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Adolescent development and growing divides in the digital age

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Adolescents are constantly connected to their devices, and concerns have been raised that this connectivity is damaging their development more generally, and their mental health in particular. Recent narrative reviews and meta-analyses do not support a strong linkage between the quantity of adolescents' digital technology engagement and mental health problems. Instead, it appears that offline vulnerabilities tend to mirror and shape online risks in ways that may further amplify mental health inequalities among youth. New approaches for supporting youth mental health, especially for vulnerable youth and those typically excluded from traditional services, are now both possible and required.

Adolescents today are the most digitally connected generation in history. However, fears about potential harm that might arise from this constant connection to devices and social media abound among educators, mental health professionals, and parents. These worries are fueled by media reports that equate the attractiveness of social media to drug addiction, claiming that it is deteriorating young minds and disconnecting children from the "real" world. This narrative around social media and smartphones is alarming, but science and streaming data from young people's devices paint a different picture.

This article highlights key study results on the linkages between new digital technologies and adolescents' social relationships and mental health, using, in some cases, information collected directly from adolescents' mobile phones. These findings are presented alongside a brief synthesis of what we know about the links between smartphone, social-media use, and adolescent mental health to date. Insights from diverse types of studies and populations are integrated to surface areas of concern, as well as opportunities for supporting adolescents' mental health in the digital age.

A key take-home message stemming from recent reviews related to this topic is that there are significant limitations and foundational flaws in the existing knowledge base. Nonetheless, as detailed below, key insights regarding both the risks and opportunities faced by contemporary youth are emerging, and urgent action is required by researchers, educators, policy-makers, and others invested in supporting healthy development in the digital age. After synthesizing what is known about the links between social media, smartphone usage, and adolescents' mental health, this article explores future risks and opportunities for research and intervention.

What do we know about the links between adolescents' mental health and their smartphone and social media usage?

Adolescents in many places around the world now spend more time on their digital devices than they do in traditional classrooms. For example, in the United States, teens spend, on average, nearly 7.5 hours each day with digital enter-

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tainment media alone, a count that excludes the time spent online for educational tasks.[1] With the recent and dramatic changes related to COVID-19, these numbers are expected to increase significantly as youth are left with only virtual means of connection to their social networks and educational settings.

Recent years have seen concerns that this continuous connectivity is harmful to multiple aspects of youth's psychosocial well-being, with an intense focus on the potential linkage between both screen time and social media usage and increasing rates of depression among adolescent girls.[2,3] Fears related to links between social-media usage and depression (and related problems) have received widespread public attention and resulted in differing perspectives on whether social media is to blame or, alternatively, could be used to respond to[4] increasing levels of anxiety and depression that have been observed among some populations of youth. There are trustworthy data and disturbing trends pointing to the need to be concerned about increasing internalizing problems among adolescents, particularly young female adolescents.[5] Emotional problems have been increasing since the 1980s among young people across a number of countries, including China, Greece, Germany, Iceland, New Zealand, Norway, and Sweden.[6] In the United States, studies likewise reveal rapid increases in adolescent depressive symptoms[7] and suicidal behavior.[8,9] Deaths by suicide have increased across all age ranges, but the data are particularly troubling among adolescent girls, where suicide rates have tripled among 10- to 14-year-old girls from 1999 through 2017.[10]

Due to the fact that engagement with digital technologies has also increased rapidly during this period, many have asked whether screen time, and social media more specifically, is to blame for rising rates of mental health problems. For psychologists and those treating adolescents suffering from serious mental health problems, it would actually be helpful if smartphones and social media were found to be responsible for a significant share of this increase. If that were the case, then there would be an identifiable and malleable target for intervention. Mobile phones could be turned off and social media restricted to help youth who are struggling. But, as many who have studied complex mental health problems and diseases know, it is rare to identify this type of silver-bullet treatment or high-value target for intervention. Simply put, the causal story is never that straightforward. Thus, it should not be surprising to learn that although there is still significant research to be completed, claims that social media and smartphone use are driving increases in serious mental health problems such as depression and suicide have not been widely supported (see recent reviews in refs 11-18).

> **Offline vulnerabilities tend to mirror online vulnerabilities**

Two large-scale reviews in this area were completed earlier this year, and both converged on similar conclusions regarding the connection between adolescents' digital technology use and well-being.[16,17] In the first review,[16] we synthesized over 50 studies examining adolescent mental health and observed associations across studies that were uniformly small, almost always correlational and confounded by third factors, and characterized by a mix of positive, negative, and null associations. Perhaps most troubling was the fact that almost none of the studies reviewed relied on research designs that facilitated causal inference (eg, experimental or quasi-experimental design) or allowed for conclusions regarding directionality. That is, when associations were found, it was equally likely that depressive symptoms or mental health problems were driving digital technology usage and, as a result, there was no opportunity to test these competing hypotheses.

Correlations between digital technology usage and mental health from these studies tended to be small in size, regardless of the direction. For example, social media and screen time measures typically accounted for less than 1% of the variation in the mental health measures (note these estimates were typically cross-sectional and confounded by unmeasured third factors and bias introduced by relying on a sole informant for both the predictor and the outcome). When interpreting these findings, there has been much discussion regarding "how big" an effect size needs to be in order to have clinically significant implications, with many raising the point that even tiny effect sizes can generate large and important effects when scaled to the population level and/or when the outcomes are costly (eg, suicide or depression). This is an excellent point; however, it is difficult to apply this logic to the present data as the vast majority of findings represent cross-sectional correlations versus properly

PARENTS AND CAREGIVERS

- Focus less on how much time youth are spending online and more on how youth are spending their time online.
- Join youth in their online spaces when you can and use this time to learn what draws them into and interests them in online spaces.
- If your child is struggling offline with anxiety, difficulties with peers, sleeping, or school, pay closer attention to how and when they are using online spaces and networks because offline risk often predicts online risk. Ask: *Are they online searching for support? Seeking out negative content? Avoiding offline interactions and responsibilities? Spending time with peers and in communities that support them?*

EDUCATORS AND DESIGNERS

- Design with and for youth. Young people are often left out of the design and creation of online spaces, especially those targeting mental health, yet they are one of the highest-need and most-likely-to-engage populations.
- Take steps to minimize the digital divide—not only with device access but also with respect to the supports, protections, and scaffolding that is provided to all young people, especially to young adolescents who are just entering into social-media platforms and learning how to navigate these spaces.

ADOLESCENTS

- Don't believe everything you read about your generation! Smartphones and social media are not like addictive drugs. Rather, they are tools you use to navigate your daily life with family, school, and friends and, especially now, are one of the main ways you stay connected with your offline networks and those you care about.
- Pay attention to why you are going online and what you are getting out of these experiences. Positive online interactions allow you *to connect, create, and contribute* to your online and offline communities.
- Avoid negative online interactions, which—similar to negative offline interactions—may increase stress and negative affect. Work to maximize positive experiences and minimize negative ones, and support your peers in doing the same.
- Know that there are places online that you can go to for support in times of crisis, including Youth Crisis Text Lines, and to develop strategies for managing anxiety, stress, and other problems when they arise (eg, apps like Headspace [https://www.headspace.com] and those reviewed by Cyberguide [https://www.psyberguide.org]).

Box 1. Supporting youth in an increasingly digital, unequal, and uncertain age.

estimated effect sizes. Moreover, in studies where adolescents' digital technology use and mental health are tracked longitudinally, very few associations between smartphone/social media use and mental health symptoms are found,[19,20] with one of the most recent longitudinal studies of sixth- to eighth–grade students (n=600) and undergraduate students (n=1100) tracked over 2 years finding no longitudinal associations between social media use and depressive symptoms, and for females only, depressive symptoms at time 1 predicted later social media use, but earlier social media use did not predict later depressive symptoms.[21]

In the second large-scale review that included studies focusing on a wide range of well-being outcomes and methodologies, Orben[17] also concluded that the majority of study designs did not enable researchers to determine whether adolescents' technology use drove mental health problems, or vice versa. When associations between digital technology use and well-being indicators were found, estimated associations were small in size and measured imprecisely. The lack of methodological rigor across studies, combined with the almost sole reliance on screen time metrics made it difficult, if not impossible in most cases, to speculate as to whether technology use was a cause, effect, or nonfactor in young people's mental health issues. A strong case was made for raising standards with respect to the design of future research; transparency in registering, analyzing, and reporting findings; and a need for future work to focus on the role of individual differences in estimating potential impacts of digital technologies on young people's well-being and development.

To summarize, a number of common themes emerged across these recent reviews (and the hundreds of studies that they were based on). First, there is a large mismatch between the data and bold claims that have been made of harm to mental

health and well-being resulting from social media and smartphone use. That is, findings have been mixed and associations small and typically confounded, with the most rigorous studies detailing very small to null associations. Nonetheless, fears about the negative impacts of smartphones and social-media use on adolescent well-being remain high. Second, there is a clear need to move beyond screen-time metrics and to raise the quality and rigor of research designs in ways that allow for the estimation of causal impacts and, more generally, invest in research that is positioned to address not just whether but how and for whom social media and smartphone use relates to well-being.

Moving from the population of adolescents to an N of 1

One of the key challenges in determining whether time spent online or certain types of social media are related to adolescents' mental health and behavior is that digital technology has become almost universal; interpretations of comparisons between youth who are "heavy" versus "more infrequent" users of digital technology are threatened by the fact that a young person who spends 1 hour online per day is very different, across a host of dimensions, from his or her peer spending 6 or more hours online each day. Similarly, two young people spending an equivalent amount of time online each day may differ dramatically in the types of experiences they are having and, importantly, with respect to the vulnerabilities and strengths they bring into their digital environments.

To address some of these limitations, our research team has been intensively following adolescents on their mobile devices across multiple days, which enables us to use each adolescent as her or his own control when making comparisons between time spent on screens, the types of activities that young people are engaging in online, and their daily reports of mental health symptoms and related behaviors. Our most recent study began with a population-representative sample of over 2000 youth attending public schools in a large southeastern state of the United States and then tracking close to 400 youth, 11 to 15 years of age, on their smartphones each day over 14 days. We collected reports of mental health symptoms from the adolescents three times a day, and they also reported on their daily technology usage each night, including multiple types of technology use (texts sent; time spent on technology for school work, communication, entertainment, creating content, and total screen time) and a wide range of mental health symptoms (conduct problems, inattention/hyperactivity, depression, and worry).

After monitoring young adolescents daily, we found little evidence to support the claims that time spent online (for specific types of activities listed above that were measured in this study) is associated with increased risk for mental-health problems.[19] Because we had both cross-sectional and daily data, we asked two types of questions. First, we asked whether adolescents who generally spent more time on their devices were also more likely to experience mental health problems. Second, we asked whether those days on which adolescents spent more time using digital technology (for various purposes) were also days when they reported more mental health symptoms (here using each adolescent as their own control). In both cases, more digital technology use was *not* related to worse mental health. Instead, in the few instances when significant associations did emerge, they were small and in the opposite direction than would have been expected (given widespread concerns about potential damaging effects of digital technology use). For instance, those teens who were heavier texters over the study period actually reported *less depression* than teens who texted less frequently. Looking over longer stretches of time, we found very few robust associations between adolescents' mobile-phone ownership or the frequency of their social-media use and their mental health over a 2-year period, especially after we accounted for existing mental health problems and offline risks.

In line with these findings, Orben and colleagues analyzed repeated within-person assessments from the UK Household Longitudinal study (10- to 15-year-old adolescents; N=12 672) and tested for associations between digital-technology use and life satisfaction over time.[20] Their specification-curve analysis yielded inconsistent estimates across models that varied considerably depending on which factors were entered into the model. The authors concluded that (at the population level) social media use was not strongly or robustly linked to adolescents' life satisfaction and that, over time, results were likely to be small, bidirectional, and largely dependent on the analytic approach taken (although more consistent associations were observed among adolescent females).

Looking across recent reviews and studies that have intensively monitored young adolescents on their phones, we see

little evidence of a strong or robust connection between time spent online and adolescents' mental health and well-being. This raises the question of why there has been such a rush to judgment with respect to the negative impacts of smartphones and social media among adolescents. A commonly cited reason for these fears is the fact that each successive generation seems to find fault in how the youth that comprise the next one are spending their time.[22] Or perhaps it is simply easier to blame smartphones and social media for problems youth are facing than to address the complex and deeply rooted causes of mental health disorders that psychiatry and psychology worked so long to understand and treat.[23] But, it is also possible that the instincts and occasional signals observed by those sounding the alarms about the negative impacts of digital technologies are indeed true but have not yet been reliably detected because we lack the types of research designs, measures, and investments that would allow for more definitive conclusions. Future research is required to fully answer many of these questions. But, in the meantime, we have decades of data and a robust developmental science of what young people need to support healthy development more generally that can be applied to understand adolescent development in the digital age. That is, many of the same factors that we know impede or promote positive relationships and social and emotional development through this transition can be applied to understand and respond to risks and opportunities in the digital age.

What do we know about risks and opportunities for adolescent psychosocial development in the digital age?

One of the most consistent findings across multiple research teams and diverse samples is that offline vulnerabilities tend to mirror online vulnerabilities.[24] In other words, much of what young people bring with them to digital interactions reflects broader assets and risks present in their communities, families, and schools, and can help to explain whether they have positive or negative experiences online. Therefore, these factors can help us to understand how adolescents are best supported online, which young people may be most at risk, and how to work with youth to build the capacity for safely navigating online spaces. For example, we and others have found that low-income teens in the United States spend, on average, about 3 hours more each day engaging with screens than their peers from more affluent

families,[25] and their online activities tend to be less directed at educational content and more reflective of passive media consumption.[26] Supports available for navigating online spaces also differ markedly by family resources and income. For example, spanning a set of studies conducted across multiple European countries, a higher percentage (73%) of children growing up in wealthier homes have parents who are engaging in two or more forms of active mediation of internet as compared with 64% of their peers living in low-income households.[27] Adolescents from low-income homes in our research are also more likely to report more negative spillovers from social media into their offline lives (eg, physical fights, problems at school) than their peers from more affluent families.[28] The overlap between offline and online risks is consistent with a growing body of research on online bullying and harassment, whereby youth who are bullied offline[29] and with a previous history of victimization[30] are more likely to be bullied online. Likewise, offline risk factors and behaviors, including the absence of strong and supportive offline relationships and patterns of self-disclosure online, are strong predictors of whether youth are solicited online (see review in ref 24). Finally, adolescents already struggling with offline mental health problems tend to seek out more depressive or negative content and tend to spend more time "lurking" versus actively engaging with others in online spaces,[31] and those who report elevated psychological distress in their offline lives are also more likely to report distressing aspects in their digital technology usage.[32-34]

Similar to how risks and opportunities are stratified in the offline world, it is becoming clear that young people are increasingly segregated within their online access, opportunities, and experiences. Traditionally, the "digital divide" has referred to the gap between lower- and higher-income individuals with respect to device ownership and connectivity. This is still a concern for many young people around the world and has been one of the key issues identified, as educational systems, from pre-K to university, have been forced to move classes and educational instruction online due to the COVID-19 crisis. However, we are also seeing the emergence of a new type of digital divide whereby the most vulnerable youth have the most to gain if afforded access to resources and support online, but are the least supported in their entry into online spaces, tailoring digital tools for their needs, and accessing supportive communities and networks. Most data support a "rich-get-richer" pattern

of associations with respect to digital technology access and usage that, in the absence of tailored solutions, will result in the amplification of existing inequalities in education, mental health, and future opportunities for youth. As youth come of age in an ever-more digital and unequal world, it will be essential to design for equity with respect to access, supports, and opportunities.

Can digital technologies be leveraged to reach vulnerable youth and provide new opportunities to support and connect young people?

Many young people turn to the internet for information and support related to their mental health. A large US study suggests that the vast majority (87%) of adolescents have gone online to seek information about mental health, while most (64%) have used a mental health app.[1] Social media is also endorsed by young people as a source of mental health advice,[35] especially for adolescents already struggling with moderate to severe depressive symptoms who, in one study, were more likely than their nondepressed peers to report using social media to access emotional support.[36]

Given that the majority of youth in high-income countries are online, that youth are naturally turning to online spaces for information and support, and evidence-based mental health interventions are increasingly made available online, it seems that online platforms could be effectively mobilized to support youth mental health and respond in times of crisis. Worldwide, rates of access to internet and mobile phones vary considerably (with dramatic differences not just between high- and low-income countries but even among high-income countries). Access to mobile devices capable of connecting youth to these services in high-income countries, although not universal or ideally networked for many youths, has increased markedly over the last decade. A study across seven European countries of youth aged 9 and 16 found that 80% of youth owned either a mobile phone or smartphone,[27] and in the US, practically all adolescents (95%) own at least one mobile device.[1]

The hope is that digital technologies will connect youth (either informally or formally) to networks of support and expertise to understand and manage their mental health needs and, ideally, reach youth who would otherwise never access traditional mental health services. Digital tools offer great potential for reducing disparities in access to treat-

ment and scaling evidence-based interventions.[37] There are already a number of excellent examples of impactful programs, including Youth Crisis Line, and various online community referral and support systems (eg, 7 Cups; https://www.7cups.com). Indeed, there have been a number of efforts to leverage new technologies to support wellness more broadly and extend clinical treatments more specifically. Unfortunately, many of the platforms and services that exist have not been designed with adolescents in mind. Rather, most wellness and mental health apps have been designed for adults or for use with young children.

More generally, adolescents, despite their high mental health needs and rates of connectivity, have been neglected in both ambulatory assessment research and the tailoring of digital platforms and apps in the mental health space.[38] A spotlight is often shone on potential problems with adolescents and digital technologies, but there is much less focus on proposed solutions or innovative uses of technology to address mental health issues among adolescents, with some notable exceptions. Moving forward, it is critical that adolescents are included in plans to extend mental health services and support digitally, especially during the current economic and health crisis, where mental health problems are expected to rise, especially among youth who are often the most vulnerable and who now find themselves physically removed from familiar settings and peer and support networks.

Conclusion

The current year, 2020, has already brought difficult global challenges that will define this generation of young people—almost overnight schools, peer networks, workplaces, and communities have been pushed online. This means that there is currently an urgent need to adopt health practices and create digital spaces for young people that support developmental needs and mitigate risks. Screen time is set to increase even more among adolescents, and consistent with main take-home messages from the review of the literature to date, parents, educators, and clinicians should be concerned less with how much time young people are spending online and more with how they are spending their time online. Previous fears about screen time and mental health are not supported by the science. While most attention has been paid to fears, we have missed opportunities to innovate and support youth in online spaces. Now, more

than ever, there is an urgent need to innovate to support young people through this crisis as physical and social distancing disrupts opportunities and supports traditionally available in the daily lives of young people, while adding increased stress and uncertainty, especially to those already vulnerable. Ideally, necessity will foster innovation and help to remove current barriers to reaching and supporting youth both in and outside of online spaces. ■

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