as the "NETS" survey, which likewise found that children had negative experiences on Instagram more than adults, including observing nudity and sexual content, violence, eating disorders and self-injury. [218]

215. ***Eating Disorders/Body Image.*** Meta's internal studies conclude that "there is substantial evidence to suggest that Instagram and Facebook use can increase body dissatisfaction."[219] Meta presentations note that "Users experience of downward spiral is exacerbated by our platform"; that different "[a]spects of IG exacerbate each other to create the perfect storm"; and that this spiral can lead to eating disorders, body dysmorphia, body dissatisfaction, depression, and loneliness.[220] Meta surveys found that "33% of Instagram users and 11% of Facebook users think the platform makes their own body image issues worse."[221] Meta also concluded that "Appearance-based comparison is worse for teens, women of all ages, and people in globally western countries."[222] As noted above, Meta personnel specifically highlight the harms of Spark filters. For example, Karina Newton, Instagram's former Head of Policy, explained: "As you know, these Spark filters primarily live on IG right now and are overwhelmingly used by teen girls. . . . we're talking about actively encouraging young girls into body dysmorphia and enabling self-view of an idealized face (and very western definition of that face by the way) that can result in serious issues."[223] It is noteworthy that, when an image is posted to Instagram, the user is directed to filters and other image manipulations, and have a variety of options from which they can choose. This can increase the likelihood of filtering

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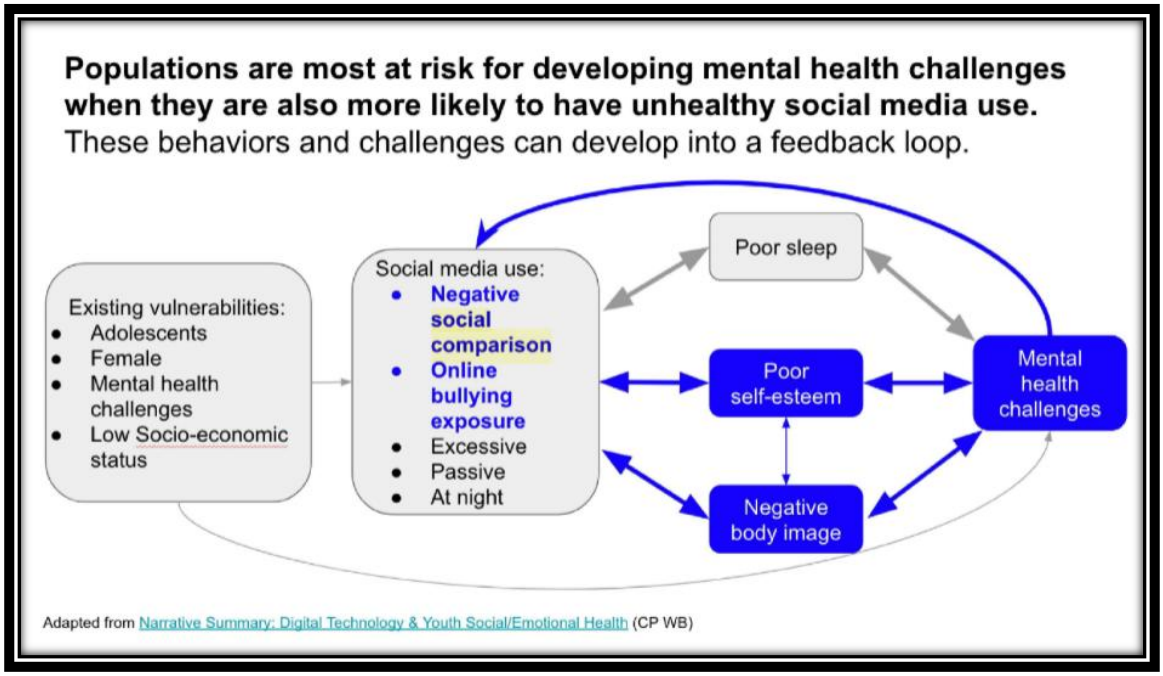
[214] *Id.*
[215] *Id* at -041.
[216] META3047MDL-034-00504889.
[217] Dep. of A. Bejar at 329:24-330:4.
[218] META3047MDL-059-00000216 at -217, -222.
[219] META3047MDL-037-00007066.
[220] META3047MDL-003-00001846 at -876, -878, -879.
[221] META3047MDL-037-00007064.
[222] META3047MDL-037-00068752.
[223] META3047MDL-003-00178107 at -117.

images, but also, of seeing filtered and otherwise manipulated images on the platform. Filtered images are 21% more likely to be viewed by users and 45% more likely to receive comments.[224]

216. Meta concludes that many of these harms are interrelated and can develop into a harmful negative feedback loop, particularly for adolescents[225]:



META3047MDL-003-00121726

B. TikTok.

217. TikTok is designed to maximize the amount of time users spend on the app and their level of engagement.[226] TikTok tracks how long its users spend on the app and the number of sessions they have, in addition to tracking engagement metrics such as "likes."[227] TikTok also utilizes hashtag challenges to maintain and increase engagement.[228]

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[224] Bakhshi et al., *Why We Filter Our Photos and How It Impacts Engagement*, Proceedings of the International AAAI Conference on Web and Social Media (2021), https://ojs.aaai.org/index.php/ICWSM/article/view/14622/14471.
[225] META3047MDL-003-00121726.
[226] TIKTOK3047MDL-002-00119724 at -725.
[227] TIKTOK3047MDL-004-00139811.
[228] TIKTOK3047MDL-080-LARK-02714281 at -288.

218. TikTok has acknowledged both the problem of addiction to its platform and the role that its practices, such as optimizing for engagement, play in fostering addiction. In its "TikTok for Good 2021 Business Plan & Vision" document, for example, TikTok states: "Addiction to technology is a ubiquitous problem that TikTok and most other platforms deal with today. Addiction takes many forms such as overall time spent on an app, de-prioritizing other important areas of life, and generating self-worth based on number of likes, all of which and countless others have made us realize the consequences of optimizing for engagement and retention metrics".[229] Other documents acknowledge that compulsive use can contribute to negative mental health effects, including anxiety, and can interfere with day-to-day functioning, such as sleep, and school/work responsibilities (which are contributing factors to poor mental health).[230] In a problem statement, the company noted that "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".[231] Again, a lack of sleep is a contributing factor to poor mental health.[232]

219. Research conducted by outside researchers on behalf of TikTok, which was reported back to TikTok, showed that adolescents struggled to manage their time on TikTok due to continuous scroll and a lack of breaks between content (two design aspects of the platform).[233] In another document, the company admitted that overuse was 'rampant'.[234]

220. A 2022 TikTok research project called "Project Who" found that users were concerned about the platform's addictive nature and said they spent more time on the platform than they wanted to.[235] Notably, TikTok's Trust & Safety personnel acknowledged that "minors do not have [the] executive function to control their screen time," making them particularly susceptible to TikTok's optimization strategies.[236]

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[229] TIKTOK3047MDL-005-00325851 at -862.
[230] TIKTOK3047MDL-024-LARK-00043038.
[231] TIKTOK3047MDL-010-00329290 at -294.
[232] Palmer, 2020; Uccella et al., 2023.
[233] TIKTOK3047MDL-002-00101574; TIKTOK3047MDL-001-00060515.
[234] TIKTOK3047MDL-002-00091634 at -636.
[235] TIKTOK3047MDL-153-LARK-07337692 at -696.
[236] TIKTOK3047MDL-039-LARK-00213033 at -036.

221. The company also acknowledged that beauty filters could contribute to negative mental health of users by perpetuating a certain way of looking.[237] This was described as a 'user problem', noting that 'filters and effects also have the potential to negatively impact the wellbeing of our community'.[238] Despite all of this information, TikTok continued to make design choices that promoted continued engagement on the platform at the expense of adolescent mental health.

222. TikTok's "Digital Wellbeing – Data Analysis" revealed that users whose predicted age was under 15 were using the platform an average of 1.74 hours daily.[239] This usage was more than 40% more than that of users whose predicted age group was 18-24 (1.24 hours daily).[240] Additionally, internal TikTok documents showed that 10 million users were participating in "Objective harmful usage (6 hours+/day=99th percentile)."[241]

223. Rather than address these issues with design changes, documents indicate that TikTok planned to change users' perceptions of addiction (so they did not perceive that they were addicted).[242] Multiple other documents show a clear interest in maintaining users' time on the platform,[243] and an unwillingness to sacrifice time on the platform at the expense of retention.[244]

224. Although TikTok implemented tools ostensibly designed to curb excessive use, its Senior Product Manager, Matthew Tannenbaum acknowledged that TikTok internally required that such tools have no "significant negative impact to guardrail metrics" related to platform utilization.[245] TikTok's internal data shows that only thirty-seven percent (37%) of its users even know that the screen time management tools exist and less than one percent (1%) of users

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[237] TIKTOK3047MDL-117-04509578 at -060.
[238] TIKTOK3047MDL-006-00326005.
[239] It is important to note that adolescents are recommended to sleep approximately 8 hours per day. Thus, daily TikTok use accounts for nearly 13% of an adolescents' waking hours. This also does not account for time in school, other activities, or time spent on other social media. It is likely that, given these time constraints, this time on social media cuts into adolescents' sleep or other activities, with negative implications for their mental and physical health.
[240] TIKTOK3047MDL-001-00060515 at 0518.
[241] TIKTOK3047MDL-002-00091798 at 1800.
[242] TIKTOK3047MDL-002-00102517 at -533; TIKTOK3047MDL-099-LARK-04519067 at -083.
[243] TIKTOK3047MDL-047-LARK-00510814; TIKTOK3047MDL-004-00144763.
[244] TIKTOK3047MDL-078-LARK-01711316 at -322.
[245] Matthew Tannenbaum Dep. 1/28/2025 at 184:11-186:13.

actually use them.[246] This is likely because these tools are not the default, and require users to, first, simply be aware that these generally un-advertised options exist, and second, take the time to go into settings, find the relevant tools, and activate them. TikTok also has a "take a break" feature but it is also easily circumvented. The "take a break" videos appear in a user's feed after the user has been on the app for either sixty (60) or eighty (80) consecutive minutes, depending on whether that usage time occurred during the day or at night. TikTok documents in 2024 revealed that take a break only had an approximately 4% penetration rate with users. Data in 2021 indicated that "91% of users watch less than five seconds on the TAB videos, so most people are not actually taking a break . . . ."[247]

225. Notably, internal TikTok documents show differences in design safety in China compared to the United States, noting much stronger safety measures for under 14-year-old users on Douyin[248], and stating "**We give spinach to kids in China and opium to kids in America**"[249] . This implies that designing for safety was possible, and indeed occurred for young users of the Chinese version of TikTok. However, these design elements were not included in the United States version of the app for young users. I have seen no evidence indicating that TikTok warned any of its users or the public that its product could be (and was designed to be) addictive to young people.

226. Additionally, TikTok made it difficult for users to delete their accounts, requiring that a lengthy multi-step process be completed before an account would be deleted.[250] Still other documents note that TikTok uses "many coercive design tactics that detract from user agency" including notifications, infinite scroll, and the slot machine effect.[251]

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[246] TIKTOK3047MDL-002-00098058 at 8060.
[247] TIKTOK307MDL-002-00091546 at 1549; TIKTOK3047MDL-006-00325873.
[248] TIKTOK3047MDL-023-00658004.
[249] TIKTOK3047MDL-004-00151118 (emphasis added).
[250] *See, e.g.*, How to Permanently Delete Your TikTok Account 2025 (Full Guide) (Jan. 18, 2025), **https://www.youtube.com/watch?v=Frz1AbNG8eo** (last visited Apr. 17, 2025).
[251] TIKTOK3047MDL-002-00101525 at -538.

C. Snap.

227. Internal documents indicate that driving usage of school-aged children is central to Snap's business.[252] Back to school is especially important for Snapchat, as it is when user engagement typically peaks.[253] It is also consistent with adolescents' social developmental susceptibility. With students making new friends at school, Snapchat aims to capitalize on this growth in social circles by encouraging users to connect on the app in addition to their real-world interactions. Snapchat achieves this through advertiser campaigns, back-to-school stories, increased school-related Spotlight content, and limited-time Lenses and geofilters.[254] In January 2020, Snap designed a program to create high school evangelists for Snapchat by putting on workshops to speak with students, walk students through the application to demonstrate adding friends via Snapcodes, how to discover new Lenses, and drive cultural relevance in schools.[255]

228. Snapchat was aware of both the problem of compulsive use on its platform and the role it plays in fostering that use.[256] In 2023, Snap's Head of Product was focused on "maintaining deep penetration of younger demo[graphic]s" and touted to investors that "this generation can't live without our app[lication]."[257]

229. Snapchat acknowledges the importance of educating users and parents about the safety risks the Snapchat platform presents.[258] However, Family Center, Snap's first parent education tool, was not available until late 2022, approximately eleven years after Snapchat was created in 2011. At that time, Snap was one of the last major platforms lacking any parental controls,[259] which demonstrates of Snap's delayed response in implementing features aimed at providing parents with any oversight over their children's usage.[260] Prior to 2023, Snap only

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[252] Dep. of K. Zicafoose at 145:14-15; SNAP5445426; SNAP4911893 at -908, 924 (discussing plan for "High School Communities" feature); Ex. 10 to Dep. of K. Zicafoose ("How to Market to Gen Z").
[253] SNAP2430328 ("Back to School on Snapchat" presentation).
[254] Dep. of K. Zicafoose at 131:9-131:16; Ex. 13 of Dep. of K. Zicafoose ("School Vibes Lens"); Ex. 14 of Dep. of K. Zicafoose ("School Style Lens"); SNAP2076002; SNAP5182516; SNAP3126961; SNAP4354975.
[255] SNAP2119514 at -525 (May 2020).
[256] SNAP0404286; SNAP0755817; SNAP5553072; SNAP0896563; SNAP1117208.
[257] SNAP2926182.
[258] Dep. of N. Yadegar at 134:17-135:6.
[259] *Id.* at 409:23-410:6
[260] Dep. of N. Yadegar at 409:23-410:6.

allowed parents to see who their child was talking to by display name. It was not until 2023 that Snap offered any parental content controls.[261]

230. Snap also acknowledges the negative impact its Lenses have on teenage girls, especially the propensity for beautification Lenses to impact user mental health and cause users to develop "Snapchat dysmorphia."[262] Snap nonetheless relies on Lenses to increase engagement,[263] particularly among adolescent females.[264]

D. YouTube.

231. The YouTube Kids platform serves as a feeder to YouTube Main, a fact that YouTube representatives have acknowledged. According to James Beser, Senior Director for Product Management: "is there strategic value to having kids product at yt[?]" answer: "yes…they grow up[.]"[265] As with YouTube Main, the YouTube Kids platform includes many of the same features that promote habitual, problematic or addictive use, including autoplay that is turned on by default and the ability to engage in endless scrolling.[266]

232. Its "2019 Project Strider: A Vision for Young Creators on YouTube" reflects the company's plans to grow engagement from young content creators. YouTube proposed incentives including, among other things, prompts for creator challenges, comments, creator badges, and algorithmically recommended videos to prompt young users to create content and incentivize them to continue creating new content. YouTube also proposed implementing tiered rewards that these youth creators would be given access to when they created an increased number of

[261] Dep. of A. Tran at 381:5-13; 407:13-20.
[262] Dep. of J. Brody at 187:7-188:6, 194:3-195:16, 219:21-220:5); SNAP0078233; SNAP0525938; SNAP0933724; SNAP0525939.
[263] Ex. 13 to Dep. of J. Brody.
[264] SNAP6340758; SNAP3105001.
[265] GOOG-3047MDL-01741439 at 442 and -443 ("we have yt kids for them to shed as their 'fisher price' moment").
[266] YouTube Kids does not, however, permit "likes," comments, or uploading content. Dep. of R. Iyengar at 137:1-137:18.

videos.[267] Further, YouTube encourages teen content by boosting comments from other teen users.[268]

233. In connection with targeting young users, YouTube's documents reflect its awareness of the vulnerability of this population. In its 2020 Roomba Policy Review for the Young Teen Policy (Formerly PG Content Rating), YouTube noted the following:

- "Changes in brain development predisposes young teens to act more impulsively, show a greater tendency towards risk taking, and lead to an increased interest in riskier content";
- "Executive Functions aren't fully developed at this age (e.g., self-regulation and decision-making capabilities)".[269]

234. A YouTube strategy document from 2019 describes the issues teens face on YouTube.[270] This YouTube Digital Well-Being note indicates the following problematic use behaviors:

- "Habitual heavy use: ~10% (32MM) of 13-24 year olds on YouTube habitually watch > 2 hours / day (excluding music). 8 ~13% (36MM) of 18-24 year olds reported "I regret how long I stayed on YouTube" in the past week."
- "Late night use: ~7% of teens on YT watch past midnight on school nights. Teen 'night owls' were 88% more likely to have emotional & behavioral problems (article, study). 30% of users 18-24 say YouTube has cut into sleep."

235. The document emphasized the need to "focus our efforts on Teens & Young adults, who are in a crucial stage of mental, emotional and social development and are more vulnerable to wellbeing challenges."[271]

236. A 2018 YouTube review of literature summarized the following: "[a] review of external and internal research and reports, empirical papers, and newspaper articles" focused on "what is considered time well spent, positive things YouTube does that affects watch time, and

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[267] GOOG-3047MDL-00666027 (Project Strider: A Vision for Young Creators on YouTube, Dec. 2019).
[268] GOOG-3047MDL-01738317 (2/7/2023 Email) (stating that "teens want to hang out with their peers . . . so we are exploring launches where we boost teen-created comments to teen viewers.").
[269] GOOG-3047MDL-02820161 at p. 5.
[270] GOOG-3047MDL-00937887 at -914.
[271] *Id.*

possible research follow-ups to improve existing practices".[272] YouTube described "'Responsibly' watching" as "watching in moderation" and "turn[ing]-off Auto-Play".[273] Notably, however, these observations were made in a document which emphasized "Growing" YouTube watch time.

237. It is my expert opinion, supported with evidence from the internal documents that I reviewed, that social media companies acknowledge problematic use by their adolescent users, yet at the same time, designed their systems to take advantage of developmental susceptibilities to encourage continued problematic adolescent social media use. Additionally, it is my expert opinion that the focus by the defendant companies on increasing user engagement, while ignoring growing concerns of negative effects on mental health, created a context where adolescent users may develop a problematic relationship with social media, which is itself associated with poor mental health.

XII. Lack of Adequate Age Verification and Opinions of Parents.

238. While most social media companies state that users must be at least 13 years old to open an account, their age verification and enforcement practices have been severely deficient, and in some cases non-existent for significant periods of time. This is evidenced, in part, by the fact that most estimates indicate that approximately 40% of 8-12-year-old children in the United States hold at least one social media account (Rideout et al., 2022). Thus, a large minority of children are using social media at an age below (and sometimes well below) the social media companies' own stated limits. This is indicative that age verification practices are currently lacking among the defendant social media companies.

239. Consider as an example TikTok. TikTok does not have a reliable way to determine which of its users are minors.[274] In January 2021, TikTok implemented a private-by-default setting for users 13-15 years old (which could be turned off), that placed certain limitations on the accounts of these users. This included, among other things, limitations on interactions with certain people and the ability to view certain videos. TikTok based its private by default setting in part on the finding that "early teens are unlikely to consider the risks associated with making a

[272] GOOG-3047MDL-04683418 at 5 (Feb. 2018 – Literature Review: Growing YT Watch Time Responsibly).
[273] *Id.* at 19.
[274] TIKTOK3047MDL-004-00147779 at -787.

public account without being prompted to do so" and that "early teens have a strong desire for social affirmation, and they are highly sensitive to acceptance and rejection, whether it's in-person or on social media. This means they are likely to pursue external validation and to be influenced by negative feedback."[275] However, accounts for TikTok users aged 16+ were made public by default, purportedly on the basis that "late teens are becoming more adept at abstract thinking and this is reflected in their increased ability to inhibit impulses and consider long-term consequences of their decisions".[276] It is unclear what, if any, data supported this conclusion by TikTok to make accounts public by default for these users.

240. Consider also Snapchat. Motivated by user retention and minimizing sign-up friction,[277] Snap's account sign-up process simply requires a new user to input their age, which is set to 18 years old by default.[278] If a potential new user inputs an age below 13, the application allows potential new users unlimited chances to input an older birthdate.[279] This, in effect, incentivizes users to lie about their age until they "get it right" (meaning, input an age that permits use of the platform.) As a practical matter, anyone at any age, including children under the age of 13, can easily access Snapchat and create an account.[280]

241. Similarly Meta documents acknowledge that they "have a weak system for keeping U13s off the platform and verifying age for protection of minors."[281] In fact, Instagram did not even begin collecting age data until 2019.[282] Internal documents note that Meta used predictive models to estimate age "for business purposes," but did not use those same models to enforce age restrictions on the platform.[283] Rather than address these issues, Meta decided "they will not prioritize this [age verification] work until we have clear legal obligations to do so."[284]

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[275] TIKTOK3047MDL-002-00100047 at -051, -052.
[276] TIKTOK3047MDL-002-00100047 at -051.
[277] SNAP3242221; SNAP5567580; Dep. of C. Chan at 56:17-58:3.
[278] Dep. of C. Chan at 118:7-118:10; SNAP2268193.
[279] Dep. of J. Brody at 355:2-355:9 ("Snap does not limit the number of attempts users can make to input a birthdate that indicates they are above the age of 13."); SNAP3242221.
[280] SNAP2987900; SNAP1047069; SNAP1556755, SNAP0548203; SNAP7125560; SNAP0788746; SNAP2386588.
[281] META3047MDL-034-00137594 at -616.
[282] META3047MDL-004-00027356 at -364.
[283] *Id.*
[284] *Id.*

Other documents note that Meta "deprioritized enforcement" of age limits "due to concerns re: legal liabilities."[285]

242. Given the ease with which adolescents, as well as children under the age of 13, can establish a social media account, the issue has become a significant concern for parents. A study conducted by Pew Research Center in 2023 found that 71% of adults supported requiring users to verify their ages before using social media sites. The same study found that 81% of adults supported requiring parental consent before a minor could open a social media account. These results also were strongly bipartisan relative to political affiliation. The fact that bipartisan super-majorities of parents support such requirements demonstrates the concern parents have about underaged access to social media.[286]

243. Recently, I conducted a survey of 1336 parents of 8-17-year-olds to measure their opinions about various regulations in US state legislatures (Vigil et al., in press). Support for all regulations was quite high, with means well above 4 on a scale where 5 equals strong support. Age verification was strongly supported by parents. Interestingly, there was no difference between parent support of regulations, including age verification, based on whether their children were between the ages of 8-12 (not allowed to create a profile according to most social media companies stated policies) or 13-17 (allowed by social media companies policies). My overall conclusion from these findings is that parents of 8-17-year-old children are desperate for help in managing their children's social media use and related safety issues. Parents want help by whatever means are available to address child and adolescent social media access, safety, use and mental health.

244. This is further confirmed by a nationally-representative survey of parents, which found that the majority (78%) were worried about their child's social media use, and more than half reported worry about their child becoming addicted to social media (Lauricella et al., 2016). Two-thirds of parents responded that monitoring their child's social media usage was more important than respecting their privacy, denoting the level of concern that parents in the United States have about their child's social media use (Lauricella et al., 2016). Importantly, this study

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[285] MT-IG-AG-NM-000180934 at -939.

[286] Emily Vogels et al., Teens, Social Media and Technology 2022, Pew Research. Ctr. (Aug. 10, 2022), https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022.

was conducted before TikTok launched in the United States (2018) and before the release of popular alternatives such as Instagram Reels (which launched in 2020), both of which are heavily utilized by adolescents, suggesting that a more contemporary survey could very well indicate higher levels of concern.

245. The point here is not necessarily that more regulation is necessary, or that it is the solution, but rather, the remarkable lack of variation in support from parents for these measures indicates that parents are looking for outside assistance to help manage their children's social media use and related safety issues.

246. **Summary.** Companies do not engage in sufficient age verification and parent consent practices. Parents, however, are interested in, and supportive of, more robust age verification and parent consent tools as well as all of the social media regulations currently being considered by state legislatures (including age verification), indicating this is a known issue that parents of 8-17-year-olds care about. Parents also are aware of the potential issues surrounding child and adolescent social media use, with majorities worrying that it might be addictive for their children, and larger majorities reporting that it is more important to monitor their children's use than consider child and adolescent online privacy, indicating significant parental concerns related to safety.

XIII. Conclusion.

247. The results of my review of evidence from the defendant companies and my review and synthesis of the scholarly literature in the area of adolescent social media use and mental health are clear and consistent: (1) Social media companies were aware of risks to adolescent users of their products, yet (2) Continued to design and iterate their products with features that aimed to maintain and promote user engagement; (3) These design features take advantage of multiple aspects of adolescent development – aspects of development known by the defendant social media companies – to promote excessive use and overuse; (4) The scholarly literature – across multiple designs and across the past two decades – consistently demonstrates links between social media use and multiple aspects of poor mental health, and more recent person-specific analyses show that sizable groups of adolescents are at risk for negative effects across many known indicators of mental health; further, very few studies show any association between social media use and better adolescent mental health; (5) Scholarly literature also shows

that problematic social media use, characterized by a struggle to stop using, and use that displaces sleep among other indicators, has an even stronger contribution to poor adolescent mental health than general time spent using these platforms; (6) However, despite knowledge that problematic and excessive use were occurring on their platforms by adolescent users, social media companies again implemented features and design choices to promote more and more use; (7) These findings occur consistently among adolescent samples across the world over the past two decades of research; (8) Despite their clear ability to design platforms that promoted excessive use, it is notable that any attempts to design products and features to support adolescent mental health were slow, inefficient, or simply did not work, as evidenced by internal documents; (9) As both internal and external research grew that showed links between adolescent social media use and adverse mental health, coupled with growing societal concerns about the link, defendant social media companies did little to warn users, including vulnerable populations like adolescents or their parents, about the potential risks of using their products; (10) As such, and in totality, it is my expert opinion and conclusion that the defendant social media platforms are a substantial contributor to adverse adolescent mental health.