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Adolescent Health and Media

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Introduction

Adolescents today have grown up immersed in digital technology, with iPads, smart phones and social networking sites at their fingertips. Adolescents have been dubbed the “digital generation” or “digital natives” given that they have grown up with access to the internet from an early age (Palfrey and Gasser, 2012). This review paper will describe ways that adolescents interact with media, particularly social media, as well as risks and benefits. The framework of optimal health will be the centering structure for the discussion of risks and opportunities. The paper will conclude with future directions and gaps in the literature.

Definitions

To begin this paper, definitions of adolescence and media types are first addressed to ground the content that will follow.

Adolescence

The definition of the age span of adolescence varies by institution. The American Academy of Pediatrics policy statement describes: “Although adolescence and young adulthood are recognizable phases of life, an upper age limit is not easily demarcated and varies depending on the individual patient.” They then describe adolescence as ranging from ages 11 to 21 years (Hardin, Hackell, and Committee on Practice and Ambulatory Medicine, 2017). The Centers for Disease Control and Prevention report on adolescent health described adolescence as between the ages of 10-19 years (CDC, 2007). HealthyPeople 2020 defines adolescents as ages 10 to 17 years, and young adults as ages 18 to 25 years (US Department of Health and Human Services, 2019). A recent Lancet article argued that the age span of adolescence proposed by the World Health Organization (between the age of 10 and 19 years) should be reconsidered and expanded to be 10 and 24 years (Sawyer et al., 2018). The statement of task for this report will focus on ages 10 through 19. Within this paper, studies that address youth ages 10 through 17 will be labeled with participants as adolescents, and studies of people ages 18 and over will be labeled as ‘older adolescents.’

Media types

To begin this section, the definition of traditional media is provided as digital media can often be understood in contrast to traditional media. The evolution of Web 1.0 to Web 2.0 was a key factor in the rise of digital media. Social media can be considered a unique type of media within the realm of digital media.

Traditional media

Traditional media, such as television, radio and film, typically involve a corporation or business creating content for distribution. The viewer's (or listener's) role is to consume this content. Messages and content are distributed in a unidirectional manner from creator to consumer; this relationship can be represented by a single arrow pointing from the corporation/creator to the consumer.

Digital media

Digital media is defined as “digitized content that can be transmitted over the internet or computer networks” (Sikarwar, 2016). Digital media became possible with the evolution of Web 1.0 to 2.0.

Web 1.0 to 2.0: The first iteration of the web was known as Web 1.0, its purpose was to provide information to consumers. The exchange of information was similar to traditional media in that it was typically unidirectional: you could look up the phone number for a plumber but could not interact with the website to request service or leave a review. Technological advancements led to Internet 2.0, a new web which allowed bi-directional information exchange and engagement. A website could now provide information to consumers as well as providing consumers tools to view, create and share multimedia data with peers and the public.

Interaction: Like traditional media, digital media are tools used for communication. This includes not only one-way dissemination of information as in traditional media, but conversations and exchanges between individual consumers and among groups, collaboration online between consumers, and provision of resources and services between consumers and creators. Thus, digital media is not just for communication of a message, but for interaction.

Digital media can be envisioned as a web of bidirectional arrows between consumers and creators. Any given user, such as an adolescent, can play the role of both consumer and creator.

Traditional to digital: Content can be converted from a traditional or analog format to a digital format, including TV shows and movies streaming online, radio programs disseminated via podcasts, and books whose printed pages have been adapted for access by an e-reader. This conversation from traditional to digital usually impacts both the way the media is disseminated, and often involves providing personalized options for consuming the media for consumers (such as choosing when and where to consume it), as well as sometimes opening a channel for interaction between consumers (such as on YouTube where users can leave comments about the video).

Social media

Web 2.0 also led to what has been called social media, also called immersive or interactive media (O'Reilly, 2005). Social media represent a set of Web 2.0 tools that are centered on interaction and sharing of personal content with others. In the world of social media, internet users became both creators and consumers of content that is often centered on themselves as individual or their products as businesses. Messages within social media can flow in all directions, from corporations to users, between users, and back to corporations through a seemingly endless array of potential paths.

Social media sites are diverse and yet share many similar features. A site user generally creates an account, makes linkages to a network of other individuals or groups, and uses the site to share thoughts, photographs, videos, news stories, and other content (Kietzmann et al., 2011). Social media is used by individuals to share information about their personal lives and by

companies to promote their products. Most of these sites have built-in mechanisms to express approval or disapproval of content, so users not only form their own impression of a post, or video, they can see how many others and sometimes exactly who also expressed approval.

Social media history and platform evolution

This section will provide a brief overview of the history and evolution of social media. This is not meant to be an exhaustive history of social media, but to illustrate current trends and their origins.

Websites to apps

Social media emerged in the early to mid-2000s. At first, the most common type of social media use was via a social networking site (SNS), a website on which users could build and edit a profile. As applications (apps) became available, many users have switched their social media use to center on apps. Instagram was the first social media site that emerged as app-focused, at present most social media use takes place via apps.

Text-focused to visual platforms

The first social networking site to generate widespread popularity was MySpace. MySpace allowed users to develop and customize a personal profile, with an emphasis around music-sharing; it was among the most popular sites globally in the early 2000s (Lenhart et al., 2007). After an early period of popularity this site was overtaken by Facebook. Facebook originated in 2004 as a Harvard University website for students of that university to connect and communicate. Since then, it has expanded such that anyone over the age of 13 can register and

create a profile page. While initially considered a social networking site only for elite college students, Facebook has significantly expanded into a globally popular site.

Both MySpace and Facebook developed with early features focused on providing text-based information and updates, including space for longer text sections similar to blogs. The initial use of Facebook was focused on providing “status updates” which were user-generated text describing feelings or experiences. Over time, Facebook has adapted its features as user posting patterns changed from text to visual. Facebook’s ongoing popularity likely relates to its ability to combine multiple functions from other sites, such as photo sharing, social networking, messaging and “liking” content.

Whereas Facebook was once the dominant platform preferred by teens, it has been replaced in popularity by YouTube, Snapchat, and Instagram (Anderson and Jiang, 2018b; Rideout and Robb, 2018). These platforms focus more on visual content such as photos and videos. For YouTube, users can upload personal videos, as well as edit or re-splice existing videos. Users can comment on and create discussions about posted videos. For Snapchat, users can share photos as well as edit existing photos in creative ways. Instagram allows sharing of photos, as well as editing photos prior to posting.

The shift from text to visual is also illustrated through changes in Twitter. While never the #1 most popular, Twitter has remained among the most popular social media platforms for over a decade (Lenhart et al., 2007; Madden, Lenhart, Duggan, et al., 2013; Pew Research Center, 2010). Twitter emerged in 2006 with an emphasis on short messages (140 characters or less; Pew Research Center, 2010). At present, Twitter has adapted to allow longer tweets as well as sharing of visual content.

Social media use patterns

Social media use is nearly ubiquitous among U.S. adolescents. Recent reports indicate that 93-97% of 13-17 year olds in the U.S. use at least one social media platform (Anderson and Jiang, 2018b; Barry et al., 2017). In this section we will explore major advances in social media use patterns among adolescents.

Single platform to multiplatform

While early studies suggested that adolescents chose a preferred social media platform and focused their attention on it, adolescents today typically use several platforms, creating a “social media portfolio.” Recent Pew Internet and American Life project studies have shown that the majority of young adults ages 18-24 use multiple social media sites such as YouTube (94%), Facebook (80%), Snapchat (78%), Instagram (71%), and Twitter (45%; Smith and Anderson, 2018). On average, adolescents report using three different social media platforms, with some using as many as 8 different platforms on a daily basis (Barry et al., 2017).

Daily use patterns

Use of social media use by U.S. teens has increased greatly since 2012 when 34% of teens aged 13-17 years reported using social media multiple times per day. By 2018, the number had doubled to 70%. Surveys have also identified that teens use social media at a very high frequency: 38% of teens report visiting sites several times per hour and 16% report they use it “almost constantly” (Anderson and Jiang, 2018a, 2018b). Adolescents report using social media an average of nearly three hours each day (Barry et al., 2017; Nesi and Prinstein, 2015).

Multitasking

Studies have illustrated that adolescents often multitask when engaging in digital media use (Brasel and Gips, 2011; Cain et al., 2016; Carrier et al., 2015; Rosen, Carrier, and Cheever, 2013; Wallis, 2006). Multitasking may include texting while watching television, toggling between two social media sites in the same session, or tweeting during a movie. A previous study used Experience Sampling Methodology (also known as Ecological Momentary Assessment) to assess daily internet use, and found that over half the time that adolescents were online, they were multitasking on more than one site or application (Moreno, Jelenchick, Koff, Eickhoff, et al., 2012). The high frequency of media multitasking impacts both our understanding of daily use patterns for a particular media platform, as well as consideration of the accuracy of self-reported time spent online.

Challenges in measurement

It is important to note that self-reported time on social media, as well as the any digital media, has been called into question as reliable data. Studies have found that teens may overestimate or underestimate their time online. The 2012 study cited above found differences between self-reported internet use time (210 minutes per day) and measured internet use time (66 minutes; Moreno, Jelenchick, Koff, Eickhoff, et al., 2012). While these times may have increased since 2012, the discrepancy between measured and self-reported time bears mentioning. The paper described that one possible reason for the discrepancy was that adolescents may include time spent thinking about or processing online interactions in their reporting of total online time, leading to overestimating their total time online. Recent articles

have argued for better measurement methods such as passive sensing to go beyond the errors inherent in self-reported media use time (Christakis, 2019).

Social media by groups

Social media use, experiences and motivations have been evaluated across several demographic groups. With over 90% of US adolescents using social media frequently, the initial focus on differences in use rates by groups has faded and more attention has been given to differences in experiences and motivations for using social media. Studies evaluating social media use and experiences across many specific populations remain underdeveloped.

Socioeconomic status

The digital divide in internet access between high and low socioeconomic groups has narrowed. Adolescents who fall into lower socioeconomic groups are now just as likely, and in some cases more likely, to use their cell phones for primary access to the internet compared to teens from higher socioeconomic groups (Duggan and Smith, 2013). Public online access in libraries and cafes has also enhanced access to the online world. A 2010 study of homeless youth found that over 90% reported frequent internet access, most often from public libraries (Rice et al.).

Age

The earliest adopters to social media use were older adolescent college students (Ellison, Steinfield, and Lampe, 2007). Over time, frequent use has steadily crept downward in age. Studies from 2007-2010 found that 73% of teens between the ages of 12 and 17 owned a social

media profile, while another study found that 22% of teenagers logged onto their favorite social media profile more than 10 times per day (Lenhart and Madden, 2007; Lenhart et al., 2007; Patchin and Hinduja, 2010). Studies have also examined younger children who are technically outside the age to sign up for a profile, a 2010 study found that 18% of 8- to 10-year-olds used a social media profile daily (Rideout, Foehr, and Roberts, 2010). Recent studies have found that early adolescents, or ‘tweens’ describe that they feel that access to digital media should be determined based on achieving developmental milestones rather than by age (Moreno, Kerr, et al., 2019).

LGBTQI

Studies examining lesbian, gay, bisexual, transgender, questioning and intersex (LGBTQI) youth have often focused on the importance of using social media and the internet to obtain health-based knowledge, create or expand support systems, and access mental health resources. A recent qualitative study illustrated 5 themes in online experiences for transgender youth, including 4 critical ways in which transgender youth utilized online resources: 1) exploring gender identity, 2) filling knowledge gaps, 3) seeking support networks, 4) finding transgender-friendly providers and one area of challenge which was encountering misinformation (Evans et al., 2017). Further, studies have found that LGBTQI youth acknowledge that technology use did increase the risk of safety and personal security concerns (Lucassen et al., 2018).

Race/ethnicity

One area in which studies have focused on race/ethnicity and social media/internet access is among Native American populations. Studies have found that Native American teens reported having fewer computers in their homes and less internet access. They were more likely to have access to video game systems, however, and spent more time using digital media than White children (Hswen, Naslund, and Bickham, 2014). Another study found that rates of digital media use among Native youth mirrored or exceeded that of national rates (Craig-Rushing and Stephens, 2011).

Studies of social media use by race have included studies focused on how youth from different races experience their own identity. One area of study has been on body image. One study reported that frequent Facebook use was associated with greater body dissatisfaction in White women compared to African American women (Howard et al., 2017). One area in which research is underdeveloped is in how youth use social media to signal racial or cultural identity. A previous study of African-American college students found that Facebook provided a platform to use both images and text to signal racial identity (Lee, 2012).

Disability

Another area in which research is underdeveloped is in how communities with disabilities experience or leverage social media. One paper argued for the use of the word “disability” in social media forums to ensure representation of these communities online (Andrews et al., 2019). An important benefit from new media has been the development and utilization of technology-aided interventions in adolescents with disabilities. This has been through the expanding use of assistive and interactive digital media to learn and to communicate in youth with autism spectrum disorder (ASD; Odom et al., 2015), physical disabilities, speech impairment, and

intellectual disability to learn and communicate (Desch, Gaebler-Spira, and the Council on Children with Disabilities, 2008).

Adolescent development and social media

Adolescents and young adult are uniquely positioned to be particularly vulnerable to the effects of social media: they are at once early adopters, nearly ubiquitous users, and highly susceptible to peer influences (Ellison, Steinfield, and Lampe, 2007; Lenhart, Hitlin, and Madden, 2005; Lenhart et al., 2007; Pew Research Center, 2010). While there are differences in functionality across social media platforms, a commonality across platforms are that they serve key developmental tasks (Uhls, 2015). These include providing space for friendships and networks, and providing a venue for self-expression, identity exploration and information access (Gerwin, Kaliebe, and Daigle, 2018).

Theories about social media and adolescent behavior

Previous work has established strong links between what adolescents see and how they act (Bandura, 1986). Observation of peers is a major source of influence on adolescent health attitudes, intentions and behaviors (Borsari and Carey, 2006). For example, adolescents who perceive that their peers are sexually active are more likely to report intention to become sexually active themselves (Kinsman et al., 1998). Studies of college students have illustrated that alcohol consumption patterns are highly influenced by one's peer group (Reifman and Watson, 2003). Many studies of adolescents have illustrated links between traditional media and health behaviors. For example, previous work has illustrated that younger adolescents exposed to

tobacco use through media such as movies are more likely to initiate this behavior themselves (Titus-Ernstoff et al., 2008).

Social media combines peer and media effects and thereby represents a powerful motivator of behavior, whether it is by content created by the individual or content shared with peers. It has been argued that Facebook may have greater influence than traditional media, as Facebook combines the power of interpersonal persuasion with the reach of mass media (Fogg, 2008). Facebook has been described as “the most significant advance in persuasion since the radio was invented in the 1890s” and initiated a new form of persuasion labeled “mass interpersonal persuasion” (Fogg, 2008). Theories applicable to social media and adolescent behavior include both health behavior theories, communication/media theories initially developed for traditional media and applied to social media, and unique theory specific to social media. Several specific theories applicable to adolescent behavior and social media include the following:

Uses and Gratifications (U&G)

In the 1970s, the Uses and Gratification Theory was developed within the communication field to explain why and how users choose certain media to satisfy specific needs (Giannakos et al., 2013). This theory was applied to many types of traditional media, and has been applied to understand social media uses and gratifications. One study examined specific gratifications reported by Facebook users. These gratifications included “social connection”, “social surfing”, “wasting time”, and “using applications.” Another study reported Twitter gratifications to be positively correlated with time spent tweeting and connecting to others (Chen, 2011).

Facebook Influence Model (FIM)

The Facebook Influence Model was developed through primary data collection with adolescents to create a concept map specific to the influence of Facebook. The FIM includes 13 clusters representing core constructs of influence, clusters include “influence on identity”, “connection to people” and “social norms” (Moreno et al., 2013). The 13 clusters can be considered within four main concepts which include: 1. *Connection*: Facebook enhances peer communication, networking and connection. 2. *Comparison*: Comparison with peers has long been part of adolescence, Facebook allows this comparison to take place using tangible information such as photos, stated behaviors and the ability to note peer comments on these information. 3. *Identification*: Facebook allows a profile owner to develop an online identity through a profile. Profile owners can then reflect and revise that identity via feedback from peers’ comments and “likes,” or by personal perusal through the Facebook “timeline.” The ability to develop one’s identity in real-time provides a unique multimedia view of the self. 4. *Immersive experience*: Facebook was described as a platform that provided positive, negative, tool-based and distracting features towards an immersive and powerful experience for users. A unique aspect of this model is that participants identified negative experiences specifically as an accepted part of the Facebook experience.

Affordances

Affordances were introduced by James Gibson in his book “The Ecological Approach to Visual Perception” and Donald Norman in his 1988 book “The Psychology of Everyday Things.” The term affordances indicates how an object is designed should suggest how it should be used. Affordances are typically described as properties of artifacts that can be recognized by users and

contribute to their function (Zhao et al., 2013). Perceived affordances can also be conceptualized as “design aspects of objects that suggest to the user how the object should be used” (Zhao et al., 2013), a simple example is that the design elements of a chair suggest to a person that the object could be used for sitting. Affordances are a concept often used in the fields associated with design, and by those systematically studying the impact of a design of an object.

Affordances can be a mechanism for understanding social media across platforms, and identify risks and benefits for adolescent users. Previous work has explored five types of affordances applicable to adolescents and their social media use (Moreno and D'Angelo, 2019; Moreno and Uhls, 2019).

1. Social affordances: Social media can provide entry, via a login and membership to a “group”, which promotes a sense of social inclusion. Teens can develop social connections with family, friends, and acquaintances, as well as online recommendations to connect with others via suggested “Friends” by social media platforms or through hashtag-supported, common-interest communities. Some social connections allow teens to access resources and support, but others may provide peer pressure to engage in unhealthy activities or behaviors, such as the “pro-ana” communities that promote anorexia (Lajunen et al., 2007).
2. Identity affordances: Identity development is a critical task in adolescence. Social media platforms that allow teens to present themselves through photos, videos, text, and creative arts promote the exploration and formation of a maturing identity and self-image (Boz, Uhls, and Greenfield, 2016).
3. Cognitive affordances: Social media afford teens the opportunity to enhance learning and knowledge, and explore environments beyond the local home, school, and neighborhood (Zhao et al., 2013). Benefits include options to develop and share creative projects and to

obtain resources for health. Digital literacy skills can be honed that can help teens assess quality and accuracy of information obtained online.

4. Emotional affordances: Teens can use social media tools to express their emotions and opinions online, via text, “likes”, and emojis. Teens can seek and attain immediate social support when in crisis. Online communications can help generate empathy—as well as envy, anxiety, and depression—from social comparisons (Chou and Edge, 2012). Negative emotions can also be stirred by misinterpreted communications, social rejection, and cyberbullying.
5. Functional affordances: Functional affordances address critical functionalities of social media and how they support ongoing use, as well as other goals and affordances. These may include how social media messages can be saved and shared. Examples include the ability to re-Tweet a message (replicable), or to share a post on Facebook to a broader audience (scalable). Additional factors include the ability to edit or delete a post, the ability for others to capture and store a post (permanence).

Media practice model

The Media Practice Model describes that adolescents choose and interact with media based on who they, or who they want to be, in that moment (Brown, 2000). This model applied to social media suggests that media users can explore information or display content based on experiences or behaviors they are considering, which may lead to reinforcement or advancement of these ideas. Thus, an adolescent who views a movie depicting drinking at a party may be influenced to partake in such a party in the future.

Social norms and media as a superpeer

Social norms are an important driver for perceptions and decisions during adolescence (Maher, 2007; O'Gorman, Wilson, and Miller, 2008; Thogersen, 2008), given that peer affiliation is a critical goal of this developmental time period. Social norms can be learned via media, as supported by social learning theory (Bandura, 1977; Bandura, 2001). Social norms can be evaluated by observing social media profiles, one study of sexual references on social media found that adolescents who chose to represent sexual content on social media were more likely to have friends who also posted this content (Moreno, Brockman, et al., 2010). The idea of media as a “superpeer” has emerged to label media as a strong source of such social norms (Elmore, Scull, and Kupersmidt, 2017; Strasburger, Wilson, and Jordan, 2008).

Connection across theories

Many of these theories have overlap, the idea of social media as a major source of influence is supported by the FIM, social learning theory, social norms, the “superpeer” concept as well as BJ Fogg’s “mass interpersonal communication.” The motivations for social media use are well described in the U&G. The functionalities and uses of social media are well explained by affordances. Taken together, there is strong theoretical basis behind our understanding of the role of social media in adolescent health behavior.

Social media and optimal health

Given this committee’s focus on optimal health, this report will now shift to focus on the specific areas outlined in the statement of task. For each area of health, the potential areas of risk

and benefit will be discussed. Some issues have crossover between areas of health, these will be categorized in the major area and overlap with others will be noted.

Physical health

There are several ways in which physical health may be influenced by social media. In the area of risk, prominent areas include risky health behaviors, sleep, and physical activity/obesity. A section will also describe the role of advertisements and physical health risk. In the areas of potential opportunities for optimal health, interventions are highlighted that have incorporated digital health tools. In these areas, the linked affordances within digital health tools include social and cognitive affordances.

Risks to physical health

Most of the literature in the arena of physical health has focused on one of two areas: risky health behaviors and sleep concerns. Risks of obesity from increased sedentary activity/decreased physical activity when engaging with media are well documented in traditional media, but understudied in social media.

Risky health behaviors

Risky health behaviors are salient to examine in adolescence as this is the time period in which risky behaviors typically emerge that can lead to physical injury or death, including substance use, risky sexual behavior and aggression/violence (CDC, 2018). Illustrating this concept, a 2018 study illustrated that in the past 30 days, 20-30% of adolescents report

consuming alcohol, 5-14% report using tobacco, 14-20% report marijuana use and 16% report carrying a weapon (Johnston et al., 2018).

It is important to note that **social media has 3 potential pathways to influence adolescent risk-taking behavior**. The first is by exposing adolescents to risky behaviors, showing how these behaviors can happen and portraying these behaviors as normative. This mechanism is similar to that which takes place via traditional media. Many of the theories described above illustrate pathways by which social media content may be influential to risk-taking behavior. Social norms, the social learning theory (Bandura, 2001), and the Facebook Influence Model (Moreno et al., 2013), are background for these potential mechanisms. These theories explain that by viewing these behaviors, teens can interpret the behaviors as normative or desirable, and see ways to do the behavior themselves. These health risk behaviors include well-known risks such as alcohol or substance use. Social media has also allowed the propagation of unusual risk behaviors whose popularity were driven entirely by online communities, such as the “cinnamon challenge” (a challenge to consume an entire spoon of cinnamon on video and post it on social media) and “roof-topping” (a challenge to sneak onto a rooftop and take a selfie in a dangerous position and post it on social media).

A second potential path of influence is via magnifying existing peer influences on behavior. The social media context may magnify this via reinforcement for risky behavior via social media “likes,” “favorites” or shares (Nesi and Prinstein, 2019). BJ Fogg’s Mass Interpersonal Communication or media as a superpeer may be potential pathways for this source of influence. These theories support the idea that a teen may view the behavior, and then note how much social endorsement the posts about that behavior have garnered, and want to do the behavior themselves to receive this public attention and support. This pathway is not present

within traditional media, and is unique to the interactive nature of social media. These likes and magnification of influence play a strong role in risk behaviors such as the cinnamon challenge described above, the more likes and shares these posts received, the more exposure these behaviors received.

A third potential path of influence may exist for adolescents who are already engaging in risk behaviors. For these teens, social media may provide a way to find and interact with others who share these interests, or further normalize these behaviors within a given community. An example of this type of community building around a risk behavior is the self-harm community, who can leverage specific hashtags to identify like-minded users and share experiences, support and advice (Moreno et al., 2016). This pathway is also unique to social media. U&G, described above, proposes that individuals are driven to use different platforms to satisfy their needs. For teens who engage in risky behaviors, social media may provide a way to engage in risky behaviors and identity with others of similar interests.

Specific areas of study in risky health behavior

Alcohol and substance use: Alcohol and social media is an area that has received much focus in the past decade. Social media is a source of exposure to two important factors that, offline, are associated with alcohol use – peer alcohol behavior (Ali and Dwyer, 2010; Mundt, Mercken, and Zakletskaia, 2012) and alcohol advertising (Jernigan, 2006, 2011). A previous study found that adolescents who view alcohol references on their peers' Facebook profiles find these to be believable and influential sources of information (Moreno, Briner, et al., 2009). Further, adolescents who perceive that alcohol use is normative based on Facebook profiles are more likely to report interest in initiating alcohol use (Litt and Stock, 2011). Several studies have

found positive associations between social media use frequency and measures of problem alcohol use including binge drinking in the past 12 months (Brunborg, Andreas, and Kvaavik, 2017), frequency of alcohol use (Huang et al., 2014), and problematic alcohol use (Kaufman et al., 2014). A meta-analysis finding indicated that more frequent alcohol-related social media engagement was associated with more alcohol use and alcohol-related problems with a medium effect size among young adults (Curtis et al., 2018). Studies focused on substance use show similar findings to that of alcohol. Frequency of social media use has been shown to have positive associations with drug use including tobacco and marijuana (Baker and Pelfrey Jr., 2016; Nesi and Prinstein, 2019).

Risky sexual behaviors: To date, studies have shown positive associations between social media use and risky sexual behaviors that take place online and offline. In the online context, one study included assessment of daily time using social media and cybersex frequency and found a positive association (Doornwaard et al., 2014). A second study found that frequency of social initiation activities on social media was positively associated with frequency of risky sexual online self-presentation (Koutamanis, Vossen, and Valkenburg, 2015; van Oosten and Vandenbosch, 2017). A study examined sexual content on social media profiles and found that while references to risky sexual behaviors were common, references to safe sex practices or contraception were rare (Moreno, Parks, et al., 2009). In one study that bridged offline and online, the study found that older adolescents who posted sexual content were more likely to report interest in sexual initiation compared to those who did not post such content (Moreno, Brockman, et al., 2012). Within the offline context, studies have also shown associations between self-reported social media use and both frequency of sexual risk behavior (Landry et al.,

2013), number of partners (Romo et al., 2017), as well as no contraception use at last sexual intercourse (Macapagal et al., 2018).

Violence/aggression: Studies have assessed self-reported social media use and aggression/violence, findings suggested higher levels of social media use and more frequent engagement in aggressive behaviors (Baker and Pelfrey Jr., 2016; Tsitika et al., 2014). Further, a study of high school students found that adolescents who reported frequent social media use were more likely to report weapon carrying compared to those with infrequent social media use (Baker and Pelfrey Jr., 2016). Observational studies of social media have found that posting about violence or aggression by older adolescents was present on approximately 15% of adolescents' profiles (Moreno, Parks, et al., 2009).

Interpreting these studies: Care must be taken in interpreting these studies, as many have assessed platform engagement and social media use in different ways. Studies also cover a range of ages, so understanding different impacts of exposure or engagement by age is important. The culture of social media, and what is appropriate or inappropriate to post on a given site, is also ever-evolving. Further, it should be noted that publication bias may have led to publishing positive results. A meta-analysis is needed to better understand findings across studies and the effect sizes.

Sleep

Studies have found that participants with higher social media use (Levenson et al., 2016) or who sleep with mobile devices in their room (Arora et al., 2014; Buxton et al., 2015) were at greater risk for sleep disturbances. One study of adults found that taking a phone into the bedroom led to longer sleep latency, worse sleep quality, more sleep disturbance and more

daytime dysfunction (Exelmans and Van den Bulck, 2016). This study illustrates the multiple mechanisms by which media use around bedtime, or during bedtime, can disrupt sleep and impact daytime function.

Physical activity and obesity

Studies show clear correlations between increases in hours of passively viewed traditional media, such as television, and increased risk of being sedentary and risk of obesity (Proctor et al., 2003). While a variety of studies focused on obesity and television watching have found positive associations, observational studies examining the relationship between social media use and sedentary behaviors/obesity risk are rare (Khajeheian et al., 2018). A 2017 review paper suggested that the different nature of digital screens may have different effects on sedentary behavior, and called for this as a priority area of research (Robinson et al., 2017).

The special case of advertising on social media and physical health

There is a rich literature around the influence of advertisements in media and adolescent behavior, with particular focus on ads for junk food and alcohol. Studies of social media advertisements are less common but have similar findings regarding influence.

Food: A recent study found that the majority of teens using social media were exposed to advertisements for unhealthy foods, particularly fast food and sugar-sweetened beverages (Potvin et al., 2019). A unique aspect of social media advertisements is that ads can be targeted to a user based on what they choose to share, or post, on their own profile. Researchers in one study observed that content related to exercise or nutrition that was posted on Facebook by an

individual user led to the user receiving ads for sports gear, diets and junk food on their own profile (Villiard and Moreno, 2012).

Alcohol: Multiple studies have demonstrated that online exposure to alcohol marketing impacts perception of social norms (Martino et al., 2016), and is positively related to subsequent alcohol use and overuse (Jernigan et al., 2017). Teens are exposed through a variety of media, including digital media, to alcohol advertising an average of more than three ads per day (Collins et al., 2016), which can influence initiation of drinking, increase underage drinking, and establish effective brand recognition which promotes brand choice (Siegel et al., 2016).

Marijuana: The legalization of marijuana in many states has led to exposure of youth under age 21 to promotional content (Fiala et al., 2018; Moreno, Gower, Jenkins, Scheck, et al., 2018). While advertising on social media is illegal by federal law, marijuana companies can create “business pages” on social media sites to promote products and directly engage with social media users. One study reported exposure to marijuana ads by 55% of young adults offline, 77% via digital media, and noted that this exposure “is associated with medical use, heavier use, and use of novel products with higher THC concentrations or longer intoxication duration (Krauss et al., 2017). A study that examined recreational marijuana companies’ social media profiles in Washington state found that many posts did not meet compliance requirements, including messages that encouraged overconsumption, messages with youth-appeal tactics and content suggesting therapeutic effects (Moreno, Gower, Jenkins, Scheck, et al., 2018).

Sexting

The term “sexting” refers to sending, receiving or forwarding sexually explicit messages or pictures over cell phone, computer or other digital device. A recent study of adolescents found

that 60% reported having been asked for a sext, 31.4% reported asking for a sext, and 27.6% reported having sent a sext. Further, sending a sext was associated with being sexually active 1 year later (Temple and Choi, 2014). Sexting by adolescents can have unintended negative consequences. A first consequence is embarrassment, regret or being harassed resulting from sending a sext. The sext can also be distributed beyond the target recipient, a previous survey revealed that 40% of adolescents had been shown a message of a sexual nature that had been intended for someone else (Dowdell, Burgess, and Flores, 2011). There are also potential legal consequences, which can include prosecution under child pornography statutes. Some states have adapted specific status that apply to sexting but these laws remain rare (Hinduja and Patchin, 2014). One study examined whether adolescents who report sexting exhibited more psychosocial health problems than their non-sexting counterparts. Teen sexting was significantly associated with symptoms of depression, impulsivity, and substance use. When adjusted for prior sexual behavior, age, gender, race/ethnicity, and parent education, however, sexting was only related to impulsivity and substance use. The authors concluded that “while teen sexting appears to correlate with impulsive and high-risk behaviors (substance use), we did not find sexting to be a marker of mental health” (Temple and Choi, 2014). Thus, sexting is listed in this paper as a risk to physical health, not mental health. However, sexting has implications for emotional health as well as social health.

Social media to support optimal physical health

Support seeking: Social affordances

One area of promoting optimal health for the physical health of adolescents is by including social support in interventions designed to promote positive health behaviors.

Adolescents have reported satisfaction and engagement with social media interventions using social support approaches, these interventions have included physical activity, weight loss, and smoking cessation (Baskerville et al., 2016; Cavallo et al., 2012; Napolitano et al., 2013). Social support in these interventions includes sharing peer support messages, goal achievements, and progress and setback updates via text, picture, and video posts within invite-only Facebook groups. Social media interventions for more sensitive and stigmatized topics, such as sexual health, have shown lower engagement among adolescents (Divecha et al., 2012).

An important feature of these successful interventions is that they often include social support approaches beyond solely social media. For example, interventions pairing social media with traditional technologies and approaches, such as telephone quit lines, text messaging, and in-person social support, have demonstrated the greatest promise for affecting behavior change. In an adolescent weight-loss trial, participants assigned to the Facebook Plus group, which included daily, personalized text messages and a non-study “buddy” for in-person support, lost significantly more weight than participants in the Facebook-only group (Napolitano et al., 2013). Similarly, in a smoking cessation study among older adolescents, participants who engaged in a social media intervention integrated with traditional quit line cessation services reported higher 7-day and 30-day quit rates compared to participants accessing the quit line alone (Baskerville et al., 2016).

Information and awareness: Cognitive affordances

Studies suggest social media is an invaluable tool for adolescents to anonymously and informally learn about, discuss, and receive support for stigmatized topics, such as sexual and mental health (Buzi, Smith, and Barrera, 2015; Carew et al., 2014; O'Dea and Campbell, 2011).

A previous study found that adolescents appreciated social media as an opportunity to learn about sexual health, but wanted to ensure that lay-person level information was included alongside medical terminology (Selkie, Benson, and Moreno, 2011).

One way clinicians have directly communicated with adolescents is through fielding anonymous health-related questions on Q&A platforms (Alice! Health Promotion, 2017; Buzi, Smith, and Barrera, 2015). A clinician-run platform, Go Ask Alice!, recognized as a reputable and accurate website for adolescent health (Greenberg and Wang, 2012; Yen, 2010), receives hundreds of questions and millions of site visits each month (Alice! Health Promotion, 2017).

Another opportunity within social media to promote optimal health is by raising awareness, which can include awareness of diseases as well as ways for an individual to help. An initial highly successful example was the “ALS Ice Bucket Challenge” which involved dumping a bucket of ice on someone then sharing the photo on social media using the hashtag. This was a challenge that went viral and raised over 100 million dollars for research on Amyotrophic Lateral Sclerosis. Other campaigns within social media have included ones focusing on blood or organ donation, or promoting sexually transmitted infection testing.

Sexual health

A systematic review of interventions using digital tools for sexual health identified 10 studies (Guse et al., 2012). Of these, 7 were web-based, one included text messages, and one used social media (Moreno, Vanderstoep, et al., 2009). A RAND report “Influence of New Media on Adolescent Sexual Health” reviewed the evidence related to sexual health and media and included the following intervention recommendation in its conclusion:

The broad reach and high interest level of these media among youth suggest great potential for these approaches. It will be important for these interventions to be informed by sound theory— existing or newly developed. Avoiding the pitfalls that many mass media interventions encounter by assuming that any accurate message, broadly distributed, will be effective will be key to success in this area (Collins, Martino, and Shaw, 2010).

Early identification

Social media may provide a new venue to identify adolescents who are considering or engaging in health risk behaviors. As current methods fail to identify many adolescents who are at risk for or engaging in health risk behaviors, innovative approaches are needed (Halpern-Felsher et al., 2000; Lehrer et al., 2007; Mangione-Smith et al., 2007; McKee and Fletcher, 2006). Studies have shown that older adolescents' posts about alcohol (Moreno, Christakis, et al., 2011; Moreno et al., 2015; Moreno, Kacvinsky, et al., 2014), marijuana (Moreno, Kerr, and Lowry, 2018), and depression (Moreno, Christakis, et al., 2012) are positively associated with self-reported behavior and experience. These posts can thus be a marker for risk, and while not to be considered diagnostic, can help identify youth who would benefit from in-person screening. A previous study asked adolescents about intervention approaches using social media, key elements of a successful approach included using a questioning approach rather than judging, and protecting privacy (Whitehill, Brockman, and Moreno, 2013).

Emotional health

There has been a rich literature developed around the areas of social media and emotional health, mostly focused on mental health risks related to social media. This area of research includes some areas of controversy, such as whether “FOMO” can be labeled a condition or a phenomenon, and whether social media can have direct effects on depression. Cyberbullying will be included in this section given its strong association with emotional health, though it is noted that cyberbullying has evidence of impact on physical health as well as social health.

Risks to emotional health

Fear of missing out (FOMO)

Social media has facilitated the development of a new mental health phenomenon: fear of missing out, aka FOMO. FOMO is defined as the anxiety or depression experienced when a vulnerable viewer sees others’ social media postings and believes that the posters may be living a “better life.” Friends can be perceived as being engaged in more fun or exciting activities, for example, or as achieving life and career milestones more quickly. Some call FOMO the modern equivalent of “keeping up with the Jones.” A study of older adolescents found that FOMO feelings were experienced most strongly at the end of the day and when performing required tasks such as attending class or studying. Students who had high rates of FOMO reported increased symptoms such as fatigue, stress, and decreased sleep (Milyavskaya et al., 2018). Another study found that teens with a high need to be popular or to feel they ‘belonged’ reported higher levels of FOMO. In comparison to teens with lower FOMO levels, the adolescents with the highest levels of FOMO used social media more frequently and experienced more stress if they felt unpopular or as if they didn’t belong (Beyens, Frison, and Eggermont, 2016).

Cyberbullying

Cyberbullying is often defined as the deliberate use of technology including social media to communicate false, embarrassing or hostile information about another individual. It can include name calling, spreading rumors, pretending to be someone else, sending unwanted pictures or texts, distributing pictures without consent, making threats or asking someone to do something sexual (Mishna et al., 2010). Though cyberbullying can have similar consequences as traditional offline bullying, such as depression and anxiety, there are some unique aspects of cyberbullying that may increase the potential severity of these consequences. For instance, because it occurs online cyberbullying can occur at any time, not just when one is face-to-face. Additionally, given the wide use of social media, cyberbullying has the potential to reach a large audience (Mishna et al., 2010). Thus, cyberbullying also has potential risk in the area of social health. Another unique aspects of cyberbullying is its extension into the older adolescent years. While traditional ‘schoolyard’ bullying typically peaks in middle school and declines, cyberbullying can extend into college and the older adolescent years. One study found that female college students who experienced cyberbullying, as either a perpetrator or target, were more likely to report depression symptoms and problem alcohol use (Selkie, Kota, and Moreno, 2014).

Controversial: Social media and depression

Large-scale surveys demonstrate a distinct negative trend in self-reported well-being of teens since 2012 (Twenge, Martin, and Campbell, 2018). Teens who spend more than 5 hours per day on screen activities (social media, texting, gaming) were more likely to report being unhappy and having lower self-esteem than those teens reporting less screen time. However,

teens with little or no screen time also reported low levels of psychological well-being. Teens who spent 1-2 hours on screen time had the highest levels of well-being suggesting that some screen time may be a positive influence when used in moderation. Similar to these findings, previous research has suggested a U-shaped relationship between internet use and depression, with increased risks for depression at both the high and low ends of internet use (Belanger et al., 2011; Moreno, Jelenchick, Koff, and Eickhoff, 2012).

Beyond the quantity of social media use, fewer studies have examined the quality of social media use as a critical factor in emotional health. A pivotal study found that older adolescents who used social media passively by solely viewing content reported declines in well-being and life satisfaction, whereas those who used social media actively by interacting with others and posting content did not experience these declines (Kross et al., 2013). Another study found that teens who used Instagram to follow strangers and engage in social comparisons had higher depression symptoms, while others who followed friends and engaged in less social comparison had fewer (Lup, Trub, and Rosenthal, 2015). These studies illustrate that beyond the number of hours spent on social media, a key factor is how an individual uses social media.

Social media for optimal emotional health

Social connection

Social media allows teens to connect with peers with similar interests whether they be art, music, food, fashion, or politics. Many teens report having friends online whom they have never met in person. For some, this is a source of great support, fostering social inclusion and peer-to-peer connections among adolescents who seek a welcoming community, such as those who

identify as LGBTQI (Olson et al., 2016) or those with physical or mental health (Dickins et al., 2016).

Health information seeking

Social media offer strong potential as a medium through which adolescents can anonymously discuss and receive support for stigmatized topics, such as sexual and mental health (Buzi, Smith, and Barrera, 2015; Carew et al., 2014). Adolescents have expressed unwillingness to receive unsolicited help from providers with whom they have not had an offline relationship (Whitehill, Brockman, and Moreno, 2013).

Social health

Perhaps not surprisingly, there are several ways in which social health intersects with social media. Connecting to peers, finding a supportive community and staying in touch with people far away are already noted and documented in the above sections. For this section, a novel area of dating is addressed for social health.

Dating via social media

Social media apps include dating apps whereby an individual can view pictures and profiles of others and swipe left (reject) or swipe right (like) to start a conversation. Some of the dating apps most popular with youth are Tinder, Kik, Skout, MeetMe, Grindr, Bumble, and Yubo (Elgersma, 2018; Wahlgen, 2019). The apps are distinguishable by their unique characteristics and features, yet they share a common goal: to connect users for romantic relationships or

encounters. Most of the dating apps have an age restriction of 17 years or older with the exception of Yubo which accepts users 12 years old and up.

Risks for social health

Privacy

Privacy issues can create challenges for teens who are not aware that the internet is public and permanent. Not all teens set privacy settings on social media, or understand the risks that a private communication could be disseminated, i.e. “go viral”, and be embarrassing or impact social standing (Madden, Lenhart, Cortesi, et al., 2013; Moreno, Kelleher, et al., 2014). The images and comments posted by a young teen may “live forever” on the internet and be disseminated beyond their control. Adolescents’ understanding of these concepts varies, one study found that one third (32%) of adolescents had given their password to friends and one fourth (25%) were unaware that content uploaded online cannot be deleted (Rideout, Foehr, and Roberts, 2010). Adolescents may not consider the potential consequences that sharing this information has if their relationships with people change. Though many adolescents understand these risks, many remain unclear about or unmotivated to maintain security settings that protect their displayed content on social media (Debatin et al., 2009; Moreno, Grant, Kacvinsky, Moreno, et al., 2012). Further, some employers and college admissions offices review candidates’ digital profiles, including Facebook accounts of prospective applicants; a risqué or embarrassing post from years earlier could negatively impact future academic and professional plans.

Social media for optimal social health

Virtual communities

Virtual communities play an increasing role in the lives of today's youth. Previous work illustrates that adolescents who experienced a greater number of positive reactions to their social media profile also experienced higher self-esteem and satisfaction with their life (Ahn, 2011). A study of young adults demonstrated that Facebook usage was positively correlated with life satisfaction, social trust and civic engagement (Ahn, 2011). Epidemiological studies over the years have repeatedly demonstrated that as the size of one's social network increases, so does their physical and mental health (Rajani, Berman, and Rozanski, 2011). Thus, virtual communities can positively impact optimal health across social health, as well as physical and emotional health.

Civic engagement and job prospects

Social media can also contribute to adolescents' civic engagement. One feature of social media such as Facebook is the ability to create groups and events, which can be private or publicly available to others. Many of the existing groups on Facebook are dedicated to political, religious or community purposes. This provides adolescents with opportunities for exposure to new ideas and information. A national survey of adolescents found that those who used the Internet more often were more politically aware and civically engaged compared to those who used the Internet less often (Beaumont et al., 2006). Others have used social media e.g. Facebook, and merchandising sites such as eBay to launch advertising and sales initiatives. And, teens skilled in computer science, web design, and app creation have successfully marketed their digital expertise online (Boitnott; wikiHow Staff).

Intellectual health

Intellectual health intersects with social media both in the ways that the brain processes information from social media, as well as in the areas of how the education system is effected by social media. Another critical area of consideration is digital literacy as applied to social media.

Interactions between social media and cognitive processes

The area of social media and cognitive processing continues to grow. One area that has been studied is how the brain processes the social endorsement received on social media posts, via ‘likes.’ A previous study asked teens to review a fictional social media site while undergoing a functional MRI scan (Sherman et al., 2016). The teens first submitted their own photos for posting on the site. The researchers then evaluated the teens’ responses to the “likes” that appeared as a reward. When the subjects saw that their photos had a high number of likes, the fMRI showed that an area of their brains central to the reward system, the nucleus accumbens, was highly activated. Another observation was that the teens were more likely to like a photo if the photo had already received a high number of likes. The researchers suggested that peer influence and conformity played a role in teens’ interactions with social media as well.

Another area of study is how teens’ respond to social media posts showing risky behaviors. In the above study, the teen subjects also viewed photos displaying risky behaviors as well as neutral photos. The researchers observed on the fMRI that the subjects had less activation in areas of the brain involved with cognitive control and response inhibition, suggesting that teens may be developmentally less equipped to make a wise decision when confronted with a perceived risky situation. The immediacy and viral nature of social media may make teens vulnerable to making unhealthy and potentially regrettable decisions.

Digital literacy and advertisements

Digital literacy has been defined as follows: [It] takes into account the full range of skills needed to read, write, speak, view, and participate in online spaces. All of these practices require media literacy, which includes the ability to access, analyze, evaluate, create, and participate with media in all its forms (Turner et al., 2017). Studies have supported that teens often have a more skeptical view towards advertising on social media than may be anticipated. A previous study examined teens viewing targeted ads on Facebook and found the following that teens had skepticism about targeted ads on their profiles, feeling that the ads came into their ‘private sphere’ (Zarouali et al., 2017). Another study examined ads present on social network games and found that adolescents with a critical attitude towards advertising had lower purchase intentions, suggesting that digital literacy training around advertisements could be protective for adolescents in this venue (Vanwesenbeeck, Ponnet, and Walrave, 2017).

Risks to intellectual health from social media

Areas in which there are risks to intellectual health include risks for multitasking on social media at the expense of academic work (described in earlier sections), and the risks of exposure to inaccurate information on social media.

Inaccurate information

Numerous studies have documented the presence and proliferation of inaccurate information on social media related to health. One area of study with robust literature is examining misinformation about vaccinations (McKee and Middleton, 2019; On, Park, and

Song, 2019; Salmon et al., 2005). Another area of misinformation include diets to lose weight, prevent cancer or cure illness. Other common areas include exaggerating the benefits of folk, natural, alternative or unconventional therapies (Shapiro, 2018). It is important to note that a 2018 study in Science found that false news spread faster than the truth (Vosoughi, Roy, and Aral, 2018). An important mechanism in finding incorrect information is that an individual searching for support for a health claim (e.g. “licorice root cures cancer”) can likely find support for that area given the vastness and specificity of web-based searches.

Social media for optimal intellectual health

Creativity

One positive aspect of social media use as perceived by teens is the ability to create and post original artwork, music, or videos. Approximately a quarter of teens report that social media is an “extremely” or “very important” avenue to share their creative projects and enlist viewers. Some teen entrepreneurs have monetized their “views” on YouTube and other online platforms through affiliate partnership, and advertising programs (wikiHow Staff).

Educational system

There continue to be a lack of clarity regarding how best to integrate technology into the classroom (Jimoyiannis, 2010); how to promote the use of technology (or lack thereof) in order to reduce socioeconomic and race-related achievement gaps (Bowles, 2018); identifying which digital hardware and software are best suited for which purpose; how technology affects learning and attention (Chassiakos et al., 2016); and at what ages different types of technology should be encouraged (Radesky, Schumacher, and Zuckerman, 2015).

One of the more common uses of social media in schools is using blogging to help increase skills in creative writing (Ahn, 2011). Further, technology can be used as a means of communication between students as well as between students and teachers to discuss homework assignments and projects.

Spiritual health

Spiritual health remains an understudied area of social media and health research. There are a few observational studies in this area with distinctly different areas of focus, most are not focused on adolescents. One study focused on older adolescents, this observational study examined older adolescents' social media profiles over one year and found that adolescents who represented religion on their social media profile were less likely to post about sex (Gannon, Becker, and Moreno, 2012).

One area with some research related to spirituality is in the role of social media and cancer. A previous study (not focused on adolescents) evaluated social media pages about cancer on Facebook and found that the presence religious terms was positively associated with more positive writing (Picanco, Biancovilli, and Jurberg, 2018).

An interesting study conducted a large-scale sociolinguistic analysis of social media messages of Christians and Buddhists living in the United States. They found that Christians used more social words and fewer cognitive words than Buddhists. These patterns of text were also paralleled by language used in the popular sacred texts of Christianity and Buddhism, with the exception that Christian texts contained more negative and fewer positive emotion words than Buddhist texts. The results suggested that the influence of religious texts on the receivers of

their messages may partially account for the social media text of religious adherents (Chen and Huang, 2019).

Social media for optimal spiritual health

Only two publications were found in this area, but both are intriguing and promising to the role that social media could play in promoting optimal spiritual health. One study of black men who have sex with men described participants' need for a safe space for spiritual reflection and genuine relationships, and that social media could potentially provide such as space (Barnes and Hollingsworth, 2018). One published piece described that spiritual care practitioners should be invested in "listening to, exploring and ministering to people's social media experiences" (Gorrell, 2018).

Multifaceted risk: Problematic Internet Use

Problematic internet use (PIU) is a growing health concern for adolescents. PIU is defined as Internet use that is risky, excessive or impulsive in nature leading to adverse life consequences, specifically physical, emotional, social or functional impairment (Moreno, Jelenchick, and Christakis, 2013). This definition of PIU goes beyond the quantity of internet use and includes the concept of a person's relationship with the internet to define problematic use. Further, the concept of Problematic Internet Use goes beyond the narrower constraints applied in Internet Addiction (Goldberg, 1995; Griffiths, 1999; Young, 1998a, 1998b). Thus, PIU is presented as a risk that may impact all layers of health: physical, emotional, intellectual, social and spiritual. A systematic review of PIU (Moreno, Jelenchick, et al., 2011) found that most studies have focused on measurement of PIU, or associations with negative outcomes (Cao et al.,

2011; Caplan, 2002; Demetrovics, Szeredi, and Rozsa, 2008; Hawi, 2012; Kaess et al., 2013; Kormas et al., 2011). Despite the many measurement tools, to date only one scale for PIU has undergone psychometric validation (Jelenchick et al., 2014; Jelenchick et al., 2015; Jelenchick, Hawk, and Moreno, 2016; Moreno, Jelenchick, and Christakis, 2013).

Evidence for interventions or prevention of PIU remains scarce. A previous study evaluated PIU in a cohort of older adolescents and reported their risk level, then followed them up one year later. Few of the participants had lower scores the following year, suggesting that self-correction of PIU is not an effective population-based strategy (Moreno, Eickhoff, et al., 2019). At present, no evidence-based interventions exist, this remains an area in which research is needed.

Adolescents' experiences and perceptions

As one weighs the risks and opportunities provided by social media, it is important to consider the views and input from adolescents. A survey by Pew found that the majority of teens felt that the effects of social media are neither positive nor negative (45%; Anderson and Jiang, 2018b). Those that believed social media has a positive effect (31%) cited reasons such as connecting with friends/family, ease of finding news/information, meeting others with similar interests, entertainment value, self-expression, and support from others. Teens who felt social media has a negative effect (24%), cited reasons such as bullying, rumor-spreading, decreased in-person contact, unrealistic views of others' lives, distraction, addiction, and peer pressure.

Future directions and trends

Shifting away from brand name

The current focus on platforms and “brand name” social media, and the opportunity to shift policies and approaches away from single platforms is important to address for two key reasons. First, it is important for those who work with adolescents, including educators, health providers, parents, researchers and other adult role models. An emphasis on platforms among the ever-changing array of possibilities may hamper adults’ sense of efficacy or understanding, as they could feel challenged to understand the specifics of any given social media platform, or to keep up with the changing landscape of apps, platforms and profiles.

Second, the platform-specific approach impacts researchers who design approaches centered on a specific platform and face challenges in translation to other sites. As the evolution of social media is likely to continue, a framework for understanding key attributes of social media is needed. This framework would allow advancement in the field beyond the current “brand name” individual platform approach to understand categories of tools and to quickly understand what new platforms have to offer. Further, this approach may allow researchers to design and test interventions focused on particular affordances rather than platforms.

Future directions may include a shift towards the functionalities, or affordances, of platforms. By understanding the affordances of social media more deeply, new platforms can be categorized by the affordances they offer, and thus more quickly understood and leveraged to achieve optimal health (Moreno and Uhls, 2019).

Understanding social media breaks

Given the risks inherent in use of social media, some have called for adolescents to avoid social media. Social media is woven into the fabric of everyday life for nearly all adolescents, and most adults. Thus, putting this genie back in the bottle is not likely to be feasible, acceptable,

or desirable given that social media also has significant benefits and opportunities. However, new strategies are needed to assist adolescents and adults with achieving balance between their offline and online worlds. Innovative ideas may emerge from exploring strategies adolescents already use to moderate their use. One study examined teens' social media, messaging, and video content habits, and found that 58% of US adolescents take significant breaks from social media (Fogg, 2008; NORC at the University of Chicago, 2017). These breaks were voluntary for 65% of the teens; and within this group their motivations varied. Among teens who took voluntary breaks from social media, 8% said social media was interfering with work or school, 24% wearied of conflict and drama, and 20% were tired of having to “keep up with what was going on.” Breaks were more common and longer among teens from households earning less than \$50,000/year. Teens who took voluntary breaks reported “feeling better”, whereas teens who took involuntary breaks (devices lost or taken away) reported more anxiety and a desire to return to social media. Thus, a better understanding of these breaks, and ways to promote them without mandating them, may be a useful strategy to consider towards optimal health.

The next new technologies

While this report is focused on social media, it would be remiss to avoid mentioning two new technologies that will or already do interface with social media. These newer technologies may augment or change the risks and opportunities presented to adolescents via social media.

Virtual reality

Virtual reality (VR) is an interactive, computer-generated experience which creates a simulated 3 dimensional environment (Bardi, 2019). Users are immersed in an alternate world

which provides input to multiple senses, including vision and hearing through a specialized headset. Virtual reality programs are being developed for uses such as entertainment, gaming, research, education and training, engineering, architecture, and assistive technology (Bardi, 2019). VR programs are being used by the aviation industry, the military, and in medicine (Wallis, 2006) including for mental health treatment. Companies such as Facebook, which bought the pioneering Oculus VR start-up, as well as Google, Samsung, Sony, and others are actively engaged in VR research and development. Thus, it is likely that we may soon see VR intersecting with social media.

Artificial intelligence

The English Oxford Living Dictionary defines artificial intelligence (AI) as “The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.” AI has become integrated into teens’ daily lives in multiple ways, among them:

- Siri, Alexa, Cortana, and “Hey Google” assistants can perform tasks such as check the weather, suggest the fastest driving route to work, play music, or order items online.
- Facebook uses AI to recognize faces in pictures posted; to personalize newsfeeds; to select ads based on searches or words/phrases used in messaging.
- Pinterest uses AI to see or categorize objects posted and then recommends other similar products/items.
- Instagram uses AI to recognize emojis. Instagram AI can interpret the emoji used and recommend other or new emoji’s.

- Chatbots are being used by online retail companies to “talk/text” with customers about questions they may have about a product or a service.

A previous study examined teens with variable levels of education as they interacted with the AI chat agent Bzz (a chatbot) that answered questions about sex, drugs, and alcohol. The chatbot was viewed positively by teens, even those who did not have experience in this realm, and the frequency of use and duration of conversations were high, when compared to search engines and other sources of information. Chatbots are becoming more popular and can serve as a source of education, health promotion and risk reduction for teens (Crutzen et al., 2011).

As VR and AI become more widely available and utilized, further research on the effects, benefits, and risks of these technologies is ongoing and encouraged.

Critical gaps in the literature: Calls to action towards optimal health

Adolescents are uniquely positioned to be particularly vulnerable to the effects of social media, both positive and negative (Ellison, Steinfield, and Lampe, 2007; Lenhart, Hitlin, and Madden, 2005; Lenhart et al., 2007; Pew Research Center, 2010). As the field of social media research moves from its infancy to its adolescence, further work is needed in several arenas towards the goal of optimal health. Based on the review of the literature described above, five areas are described below to highlight critical areas in which further research is needed to advance optimal health.

First, **the bulk of research on social media to date has focused on risk**. Studies have observed and evaluated displays of risky content, and the influence this content may have on adolescent behavior. Studies have examined associations between online risk display and offline risk behavior. The majority of studies documented in the literature, and this report, represent

illuminations of risk. Only very recently has there been a shift towards a better understanding of how social media may promote wellness, healthy behaviors or optimal health. The Technology and Adolescent Mental Wellness program launched a national funding initiative to fund research projects focused on the role of digital technology in adolescent mental wellness

(www.tamprogram.org). Very few studies have examined the role of social media in how adolescents leverage social media to positively represent specific health conditions (Kelleher, Giampietro, and Moreno, 2015), or the potential role that social media could play in promoting independence and self-efficacy in adolescents' illness management (Malik et al., 2019). Studies are urgently needed to understand the role that social media may have on improving optimal health and well-being in daily life.

Second, studies that **expand and deepen observational research on social media platforms are needed**. Past studies have described content and posting timing on single platforms such as MySpace, Facebook and Twitter (Hinduja and Patchin, 2008; Moreno, Briner, et al., 2010; Moreno, Parks, et al., 2009; West et al., 2012). The focus on big data has allowed examination of huge buckets of data snippets from single platforms. However, studies that fully harness the social aspects of social media by studying interactions between peers, distribution of content through a social network, or content posted on different platforms by an individual is needed. Previous work suggested that “currently research is preliminary and descriptive, and we need innovative methods and detailed in-depth studies to gain greater understanding” (McCreanor et al., 2013). These types of studies would provide understanding of how health-related content is distributed and shared through networks, and potentially identify approaches that can bridge social media and other offline approaches for successful interventions.

Third, the **interactive nature of social media sites provides new opportunities for bridging online and offline communication between adolescents and trusted adults**. Such interventions must be developed with an understanding of the privacy expectations within each network. Individuals who are able to view social media content and comfortable with communicating about it would be able to conduct such an intervention. Previous studies support that youth are willing to interact with adults about content posted or viewed online (Egan, Koff, and Moreno, 2013; Gritton et al., 2017; Moreno, Grant, Kacvinsky, Moreno, et al., 2012). Many successful interventions described in the physical health section above involve both online and offline intervention components. Preliminary work has explored communication strategies for these encounters and potential intervention opportunities (Moreno, Grant, Kacvinsky, Egan, et al., 2012; Park and Calamaro, 2013; Whitehill, Brockman, and Moreno, 2013). However, further work is needed to understand how this knowledge can be translated into clinical practice or educational interventions appropriate to different settings, such as schools, clinics or universities (George, Rovniak, and Kraschnewski, 2013).

Fourth, **research is also needed into how adolescents are exposed to promotional content from marijuana, tobacco and alcohol companies across social media sites**. Regulations or new, technology-based methods to avoid displaying such content to underage individuals may be possible and warranted. There are opportunities to engage youth in this process to understand their perceptions and interpretations, and in generating solutions. One study engaged youth in discussing their exposure to marijuana promotions on social media, youth identified two realistic prevention strategies for states to consider: 1) to limit access to social media pages focused on recreational marijuana, similar to age-gating for alcohol pages, 2) to place restrictions on youth-focused content on social media, with youth input into what

constitutes youth appeal (Moreno, Gower, Jenkins, Kerr, et al., 2018). This study suggests that youth can be insightful partners into crafting policy that is informed and potentially effective. Further, opportunities for targeted prevention via messaging for these substances or other risky health behaviors are also possible and underexplored. The same social marketing approaches that may be used to promote risky content on social media can perhaps be harnessed to promote alcohol abstinence before age 21 and responsible use thereafter, or contraception access.

Fifth, at present there is much attention being paid to overuse of smartphones, the internet and social media. Lay press have covered articles about Google executives refusing to allow their children to use social media, and on newer tools to self-monitor one's own media use via the "screentime" application on iPhones. The American Academy of Pediatrics has released a 'Family Media Use Plan' that has not been formally evaluated via research. Despite this interest and attention, **there is no evidence base for prevention or intervention approaches for problematic internet use.** There are two major issues at hand: 1) few opportunities to achieve funding for prevention or intervention with problematic internet use, and 2) scholarly focus continues to focus on renaming and measuring the phenomenon (e.g., internet addiction, social media addiction, problematic interactive media use, problematic internet use, internet overuse). One promising area of research is noted above, teens' engaging in social media breaks. Action is needed to develop tools and resources to help families and teens.

Conclusion

Adolescents today have grown up immersed in digital technology, with iPads, smart phones and social media at their fingertips. While adolescents still engage with traditional media such as television and radio, they typically do so via streaming and digital tools. Thus, today's

adolescents truly are the “digital generation” who are accustomed to being both consumers and creators of media (Palfrey and Gasser, 2012). This paper described ways that adolescents interact with media, particularly social media, as well as risks and opportunities. This report illustrates areas in which research is abundant, such as social media and alcohol, and areas in which evidence is lacking, such as in social media and well-being, and well as interventions for PIU. It is hoped that this report can be informative in discussions to promote optimal health for teens.

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