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Influence of New Media on Adolescent Sexual Health: Evidence and Opportunities

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Preface

This paper was written under contract HHSP23320095649WC, Task Order No. HHSP23337005T with the Administration for Children and Families (ACF) and the Office of the Assistant Secretary for Planning and Evaluation (ASPE) within the U.S. Department of Health and Human Services. The goal of the task order is to develop a working knowledge base about the use of new media (such as the Internet, social networking sites, cell phones, online video games, and MP3 players) among adolescents and the potential impact on their sexual activity. The literature review presented in this paper has the specific goals of (1) fostering an understanding of the types of new media available to adolescents, outlining both the platforms that adolescents use to access media and the media itself, and (2) illuminating the potential relations between new media and adolescent sexual activity. The intended audiences are policymakers, public health professionals, researchers studying adolescent sexual health and/or media use, and program developers.

This research was conducted in RAND Health, a division of the RAND Corporation. A profile of RAND Health, abstracts of its publications, and ordering information can be found at www.rand.org/health.

Introduction

Sexual risk behavior among U.S. adolescents is a major public health concern. Nearly 800,000 young women aged 15–19 years become pregnant in the United States each year, most of them unintentionally,[1] and half of the roughly 19 million new sexually transmitted infections (STIs) diagnosed each year are among 15- to 24-year-olds.[2] A great deal of research attention has been devoted to understanding what puts adolescents at risk for these outcomes, given their enormous social, economic, and public health consequences.[3] Yet it is clear that we need to know more and do more to address risky sexual activity among youth. One route is through the identification of additional contributors to this behavior that have been understudied—factors that put youth at risk and levers that can be used in preventive interventions.

Over the past decade, new research has identified media as having the potential to serve both roles.[4-6] Much of this work focuses on traditional media, such as television, film, music, and magazines. But the media landscape is evolving at a startling pace, and a greater diversity of content, new types of media, and new platforms for delivering media are constantly emerging. The number of television channels received in homes has moved from three to well into the three-digits, allowing youth to choose from a much wider variety of programming than in the past. The variety of content available on the Internet is practically limitless and includes what were previously considered "other media," such as music, television, games, and films. Moreover, content can now be viewed or used on computers, MP3 players, handheld video players, and cell phones, as well as on television sets, regardless of whether it was initially "television" or "Internet" media. This new portability makes it possible to use media in a variety of new settings and, conceivably, throughout the day. Adolescents are immersing themselves in these and newer media, with social networking sites, cell phones, and instant messaging playing major roles in their everyday lives. Thus, it is critical that researchers begin to systematically study new media and new platforms to determine their influence. Given the emerging evidence linking more traditional media use with initiation of various sexual activities, to the extent that new media contain relevant sexual messages, researchers may find that these media are also linked to developing sexual attitudes and behavior and could affect sexual risk-taking and health (in either a positive or negative manner) as well.

In this paper, we review the literature linking media use to adolescent sexual attitudes and behavior, focusing primarily on newer media. By "new media," we mean content created and delivered via the Internet, including social networking and other specialized kinds of websites, as well as content delivered on other digital platforms, such as cell phones. We cover what may be largely unintended effects of exposure to sexual content in these media and review new-media interventions designed to improve adolescent sexual health. Our goal is both to clarify what is already known and to identify where there is the strongest need for further study in this rapidly changing area of adolescent life.

We begin with a brief description of the state of adolescent sexual health in the United States. Then, we discuss some of the more prominent theories of media effects on youth, including those that are a particularly good fit with the characteristics of newer media, such as content creation, sharing, and portability. In the same section, we briefly describe the empirical evidence regarding the relationship between traditional media and adolescent sexual attitudes and behavior. We then discuss what is known about the use of new media among youth: what is used, how often, by whom, and (less often) for what purpose. The data show that, as one would expect with newer content and platforms, this is a rapidly shifting landscape. Nonetheless, in that section, we attempt to identify emerging trends and point to media that will play an important role in adolescent lives in the next few years. After that, in a section that makes up the bulk of this paper, we present a detailed review of the small but increasing body of research examining new media content and new media effects as they relate to adolescent sexual health. We focus on associations between the use of content and adolescent outcomes that are unintended by content creators and distributors, or at least not meant as programmatic interventions to improve sexual health. A subsequent section reviews the latter. Most of the programs that we describe have been evaluated, but because this area is so new, we also include (in the appendix) an overview of several programs that are planning evaluations that are not yet complete. Finally, we conclude with a discussion of what is known about new media and adolescent sexual health and where there are particularly important gaps in knowledge that suggest priorities for future efforts in this arena.

Adolescent Sexual Behavior and Reproductive Health

Sexual intercourse is the most commonly studied form of adolescent sexual behavior, and there is a substantial literature on the determinants of initiation of coitus.[7-10] Forty-eight percent of high school students have ever had sexual intercourse; 35 percent are currently sexually active.[11] Much is known about the predictors of sexual debut. For example, studies show the influence of perceived parental[12] and peer[13] norms on adolescent sexual activity and risk-taking.[14] Race and ethnicity are key predictors of age of intercourse initiation, as is gender, with minority youth and males more likely to have sex at a younger age.[15] According to the most recent Youth Risk Behavior Surveillance survey, a study of U.S. high school students conducted by the Centers for Disease Control and Prevention (CDC), more black male (72.1 percent) and Hispanic male (52.8 percent) students have ever had sex than black female (58.3 percent) and Hispanic female (45.4 percent) students. These rates compare to 42 percent among white males and females, who do not differ from each other in terms of the percent who have ever had sex. Possible explanations of gender differences include the differential consequences of unintended pregnancies and the opportunity costs of sexual activity, as well as differences in parental supervision.[16, 17] Racial and ethnic differences may stem from socioeconomic factors that limit opportunities for poor youth, cultural factors that consider parenting a path to adulthood among African-American youth, and differences in the normative environment surrounding sexual activity and parenting.[18] Social bonds, including strong relationships with parents, schools, or religious organizations, serve as protective factors, reducing rates of early sex.[19]

Early intercourse appears to be part of a cluster of adolescent problem behaviors. It correlates with substance use, truancy, and aggression and is also well predicted by indicators of behavioral deviance.[20] Intercourse at any age places an individual at risk for pregnancy and at greater risk for STIs. But early intercourse initiation poses special risks, with an increase in the odds of both pregnancy and STIs when it occurs at a younger age. As noted at the outset of this paper, rates of pregnancy and STIs are high among U.S. teens, and delaying the age of sexual debut may be one method of addressing these high rates.

In comparison to the study of intercourse, researchers have paid little attention to other forms of sexual behavior. However, carefully conducted surveys of a Los Angeles County high school and a nationally representative group of adolescent males (aged 15–

19 years) indicate that substantial proportions of adolescents who have not engaged in vaginal intercourse have engaged in other sexual activity involving genital contact, such as mutual masturbation and oral sex.[21-23] Because noncoital activities are an important part of adolescent sexuality, and because some of them pose a risk of STIs and may be precursors to the initiation of coitus,[24] researchers are becoming more interested in understanding and predicting these behaviors.

Researchers have also looked at the predictors of sexual risk-taking—sex without condoms, sex without birth control, or sex with multiple partners in a short period of time (e.g., one year). Many of the factors that predict intercourse initiation also predict these risk behaviors.[25, 26] These behaviors are the primary risk factors for STIs and pregnancy. As noted earlier, nearly 800,000 young women aged 15–19 years become pregnant in the United States each year.[1] This represents a pregnancy rate of 71.5 per 1,000 women[1] and is one of the highest rates among industrialized nations.[27] Half of the roughly 19 million new STIs diagnosed each year are among 15- to 24-year-olds.[2] That amounts to one STI for every four sexually active youth.[28] A recent study conducted biological testing for five STIs among a nationally representative group of females aged 14–19 years. Twenty-four percent tested positive for at least one of these infections, and among those who were sexually experienced, the prevalence rate was 37.7 percent.[29] Fifteen percent of 9th–12th graders report having four or more partners in their lifetime. Among sexually active adolescents in this age group, only 63 percent report that they or their partner used a condom the last time they had sexual intercourse.[11] Given these high rates of risk-taking, the number of pregnancies and STIs experienced by U.S. adolescents is unsurprising.

The challenge to promoting sexual health in the United States has been to identify addressable risk factors for adolescent intercourse, sex outside of a monogamous ongoing relationship, and unprotected sex that will have maximum impact on a large number of youth. Given its broad reach and the potential to control exposure, media may be one such modifiable risk factor. For the same reasons, media may also represent a particularly useful tool when employed as part of a sexual health intervention. Both possibilities depend, of course, on whether media use is related to sexual attitudes and behavior. In the next section, we review theories and evidence bearing on this question.

Theories and Evidence Linking Media Use and Adolescent Sexual Attitudes and Behaviors

Importance of Sexual Content. According to most theories of media effects, the influence of media depends largely on the content it contains. Much of the research linking media and sex—particularly studies of attitudinal effects—has focused on television. Television viewing remains the most common medium and platform, and it makes up the largest chunk of adolescents' media use, accounting for 4.5 hours of media time out of nearly 11 total hours spent with media daily.[30] Television includes a great deal of sexual content, creating the strong potential for observing such effects. A state-of-the-art content analysis of 1,154 programs representative of the content airing between 6 a.m. and 10 p.m. Mountain Standard Time on 10 channels in the 2004–2005 television season found that 70 percent of programs contained sexual content. Among those with such content, there were an average of five scenes with sex in each hour of programming.[31] Thus, there is great opportunity for television to influence adolescents' developing views about sex.

However, adolescents use a variety of media[32] and increasingly engage with these media on diverse platforms.[33] The amount of sexual content that youth encounter varies across these platforms. Looking at television, music, movies, favorite Internet sites, and magazines used by a sample of black and white youth from the Southeastern United States, Pardun and colleagues[34] found that, overall, 11 percent of these media contain sexual content. However, the content is concentrated much more strongly in music (40 percent contained sexual content) than in movies (12 percent) or television (11 percent). And only 6 percent of the Internet sites they examined contained sexual content. Other studies might produce different estimates for a given medium. The analysis did not look at a representative sample of each medium, but, rather, focused on the "vehicles" (television programs, music artists) used by a particular sample of youth. However, it does provide a rare comparison of multiple media types using the same coding scheme and metric (time presented). The wide variability in sexual content across types suggests the importance of understanding the extent and nature of sexual portrayals in newer media as well.

Outcome Expectancies. While all theories of media effects emphasize the importance of content, they make differing claims about which aspects of content are

important to measure. Social learning theory and its close relation, social cognitive theory,[35] argue that screen-media exposure leads to the cognitive acquisition of behaviors along with their expected social, emotional, and cognitive consequences. Exposure to portrayals suggesting that a behavior (sex) will lead to social disapproval or other negative outcomes (e.g., pregnancy, STIs) is likely to foster negative attitudes toward the depicted behavior, not promote its enactment. Thus, the content portrayed (sexual or not) and the specific nature of the content (consequences of sex) are critical to measure if one wishes to accurately predict subsequent beliefs and behavior. One of the findings from a RAND study linking television exposure to sexual behavior is illustrative. Overall, teenagers viewing more television sexual content at the time of a baseline survey had a greater likelihood of intercourse initiation and initiation of new noncoital behaviors by one year follow-up relative to those who viewed less. However, in the subgroup of African-American viewers (and not among members of other racial/ethnic groups), those who viewed programs that portrayed the risks of sexual activity had a lower likelihood of intercourse initiation over the subsequent year.[36]

Norms and Self-Efficacy. The Integrative Model of Behavior Change[37] builds on social cognitive theory and integrates it with other theories, such as the Theory of Reasoned Action,[38] to predict that media exposure will influence behavior through shifts in behavioral intentions, which are themselves a function of attitudes, norms, and perceptions of self-efficacy acquired through media and other sources. Thus, media users learn not only what is likely to be the outcome of sexual activity, but also whether others engage in it or approve of it, and come to see themselves as more or less able to engage in similar activities themselves. The RAND study[39] also looked at these issues, finding that the relationship between exposure to sexual content on television and intercourse initiation could be explained in whole by shifts in viewers' perceptions of themselves and their ability to negotiate sexual situations (safe sex self-efficacy), their perceptions of peer norms regarding sexual activity, and their beliefs about the consequences of engaging in intercourse. This strongly supports the integrative model's predictions.

Closely related to social cognitive theory are script theories of media use.[40] These theories argue that individuals acquire a diverse and ordered set of beliefs as a result of exposure to media portrayals. Individuals not only learn whether a behavior is common and whether it will result in positive outcomes, but they are also presented with a series

of ordered events describing how and when it is appropriate to enact the behavior (i.e., procedural knowledge). These scripts are not always used, but when events or circumstances in the environment trigger them (for example, a first date or an unexpected kiss), they may be acted out. Aubrey and colleagues[41] have applied this theory to sexual media, demonstrating correlations between television use and college-aged females' and males' expectations regarding timing and variety of sexual activities (respectively). Others have used script theory to explain the effects of exposure to sexually objectifying portrayals and portrayals of sex as a game, arguing that these lead to the acting out of roles in which boys pursue sex and girls use it as leverage.[42-44]

Selective Exposure. Other theories may better predict the effects of new media, which offer a greater opportunity to select the content one prefers and allow the user to create and distribute, as well as receive, content. Furthermore, such content is often discussed and exchanged within social networks. The Media Practice Model[45] argues that media use is selective, with users focusing on content related to the predominant issues of interest to them. Thus, adolescents whose interest in sex is growing as a result of puberty and other forces are more likely to select media with sexual content. Three studies have confirmed such a relationship empirically.[46-48] Other work suggests that youth who use media specifically as an opportunity to learn about sex may be more influenced by their exposure.[41]

Selective use of media in a social context may also set up the conditions for the "downward spiral" theorized by Slater and colleagues in relation to media violence.[49] They note that social groups may form around a shared interest in particular media portrayals, particularly on the Internet, where there is great opportunity to meet others playing the same game or watching the same video, or to send links (URLs) to members of one's existing social network, referring them to online portrayals so they can share one's experience. This creates homogeneity in user preferences and characteristics, likely to lead to social reinforcement of the messages portrayed. That is, youth who are becoming interested in sex may encounter other sexually interested youth when they view sexual media online. And these youth are likely to express approval of sexual messages and portrayals. Thus, one might expect greater impact on users in this venue, compared to the same portrayal watched on a television set, particularly if viewers report chatting on the site, engaging in instant messaging, or sharing links with friends.

Portability. New media are often viewed via portable platforms, such as cell phones and MP3 devices. As such, there is opportunity for increased exposure, as well as more private exposure. Roberts et al.[32] have written about the implications of media privatization (the viewing of media while alone) with regard to media effects. They argue that "comments from others may facilitate, inhibit, or otherwise guide understanding and/or acceptance of a given message" (p. 12). This is consistent with theories of "parental mediation" of media messages: Parents and other adults can greatly alter the impact of messages when they discuss them with youth.[50] With greater portability of media, we might expect that messages that promote sexual risk will have a greater influence on youth who encounter them—and perhaps also that health-promoting messages will have less impact.

Multitasking. A final area of theory that is particularly relevant to new media is the effect of media multitasking—either using media while engaging in other, nonmedia, activities (e.g., doing homework, washing dishes) or using multiple media at the same time. In a 2010 report on young people's media use, the Kaiser Family Foundation found that a total of 10 hours and 45 minutes of exposure are packed into 7.5 hours of use. That is, about 30 percent of adolescents' media time is spent using more than one medium simultaneously. This phenomenon seemed to have been enabled partly by the portability of media, which can now be viewed and used on laptops, cell phones, and other devices that youth carry throughout the day. How might this influence media effects? Message processing theory might predict that multitasking distracts users from sexual information and thus reduces the effects of media exposure. Indeed, Jordan and colleagues[51] found that youth who did homework or other household tasks while using media were *less* affected by media content. In contrast, Collins[52] found that exposure to sexual content on television was more strongly related to sexual initiation among those who reported using the Internet at the same time that they watched television. It is possible that the resolution to these conflicting findings lies in what youth are doing when they are online. Collins[52] conjectured that youth may be looking for additional information about what they are watching on television, or discussing what they are watching with friends, and that this enhances the impact of the content, while youth who are engaged in nonmedia multitasking are simply distracted. Regardless, both the Jordan study and the Collins study indicate that, from a theoretical standpoint, it may be important not only

to know what media are used and their content but also to learn what else is being done during media use.

Evidence does suggest that use of traditional media is a predictor of both sexual activity and sexual risk among adolescents. A growing number of studies link sexual content in media with adolescents' attitudes and sexual activities. In particular, three longitudinal studies demonstrate prospective relationships between prior exposure to sexual content in the media and subsequent changes in sexual behaviors, after controlling for likely confounding variables.[36, 53, 54] In the first of these studies, Collins and her colleagues at RAND[36] surveyed a national sample of 2,002 youth aged 12–17 years. Youth reported the frequency with which they watched a list of television programs that varied in their sexual content and their lifetime experience with a variety of sexual behaviors; they also answered questions tapping a variety of background characteristics (e.g., religiosity, parental monitoring). They were surveyed again one year later. The researchers found that the amount of sexual content in the programs viewed at baseline predicted teens' advancing sexual behavior by the first follow-up. Baseline virgins who saw more sex on television were more likely to initiate intercourse over the subsequent year than those who saw less. Exposure to greater amounts of sexual content at baseline also predicted progression to more advanced noncoital activities over the one-year study. (Such activities tend to occur in a sequence, e.g., from touching of genitals to oral sex.[55]) Both associations held after controlling for more than a dozen variables that might confound the relationship.

Brown and colleagues[53] subsequently expanded on this work by linking exposure to sexual content in a broader variety of media to intercourse initiation and advances in noncoital behavior. They surveyed 1,017 North Carolina youth when they were 12–14 years old and again two years later. Sexual content exposure in television, music, movies, and magazines predicted advancing sexual behavior, even after other variables were controlled for statistically, but only among white youth, who comprised about half of the sample. No relationship was observed among African-American teens, who made up the other half of the study sample.

Most recently, Hennessy and colleagues[54] analyzed web surveys of 506 Pennsylvania teens aged 14–16 years at baseline and followed them annually for a total of three surveys. They examined television, music, movies, magazines, and video games with a sexual content exposure measure. Data were analyzed using growth curves, testing

whether changes in exposure to sexual media over time are correlated with changes in sexual behavior during the same period. They found that changes in exposure to sexual content were associated with changes in behavior among white teens (the r = 0.46 correlation just missed statistical significance, perhaps due to the small sample), but there was no association among African-American youth.

The RAND study, in a subsequent analysis that included an additional wave of survey data, also linked sexual media use to pregnancy among sexually active teens.[56] An additional study linked sexual media exposure in the form of music videos to STIs.[57] In addition, a wide variety of studies have linked exposure to sexual media to more permissive or recreational attitudes toward sex among youths and college students, or have found cross-sectional associations between media use and sexual behavior.[6] Some of the attitudinal studies provide evidence of causal links between media use and short-term changes in attitudes and beliefs. While none of the studies of behavior reached causal conclusions (conducting a study that manipulates sexual content exposure to see whether it changes sexual behavior would be unethical by most standards), they provide some of the strongest evidence possible regarding the plausibility of such a relationship.

Although these studies focused on the risks of sexual content exposure, it is important to keep in mind that media, regardless of platform, are not inherently positive or negative in their influence. While emerging work has demonstrated increases in sexual behavior and risk as a consequence of media exposure, teens cite television, magazines, and the Internet as sources of information about sexual health.[58] Media can be a "healthy sex-educator" and a useful tool for programs and interventions designed to reduce sexual risk among youth. One study interviewed a national sample of teens shortly after the airing of an episode of *Friends* that contained information about condom efficacy.[58] As a result of viewing, many teens reported having a conversation with a parent or other adult about how effective condoms are for preventing pregnancy, and those who did so came away from the program with a more accurate understanding of the issue. This illustrates the power of media, including entertainment media, to reach youth with sexual health information. So-called "edu-tainment" has been used to convey information about sexual health in soap operas,[59] on the program *ER*,[60] and on entertainment programming appearing on Showtime and UPN (the latter occurred in combination with public service announcements and a website).[61] And, of course, public service announcements and

information campaigns have often been used to address sexual health issues, with some evidence of success.[62] Indeed, new media such as social networking sites, blogs, and Twitter are rapidly being adopted for this purpose, a phenomenon that we will discuss more in the latter sections of this paper.

Prevalence and Trends in New Media Use

Both the usefulness of new media in addressing issues of sexual health and their potential role in placing youth at risk depend critically on the extent with which such media are in use. In 2010, the Kaiser Family Foundation[30] surveyed more than 2,000 young people aged 8–18 years from across the United States regarding their media use. Results indicate that media continue to play a central role in young people's lives. Youth spend a total of 10 hours and 45 minutes each day using various media, including television content, music/audio, computers, video games, print material, and movies (and excluding texting and talking on cell phones, though the use of cell phones as a platform for other media, such as music or video, was included). More time was spent with television content than any other medium by far, with television accounting for nearly 4.5 hours of media use. Music/audio was second, accounting for about 2.5 hours of time. Nonetheless, newer media—computer use and video game use, accounted for 1.5 and 1.25 hours of youths' media time, respectively. And a large minority (20 percent) of media consumption (about two hours) took place using mobile platforms, such as cell phones, laptops, and handheld game players, confirming that media consumption is now extremely flexible in terms of time and place of use. This may account for the somewhat counterintuitive rise in time spent with television over rates observed in 2005, even as more time was spent with newer media.[30] Next, we review in more detail how and how much adolescents are using various new media. We begin with the Internet and activities based on this platform, including social networking, game playing, and video posting/viewing. We then move to the topic of cell phones, describing data on the prevalence of their use and the activities for which they are used. A selective overview of adolescent media use is presented in **Table 1**.

Table 1. Time Spent with Various Media in a Typical Day Among U.S. 8- to 18-Year-Olds

Media Type	Hours:Minutes
Television	<u>4:29</u>
On a television set	3:28
On the Internet	0:24
On an iPod/MP3 player	0:16
On a cell phone	0:15
On a computer (DVD/video)	0:06
Music	2:19
iPod/MP3 player	0:41
Radio	0:32
Computer	0:32
On a cell phone	0:17
<u>Compact disc</u>	<u>0:17</u>
Print	0:38
Movies (in-theater)	0:25
Computer	1:29
Social networking	0:22
Games (on- and offline)	0:17
Video sites	0:15

Media Type	Hours:Minutes
Instant messaging	0:11
Email	0:05
Other websites	0:11
Other	0:08
Video games (not online or on computers)	1:13
Console	0:36
Handheld device	0:21
On a cell phone	0:17
Texting	1:35
Talking on a cell phone	0:33

Source: Rideout VJ, Foehr UG, Roberts DF. *Generation M2: Media in the lives of 8- to 18-year-olds.* Menlo Park, CA: Henry J. Kaiser Family Foundation; January 2010.

Note: The study did not include texting and talking on a cell phone in the estimate of total time with media. Some numbers have been calculated from data tables, and some forms of media studied have been omitted from the table.

TABLE DESCRIPTION: This table presents time spent, in hours and minutes, with various media in a typical day among U.S. 8- to 18-year-olds.

More than 90 percent of teens are currently online—a greater percentage than any other age group.[33] Sixty percent of teens have a desktop or laptop computer.[63] Eighty-four percent of young people report that they have home Internet access, and the majority of teens (59 percent) have high-speed lines.[30] Online activity permits exposure to any content residing there, as with traditional media. But it also affords a chance for youth to create and distribute their own messages. Sixty-four percent of online teens aged 12–17 have created and posted content on the web, ranging from having a personal webpage

to blogging and posting artwork, photos, and videos.[33] Many online activities are also highly social relative to traditional media use, including social networking, email, chat room participation, and instant messaging, as well as video games that can be played by multiple online players and using voice-over-Internet protocols that permit conversation between these players. Indeed, the most popular online activities among youth are social networking (accounting for 22 minutes of use), game playing (17 minutes), and visiting video websites (e.g., YouTube; 15 minutes).[30] Very few teens (8 percent of those with Internet access) use the Internet to access "virtual worlds," such as Second City.[64] Importantly, 31 percent of online teens use the Internet to get health information, and 17 percent of online teens use it to get information about sexual health and/or the health consequences of substance use.[64] Girls spend more time on social networking sites than boys and less time game-playing and watching or posting videos. As with traditional media, black and Hispanic youth spend somewhat more time with most of these activities, relative to white youth.[30]

Facebook is currently the most commonly used social networking site on the Internet, with half a billion current users.[65] A 2010 Pew report indicates that 73 percent of American teens with Internet access now use social networking websites, a significant increase over prior estimates by Pew. In 2006, researchers found that half of online teens (55 percent) used social networking sites; 65 percent did so in a 2008 survey. Older girls (aged 15–17) are the most likely to have a social networking site. Some trends in the data also suggest differences in site use by race/ethnicity, with more use of MySpace among Hispanics and African-Americans and more use of Facebook among whites, but because of small sample sizes, these data are inconclusive.[64]

About half of all youth reported playing a video game on the day preceding survey participation.[66] In comparison to the 17 minutes youth spend playing online games, they spend about 1.25 hours using video games on other platforms. Most of that time is spent on a game console attached to a television (36 minutes),[30] and 77 percent of teens own a game console.[67] Time spent gaming on handheld players and cell phones is about equal (21 and 17 minutes, respectively).[30] Pew reports that 55 percent of teens own a handheld game player, with 67 percent of 12- to 14-year-olds owning one, compared with 44 percent of 15- to 17-year-olds. Ownership does not vary by household income or by race/ethnicity.[67] Younger males are the most frequent players of offline games, though about half of older girls play. Although the use of these platforms is less social

than online gaming, most teens (76 percent) report playing games with others at least occasionally.[30]

Videos are both downloaded and posted on the Internet, offering opportunities for participation and media creation, as well as exposure. Twenty-two percent of Americans have shot their own videos, and 14 percent of those users have posted them online. Young adults aged 18–29 years and men are the most active users of online video (70 percent and 53 percent of users, respectively). They more often receive video links, send video links to others, watch videos with others, rate them, comment about them, upload them, and post links online. Fifty-seven percent of online teens aged 12–17 watch video online, and 14 percent have posted videos online.[66] The most popular site for web videos is YouTube, with almost 5.4 billion views at most recent count. Although the use of other sites, most notably Hulu (which allows users to view television programming from all but one of the major networks, as well as other sources), is growing, 40 percent of all online video-viewing is attributable to YouTube and only 2 percent to Hulu.

Other online activities are less common. Use of email has declined among teens over the past few years. The overwhelming majority, 73 percent, still use it, but only 14–16 percent use it daily,[33, 68] and it accounts for only 6 percent of time spent with computers by youth.[30] In contrast, instant messaging accounts for 13 percent of time spent with computers, and social networking accounts for 25 percent.[30] Pew estimates that 26 percent of teens send and receive instant messages on a daily basis, and the percentage who send messages through social networking sites is the same.[67] According to another Pew report,[64] 14 percent of online teens currently blog, down from the 28 percent of teen Internet users, as estimated in a 2007 report.

One of the newer online social media platforms is Twitter, a social networking and blogging service that allows posts of only 140 or fewer characters. Currently, few of its users are youths: Seven percent are 18- to 24 years old and fewer than 4 percent are 17 or under. It boasts only 20 million recent visits across age categories, less than a fifth of the number of Facebook visitors.[65] Pew reports that 8 percent of Internet users aged 12–17 use Twitter, though numbers are higher among the older teens in this group, particularly girls. Thirteen percent of girls aged 14–17 years report using it.[64]

Nearly 90 percent of all Americans are mobile (cell) phone users.[69] The Kaiser report estimates that two-thirds of youth aged 8–18 years own their own cell phone.[30] This

closely tracks with an estimate of 71 percent ownership among 12- to 17-year-olds, based on a 2008 Pew survey.[67] Both organizations find that the use of cell phones rises rapidly at about age 14, and the vast majority of older teens (84–85 percent of those 17 and older) have a cell phone. Teens from families of lower socioeconomic status are somewhat less likely to own a cell phone (62 percent of those with household incomes below $30,000 own a cell phone, while 79 percent of those from households with incomes of $75,000 or more do so). Cell phone ownership does not vary by teens' race/ethnicity or gender.[67] However, teen girls use their cell phones for talking and texting more often than do boys.[67]

In general, more teens use their cell phones for talking than texting.[67] But the overall *frequency* with which cell phones are used for texting is higher, indicating that those who do text do so with great frequency: Youth spend an average of 33 minutes talking on their cell phones each day but an average of 1.5 hours sending and receiving texts.[30] This fits with statistics regarding the general population of U.S. cell phone users, who are more often sending text messages than making calls. U.S. mobile users send an average of 357 texts per month and make an average of 204 calls.[69] Teens make up the vast majority of those using text messages, with youth aged 13–17 years sending or receiving about 1,742 text messages per month. Increasingly, cell phones are also being used to access email and the Internet. The number of persons who did so daily last year was about 22 million.[69] Cell phones are also used to play games (17 minutes/day among youth), watch television content (15 minutes/day), and listen to music (17 minutes/day).[30] Indeed, cell phones are becoming indistinguishable from the MP3 players owned and used by 74 percent of teens.[67]

A number of lessons emerge from these data. Among them is the finding that television content still dominates the media landscape. While new media combined are taking up more and more of teens' time and television programming is increasingly being viewed on platforms other than a traditional set, television is still, by far, the most central aspect of adolescents' media lives. No other activity comes close in terms of time spent with a particular form of content or a particular platform. In terms of time spent online, YouTube, game playing, and social networking sites are the key activities and are equal-attention grabbers for youth, though as we will note below, they have not been equally attended to by researchers. Cell phones are increasingly the platform of choice: When time spent texting and talking is included in estimates, teens spend more time with them

than with computers and use them for a full range of activities. Cell phones are used for listening to music, watching television content, and playing games (when combined) more than for talking. Text messaging is not yet the preferred mode of phone communication for the majority of youth, but among those who use it, it is vastly preferred over talking.

Though largely expected, some other patterns are also apparent and should be emphasized. First, a substantial portion of the time spent with newer media involves creating content and interacting with others—posting comments and information on social networking sites and looking at or posting video on YouTube. Second, platform and content are increasingly independent. A large amount of "television" is watched on something other than a set. As the technology and software to use the Internet on television sets becomes available,[70] shifts may occur in this direction as well, such that televisions become the preferred mode of listening to music, browsing online, or communicating with friends. Thus, it will be critical to think about both platform *and* content in exploring media effects and developing interventions related to sexual health, and to make no assumptions about how or where a particular form of content will be consumed. Finally, we note that the use of new media spans racial/ethnic and gender boundaries, though there are small gender differences in the use of video and online games, somewhat lower rates of cell phone ownership among the youngest teens, and somewhat less game playing among older teens. As with traditional media, the rates of many forms of new media use are somewhat higher in the minority groups that are at higher risk for teen pregnancy and STIs. Thus, there is much potential to reach these groups with interventions, as well as some potential for negative effects of exposure.

Associations Between New Media Use and Adolescent Sexual Attitudes and Behaviors

Little is yet known about the effects of these trends on sexual socialization and development, but there is reason to believe that there may be differences in the effects of new versus traditional media. Content creation that involves portraying oneself in a sexual manner may have different effects on subsequent sexual activity than exposure to sexual content as an audience member. For example, we can speculate based on psychological theory that creating sexual content may more directly influence self-perception (e.g., perceptions of the self as a sexual object or agent) or may influence

how others perceive and interact with the content creator (resulting in treatment as a sexual object or agent). Because sexual postings and messages may result from perceived peer or other social pressures, or are intended to be funny (but not always perceived as such),[71] the materials that teens post and the messages that they receive may be inconsistent with prior sexual experience and sexual intentions. That is, a sexually inexperienced teen may post a sexual message to appear mature or to make a joke. Once he or she observes his or her own actions, and particularly if other people's reactions reinforce the teen's sexualized behavior, the teen may shift to see him or herself as sexually mature or as a sexual object. Ultimately, this could accelerate sexual activity or lead to more casual or risky activity than might otherwise take place.

Some Internet-based media (e.g., social networking sites, chat rooms) also provide youth the opportunity to construct and "try on" identities that may not fit the users' offline selves while interacting with others. One can be any gender, race, age, or level of physical attractiveness online.[72] This unique property is particularly relevant to a stage of life characterized by a search for one's identity and an attempt to integrate sexuality into that identity. It leads us to speculate that, if youth use this opportunity to try on sexualized identities, social media use might result in youth making or receiving more offers of sex than would be the case if the same time were spent passively viewing sexual materials on television sets or in film.

We can also speculate that differences in the effects of new versus traditional media might result from variations in the content and manner of use. The specific content that a person is exposed to may vary by platform (e.g., television programs viewed on a set versus over the Internet), or the platform may change the manner in which content affects youth (e.g., by influencing whether content is viewed with divided attention or accompanied by peers' comments). As noted above, the key platforms for new media are cell phones and the Internet. The Internet affords adolescents easy access to sexual information in a context of anonymity, and the content is largely free. Cell phones provide a particularly portable method of engaging with content. They can be taken everywhere and used throughout the day. Thus, they give youth access to media at every waking hour and, like the Internet, can give youth the perception of anonymity. They also make youth particularly accessible for interventions to address sexual health needs. With cell phones, youth can seek information and assistance in real time as issues and questions regarding sexual health come up, and conversely, youth can be

reached easily with reminders about sexual safety. Thus, we might hypothesize that new media results in more exposure to sexual content, more privately, at more times of the day, and in more contexts than does use of traditional media.

While there is reason to believe that the effects of new media may differ from those of traditional media, there is little empirical evidence on this issue. Indeed, few studies of new media effects have been conducted. However, there are studies describing how these media are used by adolescents and the types of new media in which sexual content is known to reside that speak to this issue. Below, we review these studies and the limited available evidence regarding new media influence on adolescent sexuality. Our literature search identified five types of new media about which relevant research has been conducted: (1) online pornography, (2) online social networking sites, (3) online chat rooms, (4) "sexting" (the posting or sending of sexual text or sexual images of oneself), and (5) video games. We look at each of these media, in turn, below. We begin with the three media that are Internet-specific (online pornography, social networking, and chat rooms) and then turn to those that cross platforms (for example, sexting occurs online as well as via cell phone, and we discuss both on- and offline video games because the literature combines the two). In the section on Internet-specific media, we also review the fairly substantial literature concerning online sexual solicitation. While not a specific medium, it is a form of sexual content, both created and received, that occurs in new media and is therefore clearly relevant to the issues addressed in this paper.

Before we begin the review, we note for readers that the Internet research we describe focuses exclusively on youth who describe themselves as 13 years of age or older. The Children's Online Privacy Protection Act[73] requires parental consent to collect personal information from children under 13 using the Internet. Social networking sites, chat rooms, and others must not allow users under the age of 13 unless the sites do not ask for or allow youth to supply personal information. This affects what researchers can do in terms of studying online behavior and what youth say about their ages when online (i.e., whether they represent themselves accurately). Following this discussion, we address research evidence regarding cell phones and sex and the empirical studies of video games.

Internet-Specific Media

Pornographic Web Sites. A broad literature has examined the influence of pornography exposure on young adults, using both correlational and experimental designs. These studies have, for the most part, looked at traditional media, such as films and magazines, and focused on young men. Nonetheless, they suggest the range of effects that one might expect to observe among adolescents exposed to pornography on the Internet. Such effects include more permissive sexual attitudes,[74, 75] overestimation of various sexual activities engaged in by others, and less satisfaction with one's own sex life (see Zillmann, 2000, Huston et al., 1998 for reviews).[76, 77] Among adolescents, Brown and L'Engle[48] found that those exposed to pornographic materials through a variety of media (including Internet pornography and traditional media) were subsequently more likely to report permissive sexual attitudes (e.g., acceptance of casual or premarital sex) and to have oral or vaginal sex than youth with less exposure. The study used a particularly strong longitudinal survey design, reducing the likelihood that permissive attitudes led to interest in pornography, rather than the reverse.

In the sexual socialization of youth, Internet pornography may be at least as influential as pornography appearing in traditional media. The Internet makes pornography readily accessible to young people, generally without cost. It also affords the user greater privacy than magazines or film and more explicit content than most television programming. The Internet is probably also more likely than traditional media to expose youth to pornography inadvertently,[78] and inadvertent exposure might reach youth less inured to the messages contained in pornographic media. Internet content, because much of it is user-generated, may also be perceived as more realistic (or actually real); moreover, it can be viewed in "real time" via webcam and can be interactive. Each of these factors may increase viewer involvement and thus enhance any effects of exposure relative to the same content in traditional media, though this is untested. In our review of the literature, we found a number of studies that describe the prevalence of exposure and the background characteristics of those exposed. A few studies have also tested for cross-sectional associations between exposure to online pornography and youths' sexual attitudes, behavior, and health. And, finally, a set of studies have examined longitudinal correlates of online pornography exposure, all based on surveys of Dutch youth.

Estimates of the percentage of youth exposed to Internet pornography vary. Ybarra and Mitchell[79] based their estimate on the Youth Internet Safety Survey (YISS), a survey of a representative group of 1,501 U.S. 10- to 17-year-olds who were regular Internet users, conducted in the years 1999–2000. Twenty-five percent of the sample reported *unwanted* exposure to sexual images (naked people or people having sex) on the Internet in the prior year. Eight percent of youth *sought* pornography online in the same period—that is, they reported visiting an X-rated website on purpose. About half of these youth also sought pornography offline, through magazines, movies, or telephone sex lines. Offline-only seekers of such material constituted 7 percent of those surveyed.

Wolak and colleagues[78, 80] examined similar issues in the 2005 YISS, a subsequent survey of another sample of 1,500 U.S. Internet users aged 10–17 years. They found that 42 percent of youth reported past-year exposure to online pornography, overall.[77] Among these, 13 percent sought this exposure—a 50-percent increase from the prior YISS. Increases in unwanted exposure from 1999–2000 were nearly as large, climbing from 25 percent to 34 percent. Most of these youth (66 percent of those exposed, or 28 percent of youth overall) reported that *all* of their online pornography exposure was unwanted.[78]

Estimates from the YISS are probably the best available for U.S. youth, given their representative sample. However, it is important to note that only regular Internet users are represented, not all youth. Those who spend little time online are probably less likely to encounter pornography, simply because they view less online content overall. The YISS sample also does little to illuminate the online experiences of disadvantaged youth, who are likely to be infrequent Internet users. Some information regarding such youth is provided by Braun-Courville and Rojas,[81] who found that, among U.S. adolescents (12–22 years) attending a primary care clinic that serves primarily minority and disadvantaged youth, 46 percent said that they had been accidentally exposed to sexually explicit websites. Although a comparison of this figure to the YISS estimate of 34 percent suggests that disadvantaged youth may be more vulnerable to inadvertent online-pornography exposure, other study factors make the difference across studies difficult to interpret. In particular, Braun-Courville and Rojas looked at a somewhat older sample and asked about *any* exposure, while the YISS assessed exposure in the prior year.

One other U.S. study also collected estimates of "any" online pornography exposure. Sabina and colleagues[82] surveyed college students, collecting retrospective reports of their lifetime exposure to Internet pornography. Since all participants had reached college age, this provides a longer window for assessing exposure than any other study, allowing conclusions about the number of adolescents *ever* exposed. But this method also increases the possibility of biased or inaccurate recall. Results indicated that 93 percent of males and 62 percent of females had been exposed to pornography on the Internet prior to age 18. Mean age at first exposure was 14 years for males and 15 years for females. Males were more likely to seek out pornography, while most females ever exposed (42 percent of females overall) reported that all of their exposure was involuntary.

Overall, then, it appears that between 38 and 55 percent of youth are exposed to pornography on the Internet each year, and most youth will be exposed by the time they are 18. Some of the variability in this estimate appears to be due to shifts in exposure over time, with higher estimates coming from more recent studies. This interpretation is supported by a trend observed in the single survey that has been repeated over time using the same methodology.[80] Although the studies discussed here are not consistent, they suggest, on balance, that most such exposure is inadvertent, with only a small minority of youth reporting that they seek pornography online (this may reflect a reporting bias, however). It also appears that exposure in the United States is similar to rates in other countries that have been studied. Differences in the representativeness of the samples, ages studied, question wording, reference periods, and definitions of pornography almost certainly also contribute to the variable estimates in the literature so far. A more definitive estimate of exposure to pornography online will be possible as researchers come to an agreement regarding the best methods of defining and asking about such exposure, based on the emerging data.

What online behaviors and conditions predict exposure? One factor may be the search strategies employed by youth. In one of the earliest reports on exposure to Internet pornography, the Kaiser Family Foundation found that 70 percent of 15- to 17-year-olds were accidentally exposed to pornography when searching for health information online.[30] Consistent with this, analysis of the first YISS indicated that unwanted exposure occurred as a result of search results, misspelled web addresses, links on websites, pop-up adds, or spam email. However, that study included in the "unwanted exposure"

category youth who had experienced wanted as well as unwanted encounters with Internet pornography. Analysis of the second YISS showed that, among youth for whom *all* exposures were unwanted, exposure was related to only one Internet activity: using file-sharing software to download images.[80] Filtering and blocking software appear to reduce the likelihood of both wanted and unwanted exposure to Internet pornography.[78]

Certain demographic and behavioral characteristics also predict exposure to online pornography. Several studies indicate that males are more likely to be exposed than females.[79, 83] Age is also a factor, with older youth more often exposed.[78, 79] Other identified predictors suggest that youth who are "at risk" offline are more likely to be exposed to pornography online, whether deliberately or inadvertently. Youth exposed to online pornography score higher in sensation-seeking,[83] a personality characteristic linked with multiple risk behaviors. Consistent with this, online pornography seekers more often report substance use (37 percent used cigarettes, alcohol, or other substances four or more times per week) or delinquent behavior (48 percent) in the prior year, compared with youth who do not seek out pornography online.[79] Those who experience only unwanted exposure to Internet pornography are more likely than those not exposed at all to be harassed or victimized both online and offline and to show symptoms of depression.[78] It is also important to note that some of these characteristics distinguish offline seekers of pornography from nonseekers of such materials.[79] Thus, the seeking of pornography on the Internet may be another in the cluster of risk behaviors that distinguish some adolescents.[20]

Exposure to Internet pornography is of interest to those who study or attempt to improve public health and positive youth development because theory predicts that it may influence beliefs and behaviors. Few studies have attempted to assess this, but those that have done so indicate that this could be the case. For example, a survey of adolescents (13–18 years) recruited from an online convenience panel found that those who reported exposure to sexually explicit material online were more likely to endorse statements that describe women as sex objects[84] and sex as recreational.[83] In their study of adolescents attending a primary care clinic, Braun-Courville and Rojas[81] found that reported exposure to Internet pornography was related to permissive sexual attitudes, having multiple lifetime and recent sex partners, use of alcohol and other drugs at most recent sex, and ever having engaged in anal sex. It was not related to condom use or STIs. Similarly, in a survey of Taiwanese adolescents, Lo and Wei found that

youth with more Internet pornography exposure reported more sexually permissive attitudes and sexually permissive behavior, even after accounting for gender, age, religion, and exposure to pornography in traditional media.[85]

While this research provides some preliminary insights, the results are limited by a few key factors. First, all of these studies employed a cross-sectional design in which data were collected at a single time point. It is unclear whether positive attitudes toward casual sex and more casual sexual behavior lead to an interest in Internet pornography or are caused by it. It is also possible that both are caused by a third factor. For example, permissive parenting might lead to both pornography exposure and permissive sexual attitudes or behavior; this was not controlled for in the studies. While each study did include some covariates in its analyses, the set used was sparse in most cases and not exhaustive in any case.

Longitudinal studies go one step beyond this. By measuring pornography exposure at one point in time and "outcomes" at a later point, they reduce the possibility that attitudes and behaviors precede adolescents' use of pornography and thus the likelihood that the causal relationship between these factors is reversed. As yet, no studies have examined longitudinal correlates of online pornography exposure among U.S. youth, but a few reports have been published based on a longitudinal study of Dutch youth. Peter and Valkenburg[84] followed 1,052 Dutch adolescents and young adults (13–20 years) over a period of one year, collecting three waves of data. Self-reported intentional exposure to Internet pornography at wave 1 and wave 2 each predicted lower levels of sexual satisfaction at the subsequent survey wave, after controlling for prior levels of satisfaction. Some, but not all, analyses indicated that this relationship is stronger among youth with less prior sexual experience and among those who believe their peers to be sexually inexperienced. In an earlier analysis of the same data set,[83] the amount of intentional exposure to Internet pornography was also found to predict subsequent "sexual preoccupancy" (defined as a strong cognitive engagement in sexual issues, i.e., "I have thought frequently of sex").

Social Networking Sites. Social networking sites are places where youth can encounter sexual text, photos, and videos and can also create and/or post such materials themselves. No study has attempted to determine the effect of such materials on young people's sexual attitudes and behavior. A few studies have examined the potential for this by documenting the sexual content of these sites. Although what is

known even in this area is still quite preliminary, a few insights can be gained from their results. As with the Internet more generally, some caveats to what can be studied on such sites are in order before this evidence is reviewed. It should be noted that all of the research is based on publicly available profile content. Social networking sites allow users to mark some information as private, and what is hidden is probably more personal in nature. Of course, adolescents surfing through profiles will not encounter this private information, but if it is posted on the profile of an online "friend," they will, and this is the more typical way of using social networking services. We also note that one of the major social networking sites, MySpace, automatically sets profiles of youth who report their ages as 14 or 15 to "private." Thus, content analysis of their profiles is not possible.

Hinduja and Patchin[86] analyzed the content of a random sample of 1,475 public MySpace profiles posted in June through August 2006 by individuals describing their age as 16 or 17 years. They found that 5.4 percent had posted a picture of themselves in a swimsuit or underwear, and 15.5 percent included a picture of a family member or friend in a swimsuit or underwear. There are some difficulties in interpreting these results; for example, it is unclear whether these photos were sexual in nature. But the authors note that there may be some risk to picture-posting adolescents from sexual predators. We note here that, if the pictures are sexual, exposure to these photos on others' profiles may also influence normative perceptions regarding sexuality.

Moreno and colleagues also conducted content analyses of MySpace profiles in order to determine to what extent sexual and other information is displayed there. In their initial study,[87] they examined 500 profiles of youth aged 18 years that were publicly accessible and had been recently accessed by their owners. They coded for sexual content in each profile, defining sexual content as "completion and display of a 'sex survey'" (i.e., one of the many surveys that one can complete on a social networking site, sharing results on one's own profile) or "describing personal sexual preferences, self-disclosures of sexual experiences, pictures of profile owner in undergarments, and downloaded sexually suggestive icons such as Playboy bunnies." Based on these criteria, 24 percent of youth profiles contained sexual content. There was a trend indicating that female adolescents may be more likely to display sexual content than males. Reporting a sexual orientation other than "straight" was associated with more references to sexual behavior, while displays of religious, sports, or hobby involvement were associated with fewer references to sex.

In a subsequent report,[88] these researchers explored the homophily hypothesis for sexual content: that youth who posted sexual content on their own profiles were more likely to have online friends with posted sexual content than were youth who did not include sexual content in their profiles. Moreno and colleagues collected a representative set of public MySpace profiles belonging to individuals who posted their age as 18 years. From these, they selected 10 profiles that included at least one sexual reference (using the definition from the aforementioned study) and 10 that did not. The profiles for all eight of each individual's "Top 8 Friends" (a feature on MySpace at the time of data collection) were then sampled, resulting in a total of 160 friend profiles for analysis. Based on the broad definition of sexual content in the study, friends of persons with a sexual reference on their own profile were as likely to display a reference to sex on their own profile as friends of persons who did not display a sexual reference (i.e., there was no association between a person's sexual references and the likelihood of a sexual reference among their friends). However, when a more narrow definition was applied that focused on *explicit* references (e.g., a "personally revealing" photograph or a statement using explicit language), those with a sexual reference on their own profile were more likely to have friends with an *explicit* sexual reference in their profiles.

Williams and Merten[89] looked at 100 profiles posted by youth reporting their ages as 16 to 18 years and accessed within the 60 days prior to data collection. The sample was purposive and based on equal distributions by region of the country, school affiliation (public or private), gender, and age. Sexual text was coded as referring to sexual activity or as sexual language. Photos were coded for whether or not they were "inappropriate," including scanty clothing and/or risky behavior or sexually suggestive body positioning, as well as activities such as alcohol use. Seventeen percent of photos were coded as inappropriate. Nearly half of all profiles (44 percent) contained explicit or graphic language, and 16 percent contained references to sexual activity.

There is also evidence that some youth who use social networking sites will be subject to unwanted sexual solicitations. Of the 15 percent of youth who reported receiving an unwanted online solicitation in a 2006 survey, 27 percent reported that such an incident occurred on a social networking site, while 32 percent and 43 percent reported that an incident occurred in a chat room or via instant messaging, respectively.[90] Thus, while social networking sites open youth up to solicitation, other online activities pose a greater risk. The study did not examine the percentage of youth who receive wanted

solicitations or who sexually solicit others. We will say more on these issues later, in the section on sexual solicitation.

Chat Rooms. Although they are less popular with teens, teen chat rooms appear to be highly sexualized environments. In an early analysis, it was found that a sexual comment was made every four minutes in a sample of 321 minutes of conversation from AOL teen chat rooms, observed during after-school and weekend hours.[91] This is roughly three times the frequency with which sexual content was likely to appear on television in 1997–1998 (among shows that contained any sexual content).[92]

More recently, Subrahmanyam, Smahel, and Greenfield[93] conducted a content analysis of 20 chat sessions, constituting approximately 600 minutes of conversations among 583 individuals (as indicated by distinct screen names). They looked at two popular teen chat services, one in which chats were monitored and one in which they were not, coding 10 chats from each type. Monitors warn chatters not to reveal personal information that might make them vulnerable (e.g., names, zip codes) and enforce rules such as not encouraging drug use and not engaging in hate speech. Nineteen percent of all nicknames were sexual in nature (note that "sexual" was very broadly defined and included anything that "made its owner more sexually attractive," such as "angel" or "prettygirl"). Across the two types of chats, sexual themes constituted 5 percent of all utterances, which translated into one sexual comment per minute of discussion. These comments were uttered by 28 percent of all participants (as indicated by distinct screen names). Males and females (based on the gender suggested by screen names) were equally likely to contribute sexual comments, though males were more likely to contribute *explicitly* sexual comments. Explicitly sexual utterances were also twice as common on unmonitored as monitored sites, but there was no difference between sites in the frequency of implicit sexual comments (e.g., "all hot guys that wanna chat . . ."). It is important to note that, while teens who want to engage in more sexually oriented chat may gravitate to unmonitored sites, the study also found a difference in what was said online *within* monitored sites when the monitor stepped away from the conversation periodically. Thus, the presence of a monitor does seem to affect conversational content among teens. Finally, the study found that chatters who claimed to be older were more likely to make explicitly sexual remarks than those who reported a younger age.

Whether chat room experiences affect sexual attitudes or behavior has not been tested. The only evidence speaking to this possibility are analyses of a cross-sectional,

statewide survey of ninth-grade public school students in Minnesota. The study found that youth who used chat rooms to connect with others were more likely to engage in a variety of risk behaviors, including initiating sexual intercourse. Those who reported chatting online were between 50 percent (among boys) and more than 100 percent (among girls) more likely to have ever had sex than those who did not chat online.[94] However, the assessment of chatting and intercourse initiation in a single survey, and the absence of statistical controls for factors that might affect both of these behaviors, renders these results inconclusive. Teens who chat online may be more likely to initiate intercourse as a result, but it may be instead that risk-prone youth tend to engage in both behaviors. One final issue of note with regard to chat rooms is that their use by teens has been discussed and examined as possibly placing teens at risk for sexual solicitations. We discuss this in more detail in the next section.

Sexual Solicitation. Another way in which youth may encounter sexual information online is through experiencing sexual solicitations or witnessing them. Unwanted online sexual solicitation is defined by most research as "the act of encouraging someone to talk about sex, to do something sexual, or to share personal sexual information even when that person does not want to."[95] Solicitations have received a great deal of public attention, largely because of fears that they may result in the rape or abduction of adolescents by adults. As a result, the literature focuses primarily on determining the likelihood of these risks. It is important to note that more benign solicitations (e.g., solicitations between acquainted same-age youth) may also be of research interest. Such solicitations could theoretically influence the ways that youth think about sex, fostering perceptions of casual sex as normative, and perhaps as menacing or harassing (when solicitations are perceived as such). They might also influence sexual activity, if solicitations are accepted. Below, we review what is known about online solicitations, including both the prevalence and predictors of receiving such communications.

The primary source of information concerning online sexual solicitation is the YISS, described earlier, in the section on Internet pornography. The initial survey, conducted in 1999–2000, found that 19 percent of regular Internet users aged 10–17 years reported receiving an unwanted online solicitation in the prior year. Three percent of youth reported receiving an aggressive solicitation, defined as an attempt by the solicitor to make offline contact. The primary behavioral factors in solicitation risk were communicating with strangers online (i.e., persons who were not known offline),

participating in chat rooms, and using the Internet more frequently. Demographic risks included being female, being older, and having problems in other areas of life. Parental supervision of youth Internet use, measured in a variety of ways, was unrelated to risk for solicitation.

In the 2005 version of the YISS (conducted with a new cross-sectional sample),[79] Mitchell and colleagues found a decrease in reports of solicitation receipt of approximately 50 percent, compared with the prior survey. This decrease was found regardless of age and gender but did not occur for low-income and minority youth. There was no decrease in the number of aggressive solicitations in any subgroup.

In another analysis of the YISS, Mitchell and colleagues[96] examined whether young bloggers are at greater risk of online sexual solicitation. They found no evidence that this is the case. As in their prior analyses, those who interacted with people they met online were at greater risk for solicitation, but bloggers were no more likely to do this than those who did not blog. Bloggers were more likely to post personal information, but this was unrelated to risk for solicitation. The study did find, however, that young bloggers were more likely to report online harassment, suggesting that some nonsexual forms of risk may be increased by the activity.

In the Growing Up with Media study, a national survey of 10- to 15-year-olds who had used the Internet at least once in the six months prior to survey (conducted in August through September 2006), 15 percent reported receiving an unwanted online sexual solicitation in the prior year.[95] As noted in the section on social networking, the most common venue for such incidents was instant messaging (43 percent), followed by chat rooms (32 percent) and social networking sites (27 percent). The same survey provides the only published data regarding *perpetration* of unwanted sexual solicitation. In an analysis of the Growing Up with Media data, Ybarra and colleagues[97] find that 3 percent of Internet users aged 10–15 years report engaging in this behavior in the past year.

That report and others suggest that sexual solicitation overlaps with other forms of interpersonal victimization. Ybarra and colleagues[95] found that 13 percent of all youth reported being victims of *both* Internet harassment and online solicitation, and 3 percent of youth said they were perpetrators of both. *All* youth who were perpetrators of online sexual solicitation reported being either a victim or a perpetrator of harassment. Internet harassment involves making rude or mean comments online, spreading rumors about someone online, or making aggressive or threatening comments online.

Others have linked online receipt of sexual solicitations with a history of child abuse victimization.[98] Mitchell and colleagues looked at factors associated with aggressive sexual solicitation (solicitations accompanied by an attempt at offline contact) in the YISS at both survey time points. They found that youth who had experienced offline physical or sexual abuse were more likely to be aggressively solicited online. In addition, girls were at more risk than boys, as were youth who participated in chat rooms or used a cell phone to access the Internet.

In a 2009 study with a convenience sample of girls aged 14–17 years, more than half of whom were selected for participation based on a history of child abuse, 40 percent reported experiencing an online sexual solicitation, and 26 percent reported meeting someone in person whom they originally met online.[99] Consistent with prior work,[98] youth with a history of child abuse were more likely to report having been sexually solicited online. This same study provides some novel insight into a factor that may place adolescents at risk for solicitation. The report found that youth who have experienced online solicitation tend to construct avatars (animated images that represent the youth in online encounters) that are more sexualized in appearance. This may indicate either an outcome of experiencing sexual solicitation (i.e., the creation of a sexualized self-image) or a tendency for those who create such avatars to conduct themselves online in ways that result in solicitations.

Another key factor in online solicitation appears to be the pattern of youths' online relationships. Those who converse with persons they meet online are more at risk than others.[98] Examining this pattern in more depth, Wolak and colleagues[100] confirmed that while those who interact only with those they know offline experience aggressive sexual solicitations at a very low rate (1 percent), but those who interact freely with others online are at differential risk for solicitation, depending on the specifics of their online interactions. Exchanging personal information and photos with others, talking about sex, and harassing others are associated with much higher rates of online sexual solicitation. Similar findings have been reported by Ybarra and colleagues.[90]

Finally, we note that sexual solicitation of minors is more likely to be perpetrated by other minors than by adults. This is consistent with national surveys looking at "sexting," the sending of sexual text messages and suggestive photos via cell phone, email, or social networking sites, which we describe below. Like Internet sexual solicitation, when sexting involves a sexual solicitation, it is usually between teens.[101]

Other New Media

"Sexting": Sending Sexual Messages and Photos of Oneself. No studies of sexting have been published in peer-reviewed venues. However, there have been four surveys or polls on the issue whose results have been published. According to one national survey conducted by the National Campaign to Prevent Teen and Unplanned Pregnancy (the National Campaign)[71] 20 percent of teens aged 13–19 years have sent or posted nude or seminude pictures or video of themselves. The number of youth posting or sending messages that are sexually suggestive but do not necessarily include pictures is approximately double these rates (39 percent). Thirty-one percent of teens reported having received a nude or seminude picture via cell phone or email from someone (i.e., a photo or video of the sender), 29 percent had such a photo/video shared with them (i.e., it was sent to someone else initially), and 48 percent had received a suggestive message (text without pictures or video). A subsequent survey conducted by Cox Communications[102] reported rates approximately half of these: Nine percent of teens (13–18 years) have sent, and 3 percent have forwarded, a nude or nearly nude photo via text or email. Seventeen percent have received such a message. Results of an MTV-AP poll are more consistent with Cox's numbers. Ten percent of youth aged 14–24 years reported sending images of themselves, and 22 percent have received naked images of someone else.[103] Finally, in the its 2009 report, Pew[67] finds that only 4 percent of teens 12–17 years who own cell phones have sent nude or nearly nude images of themselves via cell phone, and only 15 percent have received them.

It is difficult to point to a single factor that might account for this wide variety of estimates. The National Campaign survey was conducted online, and as such may have elicited more candid responses from participants than did Pew's phone survey. It may also be a less representative sample, however, drawing a more Internet-savvy group than the average teen. Pew used a telephone survey and sampled randomly from those with cell phones and household landlines and may therefore have produced better estimates. The context of the questions also varied substantially (i.e., the other items in the survey), and this may have influenced participants. Pew focused only on messages sent via cell phone, while Cox and the National Campaign asked respondents to include "email, IM, etc." and asked about posting to Internet sites. Finally, the substantial press coverage of sexting during the period covered by these studies may have changed the way adolescents think about and report their sexting experiences. Surveys conducted

after major news stories may either exaggerate levels of sexting (if youth wish to appear part of a trend) or underestimate them (if youth wish to disassociate themselves from a practice portrayed as risky or illegal). A clear understanding of the prevalence of these messages and the characteristics of those involved (as senders or as recipients) will require collection of data from a nationally representative survey using items that distinguish these various methods of digital communication and collection data in a nonreactive and private manner.

What are the correlates of sexting? None of the studies find gender differences in the sending or posting of sexual messages,[63, 71] but they do find an increasing likelihood of sending and receiving these messages as teens reach young adulthood.[63, 71] Pew found that teens who pay the costs of their own phones are substantially more likely (more than five times as likely) to send sexually suggestive texts compared to those who pay none or only a part of the cost.[63] The same report found that those for whom cell phones were more central to their lives (e.g., were always on, were used to combat boredom) were more likely to send or receive sexually suggestive texts. It is unclear to what extent these various factors are independent contributors to sexting. It is likely that they are highly correlated, and multivariate analyses were not reported.

Most of these exchanges, like most online interaction,[84] are with persons already part of teens' offline social networks. The survey conducted by the National Campaign found that most teens sending these messages online or via cell phone sent them to a boyfriend or girlfriend (71 percent of girls and 67 percent of boys who have sent such messages). Many also sent them to someone they wanted to date or "hook up" with (21 percent of girls and 39 percent of boys who have sent such messages). Thus, "sexting" may be an extension of behavior that was equally commonplace but involved paper and pencil or telephone audio in the past, although text messaging may be increasing the prevalence of sexually suggestive communication between sex partners, friends, and acquaintances. The ubiquity of cell phone ownership among youth, ease of communication, and the apparent tendency to be more disclosing via relatively impersonal digital media[88] could certainly lead to the latter. Available data make it difficult to assess this, since no historical information on sexual messages between teens was published prior to the wide availability of the Internet and text messages.

There is some indication that at least a portion of this behavior goes beyond the mere transfer of sexual messages from print to digital media. Some teens report that they are

more forward and aggressive in their use of sexual words and images online than offline.[71] Further, in both the National Campaign and Pew reports, a small but not trivial minority of teens report that they have sent these messages to someone they only know online (15 percent of all those who sext[71]). Thus, sexting may be resulting in greater exposure of youth to sexual messages, and greater incidence or prevalence of creating sexual messages among youth. If so, this may affect adolescents' developing attitudes toward sex or their sexual behavior.

It is important to note that sexting may also affect youth in ways other than through altering their sexual attitudes, beliefs, or behaviors. The ease with which sexual messages can be shared with very broad audiences suggests a greater potential to result in social stigma. One posting to a social networking profile, or one photo sent via cell phone, can quickly reach hundreds of people. Moreover, the difficulty of permanently deleting all copies of a digital message means that risks to college admission, employment, and personal relationships could persist for many years. Most web information is available even after a site has been altered or deleted, and users can easily save and redistribute text messages and photos from their cell phones.

Video Games. Evidence reviewed in the earlier section of this paper on prevalence and use of new media indicates that game playing, more than any other activity, crosses platforms. Playing offline, on consoles, handheld devices, and cell phones is currently more common than online play. Next, we review what is known about both on- and offline games and how they might provide opportunities for youth to be exposed to or otherwise engage with sexual content.

Console and Computer Games. A few studies of the content of offline games (played on consoles or computers but not connected to the Internet) have been published. In one, Haninger and Thompson[104] sampled 80 video games rated T ("Teen") from the full population of 396 such games that had been released by April 2001. The 80 games were randomly selected within strata reflecting 10 different game genres. A "T" rating by the Entertainment Software Ratings Board (ESRB) reflects a judgment that the game may be suitable only for those 13 and older. It may contain violence, strong language, and/or "mildly provocative" sexually suggestive material. Haninger and Thompson found that 27 percent of their sample (22 games) contained sexual themes defined as "behaviors (e.g., provocative touching or moaning) or dialogue related to sex, as well as depictions of exposed breasts, buttocks, or genitals"; nine of these games did

not receive a content descriptor from ESRB that indicated suggestive material. When they expanded their definition of sexual material to also include "pronounced cleavage, large breasts, or provocative clothing," they estimated that 46 percent of games included sexual content. Games were significantly more likely to depict female characters partially nude or engaged in sexual behaviors as compared with male characters.

The same research group conducted a similar study of the content of M ("Mature")–rated games.[105] An "M" rating indicates that the content may not be suitable for those younger than 17 years, although in 2002, nearly 40 percent of M-rated video games were purchased for children below that age.[105] Thompson and colleagues coded the content of 37 of the 147 M-rated games that had been released by April 2001. Thirty-six percent of the sample (13 games) included sexual themes; only 15 percent of the sample had received a content descriptor from the ESRB that indicated this. Sexual themes appeared for an average of 4.9 percent of playing time, although it should be noted that the range on this variable was vast, from less than 1 percent to more than 40 percent of play time. Prostitution appeared in 17 percent of games. The authors do not note this, but it appears from the tables that sexual behavior did not differ by gender. However, female characters were significantly more likely than male characters to appear partially nude. When the definition of sexual material was expanded in the same way as for the authors' earlier study, 47 percent of games contained sexual content.

Other researchers have also found that women are scantily clad in video games, with one estimate suggesting that 28 percent of games contain depictions of women as sex objects.[106] In games with female characters, 48 percent of women and only 22 percent of men are shown in sleeveless attire, while of all those appearing in low necklines, 86 percent are female. Typically, women are wearing tank tops, halter tops, or bathing suits in these portrayals.[107] Although depictions of women in sexualized clothing may not convey an explicitly sexual message to youth, it is possible that they foster a perception of women as sexual objects among youth—as having value primarily because of their sexual appeal or behavior, suggesting that women must be attractive to be sexy and that women exist for others' sexual use, rather than as independent persons.[108] Researchers have speculated that these perceptions may foster unhealthy sexual behaviors, such as earlier initiation of intercourse, causing youths to distance themselves from their personal desires and ignore their anxieties surrounding first intercourse in order to act out a sexual script in which men are sex-driven and women are sex objects to be

pursued and won.[42, 43] Exposure to objectifying and degrading sexual content in music has also been linked to subsequent early initiation of intercourse,[44] though causality has not been shown.

Online Game Playing. When youth play games online, many interact with other players, sending instant messages or using voice-over-Internet protocols that allow them to meet others and socialize as they play.[66] These social aspects of online gaming may put youth at risk in some ways—for example, by increasing opportunities for online bullying. However, it is unclear whether online gaming might influence sexual attitudes or behavior. To do so, it would need to involve sexual content (either in the games or in exchanges with other players). We did not identify any published studies addressing issues of sexual content in online games or in online gamers' interactions, nor did we uncover studies that identified sexual attitudes or behaviors as correlates of using those games.

Summary and Identified Gaps

There is very little research evidence regarding the unintended effects of new media on sexual health, and more is clearly needed. The most thoroughly studied area is Internet pornography. Research in this area indicates that intentional exposure to such depictions may influence adolescent attitudes, promoting more recreational attitudes toward sex. But the research evidence has so far come from only one lab, and no longitudinal studies of U.S. youth have been conducted. There are also no longitudinal studies of sexual behavior or sexual risk-taking subsequent to viewing pornography on the Internet. What indirect evidence there is (regarding the prevalence of exposure among youth and the cross-sectional correlates) indicates that this topic is worthy of further study, as there may well be negative effects on sexual health.

The other area in which there has been considerable research is that of sexual solicitation via the Internet. Here, the research has focused primarily on the issue of whether youth who use a variety of online media might become victims of adult sexual predators. The conclusion is that this is unlikely. Indeed, most of these solicitations come from same-age peers who are known offline. But there may be other negative effects of both receiving and generating these solicitations. Their presence may create a more sexualized, and perhaps a more sexually harassing, environment that affects those exposed, directly or as bystanders. Here, again, such solicitation appears common

enough that it may be worth pursuing additional research. A key issue in such research would be to separate the processes of selection and influence. The fact that youth who report receiving solicitations are likely to be involved in online harassment as victims or as perpetrators, and are often victims of child abuse, suggests a strong potentially biasing factor in understanding and estimating the effects of any exposure.

Similarly, the sending or receipt of sexual messages or text via cell phone or email does not appear to pose a direct threat to youth. But, like sexual solicitations more generally, it may contribute to a sexualized environment that affects normative perceptions. Longitudinal survey studies testing for relationships between exposure to or participation in sexting and changes in sexual attitudes, norms, and behavior among youth are needed. Apart from issues of changes in sexual attitudes or behavior, it is also important to keep in mind that the creation of digital content, particularly nude or provocative photos of oneself, may pose other risks. Such content may be passed on to other teens, causing embarrassment at best and psychological distress at worst, or cached on websites where future employers, colleges, and others may find them. While it is the subject of much speculation, there are no studies so far that test for links between sexting and these important social and mental health outcomes.

Results suggest that there is a substantial amount of sexual content in teen chat rooms, both *constructed* by teens (names, utterances) and present for teen users to be exposed to as observers. It is also clear that the majority of users do not create such content, though the number of those who do is not insubstantial. A useful next step would be to study the evolution of users over time to understand to what extent those who are not generating sexual posts initially come to do so later, and to what extent users continue with or leave these sites as they are exposed to or participate in the creation of sexual messages. Because chat rooms are not particularly popular with teens, it may be wise to focus such efforts on Internet sites and activities that resemble chats but have not yet received much study, such as discussions among participants in online video games, posted comments on YouTube, and comments on social networking sites.

Selection versus influence is also an important issue in understanding any effects of visiting social networking sites. The data reviewed above indicate that sexual references are common on public pages. An adolescent who browses profiles on MySpace or YouTube is likely to encounter sexual references or pictures in anywhere from 15 to 24 percent of profiles. It is unknown, and perhaps undeterminable, what percentage of

private profiles contain sexual references. But it is reasonable to believe that youth who use these sites encounter sexual messages suggesting that casual sex is normative and reflect a preoccupation with sexuality. Nonetheless, most youth who visit these sites do so to check in with people they already know, at least indirectly, and so they may encounter messages that simply support what they were already hearing from offline peers. The Moreno study[88] showing homophily in the sexual references that appear on friends' profiles indicates as much. Analyses that look at the evolution of sexual information in profiles over time, within online networks, might help to separate selection and influence processes and determine the extent to which online interaction alters young people's developing sexual attitudes and behaviors.

Even if such work suggests that there may be online network influences on teens' behavior, in order to fully understand them, it will be important to try to estimate the magnitude of these associations relative to offline processes of peer influence. Because the Internet is a mass medium, selection processes might be exaggerated over those offline. An adolescent will always be able to find others online—indeed many people— who share his or her interests and values, even if those interests are quite unusual in the broader society (e.g., are shared by less than 1 percent of the population). Thus, we might see a greater tendency for similar people to associate than would be observed offline. For the same reason, influence processes may be greater: Unusual beliefs that would otherwise fail to find validation in everyday life may be normalized when other persons are encountered who share these beliefs. The Internet may create the illusion of consensus because someone can be found to support one's ideas, even when the number of such people is actually quite small. But it is also possible that association patterns will be no different from those observed in offline networks, or when they do differ, may have a smaller influence on those who participate. The apparent distancing of oneself that has been conjectured to lead to sexualized and calloused online interactions may also buffer people from the effects of online interactions.

Estimates regarding the amount of sexual content in video games indicate high levels, with 27–36 percent of games containing explicitly sexual language or pictures and 46–47 percent containing sexualized images of women. Given the large number of studies that have looked at violent content in these games and its possible effects, it would seem appropriate and fairly straightforward to conduct analogous work regarding sexual content in games. It may be that this content, because it appears to be less integral to

game play than violence, is not particularly likely to influence teens. However, because youth are currently spending more time with this activity than with any other except listening to music and watching television, an understanding of effects on sexual attitudes and associations with subsequent behavior should be a priority.

Glaringly absent from the research literature, given its popularity with youth, are studies of YouTube or other online video sites. Visits to YouTube are among the top three online activities identified by the Kaiser Family Foundation, and while we uncovered no relevant content analyses, a quick search of the website (youtube.com) using the term "sex" indicates there is potential to encounter vast amounts of sexual information (some of it related to health and risk reduction) and entertainment in the 17 minutes the average adolescent spends there each day. YouTube allows the creation of personal profiles and networks of friends, as well as the posting of comments about each video. Thus, it also affords many of the same opportunities for social influence and sexual involvement provided by more general social networking sites. Among the gaps we have identified, this is perhaps the one that needs to be filled most urgently.

Research addressing a variety of issues related to new media is sorely needed in order to understand whether their use contributes to the sexual socialization and sexual behavior of U.S. youth, and if so, how?

Digital Media Interventions to Reduce Sexual Risk Among Youth: Evidence and Prospects

Digital media interventions involve the use of computers, the Internet, cell phones, and video games to try to improve sexual health or reduce risky sexual behavior. Given their reach and the level of youth involvement, digital media have tremendous capacity to reduce sexual risk-taking. Other advantages of cell phone and Internet interventions include the ability to reach populations isolated by rural location, lack of transportation, or stigma. For teens who may fear being seen entering an intervention facility or who may have to account for their whereabouts during free time, an intervention that can be accessed in a private area at home, at school, in a library, or on a bus may afford both access and privacy. Noar and colleagues[109] have discussed some additional advantages, including the inherent scalability of the intervention (i.e., interventionists can move from dissemination to a small population to an extremely large one with relatively little change in approach) and the fact that there is no need to maintain a facility for

group or individual sessions. It is also possible to eliminate or greatly reduce the training of facilitators and ensure fidelity through the use of standardized materials.

Perhaps the greatest advantage in terms of potential program efficacy is that digital interfaces allow individualized and interactive intervention. In the past, video or print materials were largely limited to use in didactic programs, but cell phone and Internet-based intervention make it possible to create multiple pathways through such materials in response to participants' individual inputs. For example, this could be achieved by exposing boys and girls to different information based on their reported gender, or providing information about condom use to sexually active youth and information about abstinence to those who have never had sex. Increasing evidence suggests that tailored interventions are more effective in changing behavior and that discussion leads to greater change than didactic intervention. Digital formats can also lend themselves to simplified evaluation, automatically or very easily collecting data from participants (see Pequegnat et al., 2007, for further discussion of online evaluation[110]).

There may also, however, be some downsides to digital intervention. It is possible that youth pay less attention to material when it is presented online or on a cell phone, since there is sometimes no teacher or group facilitator present to keep them on task. Users might also skip through the material or miss entire modules of a program, likely reducing effectiveness. We encountered no data on fidelity of delivery and use of new media interventions; collecting such information should be part of future intervention evaluations just as it is in offline research.

Many organizations promoting sexual health appear to be taking advantage of youths' online participation. We reviewed the published literature on the development and evaluation of sexual risk interventions and also attempted to identify promising programs that have not yet been subject to evaluation. **Table 2** provides an overview of studies that have been evaluated. Following the table, we describe what we found in detail.

Table 2. Summary Information for Reviewed Interventions

Program Name	Participant Characteristics	Mode of Delivery/ Medium	Brief Description of Program	Citation
Adaptation of Becoming a Responsible Teen (BART)	African-American youth, aged 13–17 years	Text message	As a supplement to an existing HIV prevention curriculum, the study explored the feasibility of sending sexual health information via text message.	Cornelius & St. Lawrence, 2009[111]
SEXINFO	African-American youth, aged 18–24 years	Text message	Provides sexual health information (e.g., what to do if you think you're pregnant) and referrals through a text messaging program. The messaging service is supplemented by a website with example messages.	Levine et al., 2008[112]
HOOKUP	Persons aged 13–24 years	Text message	Statewide version of SEXINFO conducted in California. Provides sexual health information and referrals to Title X clinics through a text messaging program. The messaging and referral services are supplemented by a website.	Braun et al., 2010 [113]
Not Available	Washington, D.C., high school students	Text message	Youth are given the opportunity to be tested for STIs. Students who opt in receive a text message when their results are available. Students call a toll-free number to receive their results, counseling, and referrals.	Winston, 2010[114]

Program Name	Participant Characteristics	Mode of Delivery/ Medium	Brief Description of Program	Citation
A Story About Toni, Mike, and Valerie	African-American women, aged 18–29 years	Handheld computer with 4-inch screen	Device delivers a soap opera intended to influence cognition and behavior related to sexual risk for HIV.	Jones, 2008[115]
Feasibility Study	Persons in Atlanta, GA, aged 18–26 years	Viral video delivered via cell phone	Use of viral video to disseminate information encouraging young men to get tested for HIV. Participants viewed the video on their phone and then sent it on to two friends. Study assessed recalled receipt and whether video was further disseminated.	Freimuth et al., 2009[116]
It's Your Game—Keep it Real	Middle school students	Computer, Internet	Sexual health program that includes computer components, such as a virtual world interface, quizzes, fact sheets, and videos of serial stories associated with classroom discussion.	Tortolero et al., 2009[117]
What Could You Do?	Female adolescents	Interactive video	Participants were shown models of decisionmaking through stories about relationships and sex and allowed to change the course of the storyline based on their choices.	Downs et al., 2004[118]

Program Name	Participant Characteristics	Mode of Delivery/ Medium	Brief Description of Program	Citation
Project LIGHT	Students attending alternative schools, aged 14–18 years	Computer	Computer-based intervention program (adapted from an in-person intervention) aimed at increasing adolescent condom use.	Lightfoot et al., 2007[119]
YouthNet	College-age youth, 18–24 years	Computer/ Internet	A theory-based HIV prevention intervention that addressed constructs such as attitudes, norms, and self-efficacy by showing role-model stories delivered in a single Internet session.	Bull et al., 2009[120]
AIDS Interactive	College students	Computer	A computer-based instructional program using stories, role modeling, and demonstrations to reduce HIV risk.	Evans et al., 2000[121]
Not Available	College students	Computer	Motivational interviewing intervention with the goal of increasing HIV knowledge.	Kiene & Barta, 2006[122]

TABLE DESCRIPTION: This table presents the characteristics of interventions evaluated in the literature. These characteristics include program name, participant characteristics, delivery medium, a brief description, and a citation to the relevant study.

Interventions Using Cell Phones, Smartphones, and Other Handheld Devices

Text Messaging. Two studies have examined text messaging as a method of reaching youth with sexual health information. Such studies of "reach" look at how many

individuals receive a message and often consider who is reached and the barriers and facilitators of message receipt (rather than message effects on beliefs, attitudes, or behavior). Cornelius and St. Lawrence[111] conducted a qualitative exploration of the feasibility of using text messaging among African-American adolescents to supplement the Becoming a Responsible Teen (BART) intervention. BART appears on the U.S. Department of Health and Human Services (HHS) list of evidence-based teen pregnancy prevention programs, a listing of programs with evidence of effectiveness for impacting rates of pregnancy, STIs, or sexual risk behaviors (http://www.hhs.gov/ash/oah/prevention/research/programs/). The study included two focus groups with a total of 14 participants, aged 13–17 years, and a small survey of the same group. Participants were enthusiastic about using text messages to supplement an existing HIV prevention curriculum (the existing curriculum involved multiple in-person group sessions designed to build skills and knowledge).

The authors noted that the use of such messages as a booster post-intervention may help to prolong curriculum effects, which typically diminish over time. The optimal number of messages per day ranged from one to three, with participants perceiving more messages as desensitizing recipients to the information they contain. Other potential issues noted included the best time of day for receiving messages, how to pay the costs of a messaging plan without creating abuse of the service for personal messages, and what to do about phones lost or damaged by participants (the study was considering providing these phones). Because the original HIV prevention curriculum involved participants in creating the intervention and emphasized communication skills, the focus groups were asked about creating as well as receiving messages, a procedure that would take advantage of the interactive nature of digital media in attempting to change sexual risk behavior. Participants were also excited about the possibility of designing and sending text messages themselves. They suggested formats for adapting the curriculum to text messaging, including sending a fact-based message to intervention participants as a multiple-choice or true-false question that could be responded to with a return text indicating "A," "B," or "C," or "T" or "F," for example. It was emphasized that messages and responses should be quick and simple.

The San Francisco Department of Public Health has implemented a text messaging intervention for African-American youth, based on a program developed in London.[123] SEXINFO provides sexual health information and referrals for those who text "SEXINFO"

to a five-digit number. This links them to a menu of options, asking them to, for example, text "B2 if u think ur pregnant," and responds with basic information and referrals for diagnosis or other consultation. Responses were no more than 160 characters in length and developed by health educators in conjunction with focus group participants. The messaging service is supplemented by a website that shows examples of these messages. The program was promoted with posters, street marketing, and banner ads on Yahoo! targeted to 18- to 24-year-olds and a press release. As reported by Levine and colleagues,[112] the messaging service received 4,500 texts in its first 25 weeks. Surveys of two convenience samples of youth suggested that it reached the target demographic of African-American youth. Of those who remembered seeing ads for the service, "nearly 10 percent" reported that they had used it. The surveys also found that those with less expensive cell phone providers were more likely to report awareness of the SEXINFO program, and those who remembered seeing ads for the service stated that the use of text messaging caught their attention.

It is important to note that the focus groups used to develop the SEXINFO cell phone intervention felt that it was important for users to initiate the messaging themselves, not the intervention provider.[112] Confidentiality and informed consent can be key issues with cell phone interventions. It is not possible for those who use such services to be fully anonymous, since their phone numbers are accessible to the intervention providers. Many users may be unaware of this when they decide to use the service.

Following up on SEXINFO, a statewide version of the program called HOOKUP is currently under way in California.[113] The goal of HOOKUP is to provide sexual health information to youth aged 13–24 years and to leverage the more than 300 Title X clinics that provide free or low-cost sexual and reproductive health services. The service provides weekly sexual health messages. To opt in, users text "HOOKUP" to a code. Users can get further information in two ways, noted in each weekly text. They can get clinic referrals by texting CLINIC and the zip code of the area where they would like to find services. They can get the same referrals and additional sexual health information by visiting a website. Evaluation of HOOKUP has been limited, and it has not yet been subject to peer review. After nine months, 2,826 subscriptions had been received from across the state, and 33 percent of users had obtained clinic referrals via text message. But it is unknown whether subscribers are in the target age range or at high risk of STIs; some subscribers might even be sexual health professionals interested in trying the

program rather than using its services. HOOKUP plans a survey of subscribers, using text messaging to obtain some information (e.g., gender, age, personal or professional us), but effects on knowledge and behavior will not be assessed, so conclusive data regarding its effectiveness in reducing sexual risk are unlikely to emerge.

Another text messaging intervention that has yet to be fully evaluated used cell phones as a method of communicating STI test results to youth tested in Washington, DC, high schools.[114] After an information session, youth were given an opportunity to provide a urine sample and personal information to program personnel. Youth who opted in to the text message system received a text notifying them when their results were available. All participants were able to call a toll-free number to receive results, counseling, and referrals, as appropriate. A series of three studies involving a total of nearly 8,000 youth and 33 schools was conducted. Results appear promising. Across venues, 66–75 percent of those attending the informational session provided a urine specimen, and an STI was detected among 5–9 percent of these. Follow-up confirmed that treatment was received by 79–97 percent of those who tested positive. However, a full write-up of these results has yet to be completed, and findings have not undergone peer review to date.

Video on Handheld Devices. A third study did not look specifically at cell phones but was conducted with potential cell phone applications in mind. It examined the use of a handheld computer with a four-inch screen to deliver a video soap opera intended to influence cognition and behavior related to sexual risk for HIV.[115] Participants were a convenience sample of young African-American women (aged 18–29 years). The intervention video, the 43-minute *A Story About Toni, Mike, and Valerie*, was designed to challenge "internal sexual scripts" that suggest that women use sex as a way of winning and holding onto men, and unprotected sex as particularly serving that function. To this end, the actors revisited scenes and discussed different reactions through which the female character might have asserted power (e.g., asking for condoms to be used).

The study found that viewers were less likely to complete a second unfinished story in a manner consistent with stereotypical gender roles (e.g., less likely to believe that a woman would have unprotected sex when she does not want to in order to maintain a relationship with a man) than a control group of women who viewed a video about health careers. This suggests their "internal sexual scripts" (ideas about where and when certain kinds of sexual behavior are appropriate) were less linked to unprotected sex. The authors point to the adaptability of such an intervention to the streaming of video to

smartphones, and thus the potential opportunity to deliver entertainment with embedded sexual health messages to youth.

Freimuth and colleagues[116] explored viral dissemination of a video designed to promote HIV testing among young men. This not-yet-published study highlights some of the difficulties of studying this phenomenon using controlled research protocols. Video was sent to participants' cell phones (all participants were screened to ensure that their phones had this capability). After viewing the video and answering a few questions, participants then sent the video to the phones of two additional individuals, whose contact information was provided to researchers for follow-up. The study found that only 15 percent of those who were sent the video by "seed" participants recalled receiving it, and a much smaller percentage reported that they passed it on to an additional contact for viewing. It is unknown whether the low rate of dissemination was an artifact of the appeal of the particular video studied, the fact that the video was about HIV testing (i.e., sending it to someone may be thought to convey an implicit negative message about their sexual conduct), or the effect of study procedures (e.g., noncompliant participants may have sent the message to false or landline phone numbers, participants may have hesitated to provide contact information to researchers).

Cell Phone Caveats. The STI testing intervention in Washington, DC, was not strongly reliant on new media. Individuals could participate in the intervention without using text messaging or even a cell phone. However, 43 percent of participants in one of the studies opted into the text message notification that results were ready (this was not reported for the other two studies). Anecdotally, the program staff believes that cell phones and the availability of texting increased participation and were preferred communication modes for many youth. However, in the long run, as the novelty of text messaging and cell phones wears off, unless programs make use of the mobility feature that is unique to cell phones (e.g., GPS location information), they may prove less effective than computers with Internet access (which involve a larger screen and keyboard and, unless the phone is a high-end smartphone, greater graphic and video capabilities).

Computers and the Internet

In spite of their popularity with youth and great potential to harness social influence processes among interconnected peers, we encountered only one evaluation of an

online intervention involving social networking sites. In an adjunct to their study of the risk behaviors displayed by young adults with profiles on MySpace, Moreno and colleagues[124] sent an email from "Dr Meg," to users who made three or more references to sexual behaviors or substance use in their profiles. Recipients of the email were a randomly selected subgroup of this population, with the remainder serving as controls. "Dr Meg" was an adolescent medicine physician with a profile on the site. The email warned that there might be risks to disclosing information about sex and substance use in one's online profile and encouraged the recipient to consider revising his or her information. At follow-up, 13.7 percent and 26 percent of the intervention group had removed references to sex and substance use from their profiles, respectively. Reductions in the control group were 5.3 percent and 22 percent, respectively. In addition, there was a trend for the intervention group to reset their profiles to private (10.5 percent) more often than the control group (7.4 percent). Although changes were small and not statistically significant, the study shows the feasibility and potential effectiveness of a simple intervention using social networking sites.

Other computer-based interventions have used more traditional approaches, taking advantage of computer or Internet platforms to varying degrees. It's Your Game: Keep it Real is a middle school sexual health program that includes computer components along with a more traditional classroom intervention: a virtual world interface, educational activities such as quizzes and fact sheets, and teen serials that allow real-time classroom discussion.[117] This intervention was reviewed as part of the Office of Adolescent Health's Pregnancy Prevention Research Evidence Review and appears on the HHS list of evidence-based teen pregnancy prevention program models (http://www.hhs.gov/ash/oah/prevention/research/programs/). The intervention was tested in schools in Southeast Texas with a predominantly African-American and Hispanic, low-income, urban student population. The program consists of 12 seventh-grade and 12 eighth-grade lessons. Effectiveness was compared to treatment-as-usual health classes. Approximately one in three students in the comparison condition initiated sex by ninth-grade follow-up, compared with about one in four youth in the intervention group. After adjusting for covariates, students in the comparison condition were 1.29 times more likely to initiate sex by the ninth grade than those in the intervention condition.

Detailed analyses indicated there were differences in initiation of vaginal, anal, and oral sex in a variety of subgroups. Program effects on initiation of vaginal intercourse were comparable in size to other effective interventions. The intervention also produced shifts in attitudes, self-efficacy, and knowledge at eighth-grade follow-up, some of which were sustained to grade 9. Conclusions are limited by the study's failure to follow program and comparison group dropouts; program effectiveness may be specific to those who are willing to remain in the study. However, the researchers found no evidence that dropouts tended to be higher-risk youth. A key limitation for the purposes of this review is that program components were not isolated in the study design. Thus, it cannot be determined whether the computer components of the study are effective on their own, or even whether they add to the effectiveness of the rest of the curriculum.

Two other interventions have also produced changes in adolescent sexual risk. "What Could You Do?" was an interactive video intervention that modeled sexual decisionmaking through stories about relationships and sex. The positive consequences of condom use and modeling of safe behavior were repeatedly shown in the intervention, and viewers were asked to cognitively rehearse (practice in their heads) what they would say or do in the situation. The video incorporated specific choice points and behavioral alternatives, with selections determining the remainder of the storyline (i.e., safer or less safe sex among the characters). Users were also allowed to select the particular sections of the video program that they were most interested in using. Because many did skip sections, the one-hour video typically took less than that time to complete. Boosters were delivered at one, three, and six months. Participants in the evaluation of "What Could You Do?" were 300 urban, mostly African-American adolescent females recruited from a variety of health care settings in the Pittsburgh area. Those in the intervention were compared to two randomized controls, girls who received the same content in book form and girls who received preexisting high-quality sexual health informational brochures. Greater abstinence and reduced condom failure were observed at three-month follow-up, and there were fewer self-reported diagnoses with an STI at six months among video participants when compared to controls.[118] This intervention appears on The HHS list of evidence-based teen pregnancy prevention program models (http://www.hhs.gov/ash/oah/prevention/research/programs/).

Lightfoot and colleagues[119] also compared the efficacy of a computer-based intervention to the same information delivered in person (in a small-group setting), as well as to a no-

exposure control. The program evaluated was Project LIGHT, an intervention with previously established efficacy in increasing adolescent condom use. Adolescents aged 14–18 attending alternative schools participated, and all three groups were assessed at baseline and three months. Results showed a reduction in rates of self-reported sexual activity among computer-based participants versus those participating in small groups, and both of these groups had fewer self-reported sex partners compared to the controls. This is the only intervention we encountered that looked at behavioral outcomes and compared a computer-based intervention to an efficacious "in-person" delivery of the same program. As a caveat, HHS does not list this program as evidence-based, reporting that its evaluation included "only one subject or group in either the treatment or control condition" and therefore did not meet quality criteria (http://www.hhs.gov/ash/oah/prevention/research/database/). The lead author confirms that assignment to condition was at the school level (Lightfoot, personal communication, July 10, 2010), making it difficult to be certain that effects were due to the intervention and not another factor that varied across schools.

Another (unnamed) intervention that has been evaluated is an online seven-week intervention consisting of six activities or modules. Each module was posted online for one week, and all were posted during the final "make-up" week. Activities included completing surveys and quizzes and receiving feedback, going on a "virtual date," and competing in a "delaying tactics" contest to generate strategies for waiting to have sex. Each session took about 15 minutes to complete. Among the ninth-grade adolescents who participated, the program successfully increased sexual knowledge, condom use self-efficacy, and perceived susceptibility to HIV while creating more positive attitudes toward waiting to have sex, relative to changes observed in a control group.[125]

College-age youth have also been targeted with online interventions. YouthNet[120] recruited 18- to 24-year-olds through banner ads or direct website access (i.e., as a result of online searches or word of mouth). Although participants were asked for extensive identifying information, 20 percent of participants enrolling online were removed based on excessive inconsistencies in responses or duplicate enrollments, indicating the potential problems in enrolling a sample via the Internet. The remaining baseline sample included 2,623 individuals. A second sample participated at clinics using a computer kiosk. A smaller number (11 percent) of these individuals were dropped due to data inconsistencies, leaving a sample of 1,444. The theory-based

intervention addressed constructs such as attitudes, norms, and self-efficacy via five role-model stories delivered in a single Internet session. Each story involved a picture of an individual accompanied by music and voiceover telling a story lasting 60–90 seconds. Controls viewed online text containing standard HIV-prevention information. After one month, both groups were asked to log on to the site and view the materials a second time as a booster. Follow-up occurred at two months for the Internet sample and three months for the clinic sample. No effects were found in the clinic sample. Among participants recruited online, effects were very modest: Small shifts in norms promoting condom use were observed, and these shifts predicted more frequent use of condoms.

AIDS Interactive is a computer-based instructional program that uses stories, role models, and demonstrations to reduce HIV risk. In a randomized controlled trial, 152 college students used the AIDS Interactive educational program, heard an educational lecture on HIV prevention, or were unexposed to either intervention. AIDS Interactive participants had greater HIV knowledge and greater intentions to practice safe sex following participation, compared to the other two groups.[121] A computer-delivered motivational interviewing (MI) intervention has also been found to increase HIV knowledge among college students.[122] In this study, students completed a two-session computer-delivered MI intervention with follow-up immediately and again four weeks later. Control participants received a nutrition intervention. In addition to increased HIV knowledge, those who participated in the sexual risk behavior intervention were also more likely to report having condoms available and to increase their use of condoms.

In a meta-analysis including a large subset of these studies, along with some additional computerized interventions for men who have sex with men or for adults, Noar and colleagues[109] concluded that computer-based HIV-prevention interventions are effective and "have similar efficacy to more traditional human-delivered interventions." The mean effect size for condom use was $d = 0.259$, which converts to an odds ratio of 1.54. Noar and colleagues compare this to results from a prior meta-analysis of in-person HIV-prevention interventions that estimated average odds ratios of 1.13 to 1.64 across studies.[126] Given the advantages in terms of cost, reach, and fidelity, this may be sufficient to justify a push to develop and test more such interventions. However, fine-tuning our knowledge of the key elements of computerized and online intervention is clearly warranted.

Noar and colleagues[109] found that a few factors moderated program effects. Stronger effects were observed among programs individually tailored to participants and those with more sessions. There were also nonsignificant trends suggesting that the interventions were more effective among youth, men who have sex with men (versus heterosexuals as a group), women, and whites. Other unstudied factors that are probably important to efficacy also take advantage of the unique characteristics of computerized platforms and should be evaluated, including how interactive a program is, whether it uses multiple media within the computer platform (e.g., video, music, text), and whether there is a social component to the program (e.g., viral referrals, chat groups, comments of other users posted online). Such factors could be varied within studies as part of a randomized trial, or once a sufficient number of studies have been conducted, they might be evaluated with further meta-analysis.

 While they are not intervention programs *per se*, many nonprofits promoting sexual health have a presence online, including web pages and pages on social networking sites. To our knowledge, none of these have been evaluated to assess their impact on teen beliefs, behaviors, or outcomes. However, a few studies have evaluated the content of such pages in an effort to determine likely effects.[127, 128] In their 2009 review, Noar and colleagues identified 21 Internet sites promoting safer sex among teens. Most of the sites (86 percent) targeted teens and topics of avoiding STIs (and, secondarily, pregnancy). Most presented the messages "use condoms" (95 percent) and "be sexually abstinent" (67 percent). Nearly all sites (95 percent) presented safer sex information as well as using the possibility of negative outcomes—STIs (100 percent)—as a motivator to use this information. Most sites took advantage of some of the interactive features that make Internet-based interventions a unique opportunity to engage youth (online quizzes, changing homepages) and about half (48 percent) had message boards, but few used these fully. Only 15 percent had a click-through module, a feature that is likely to be particularly engaging and would allow tailoring of messages. Sites seldom provided pages specific to sexual orientation, as the authors note, with most speaking only very generally about sexuality and risk. This is an important omission, given the same research lab's aforementioned meta-analysis of computer-based HIV-prevention interventions, which indicated advantages for tailored interventions.[109]

Some organizations *have* gone beyond a mere presence on the Internet to create online campaigns that involve teens in sexual health promotion. For example, the National

Campaign to Prevent Teen and Unwanted Pregnancy (the National Campaign) has the Stay Teen Campaign, in which youth who view the website are encouraged to create their own sexual health video to enter into a contest. Videos are posted to the National Campaign's website, thereby reaching other teens, as well as theoretically enhancing the efficacy of the teens creating them. Similarly, Internet Sexuality Information Services, Inc. (ISIS), has an online contest for teens in which they are encouraged to create safe sex "slogans" to appear on underwear. These participatory elements may generate buy-in among the targeted audience; enhance feelings of self-efficacy; push peer norms toward acceptance of positive health behaviors, such as condom use, more readily; and take greater advantage of the Internet context and broad availability of digital technology. It would be helpful to evaluate whether such elements do indeed increase the efficacy of sexual health websites in reducing adolescent risk.

Other Studies in Progress. Through the online database NIH REPORT, Internet searches, snowballing, and personal contacts, we identified several interventions that are in progress and for which evaluations are planned or under way. In the appendix, we provide these as examples of what is being attempted and as a trail to studies that may be published shortly after we issue our review.

Summary and Gaps

We identified nine interventions that have received a peer-reviewed evaluation involving a randomized control group. Of these, three found changes in sexual behavior, including lower rates of sexual initiation and higher rates of condom use. The remainder found changes in online behavior that may be risky or shifts in attitudes, knowledge, behavioral intentions, and norms. All but one of these fell into the "computer-based" category. The other was a unique test of the use of handheld devices to deliver a video intervention, and it found positive shifts in gender stereotypes that might foster risky sex. The other intervention that had relatively strong evaluative information was a text messaging intervention that documented high rates of receiving texts requesting information. These data suggest the potential for such efforts to be effective in reducing teens' sexual risk. Indeed, the Noar review of computer-based studies, while including many programs for populations other than youth, found strong evidence that these programs work, in general. And there was a suggestive trend indicating that they may work *best* among young people.

Nonetheless, more programs and evaluations are needed before conclusions can be reached. Certainly, many more interventions need to be developed that take advantage of the key areas of online media use among youth: social networking sites, video games, and video exchange sites like YouTube. Cell phone interventions need to use the fuller capabilities of this platform, moving beyond texting to video, music, and more. Interventionists may wish to develop programs that are delivered wholly via new media and platforms (e.g., an online interactive website that constitutes an entire intervention program) or may benefit from using new media to supplement new or existing in-person interventions. A new media component might serve as a booster to enable a program to reach participants between sessions, or weeks or months after the in-person component is completed, potentially prolonging program effects. New media may also serve as useful recruiting tools for hard-to-identify populations, like sexual minority youth. "Viral" transmission of messages from one individual to another might enable a highly efficient form of snowball sampling in which one intervention participant recruits others who are similar.

Finally, program developers may usefully take a lesson from the recent experiences of those employing traditional media to enhance adolescent health. Efforts such as the CDC-funded "Hollywood, Health and Society" at the University of Southern California's Annenberg School, or joint efforts between the Kaiser Family Foundation and MTV, have placed key health information in the hands of television writers and producers, resulting in health-promoting messages and the modeling of health-protective behavior in entertainment programming. Although largely unevaluated because of the difficulty and expense involved, it is clear that these programs have reached large audiences of youth. A parallel in the realm of new media might involve placement of health-promoting messages within video games as they are being developed.

But as researchers and program developers consider designing new interventions, some key things should be kept in mind. There is a very significant challenge involved in recruiting appropriate individuals to one's intervention online and in retaining them long enough (in a single long or multiple short sessions) to make a difference in behavior. Getting help from experts in digital media may be important in overcoming these issues of targeting and reach. Online and cell phone interventions can also be extremely difficult to appropriately evaluate. Those who access a service are selecting in, and randomization may be difficult. And because participation is anonymous, it may be

impossible to follow a sample for assessment of meaningful outcomes. Issues of privacy must also be considered. People who visit a website or send a text message are not identifiable, but their phones and computers are, and so they cannot be considered truly anonymous participants. Researchers need to be careful that they fully understand these issues and that their institutional review boards are aware of them as well.

Researchers should also consider the risks involved in using media that can "go viral." The ability of new-media messages to be rapidly redistributed through the social networks of those they initially reach may result in unintended effects. For example, materials that might have been developed for older teens may reach younger adolescents. If this possibility is considered early on and accounted for in message development, there may be no adverse effects, but if it is not, and youth misunderstand a message, it could increase risk for some groups by undermining knowledge or shifting normative perceptions in a direction that promotes riskier sex.

Conclusions and Future Directions

New media are still far outpaced by traditional forms, particularly television and music. In part, however, this is because digital platforms, such as computers, cell phones, and MP3 players, have extended the reach of traditional media by removing time and place constraints. Thus, it seems possible—indeed, likely—that the balance between media will shift quickly toward content that is designed specifically for these platforms in the next several years. Equilibrium may be reached, or television may remain dominant, but it seems clear that other media will also play a strong role in adolescents' daily lives, and perhaps the dominant role. Research knowledge has already fallen behind and is likely to lapse even further if more studies are not initiated quickly. Our review suggests several foci for these efforts:

1. There is a pressing need for rigorous, systematic content analyses of the sexual content in new media, including both overall prevalence and key subtypes (e.g., sexual health information, portrayals of positive and negative consequences, sexual stereotypes). As part of this, researchers may need to develop new methods or adapt old ones to account for the unique characteristics of digital content.

2. Theory development is needed. Existing theories do not easily account for the likely effects of users' new roles in creating and distributing content, as well as

consuming it. Nor do they incorporate factors that are emerging as likely moderators of new media effects, such as interactivity, privatization of use, portability, use of multiple media at once or while performing nonmedia tasks, synergies across platforms (e.g., interactive websites related to television programs), and the social aspects of new media use (e.g., receiving content from friends, comments on content displayed alongside it). While existing theories of media and behavior may be able to stretch to cover these factors under broad conceptual labels, these new applications and adaptations will require testing, and development of new theories may also be warranted.

3. Sexual health interventions based in new media or incorporating new media components should be developed and tested. 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.

4. Experimental and longitudinal survey studies of the effects of exposure to new media content on adolescents are needed to determine whether new media pose risks or confer benefits in the area of sexual health. These also should be informed by theory and should focus on those new media that contain sexual messages of theoretical import, that are widely used by youth, and that have characteristics setting them apart from traditional media, suggesting that existing research knowledge may not apply. Although the lack of content information in the current literature makes it difficult to assess the first of these criteria at present, our review suggests that good candidates for study include social networking sites such as Facebook, video sharing sites such as YouTube, and online multiplayer video games.

5. To conduct these studies, new measures will be needed that allow researchers to accurately assess the amount of sexual content that youth are exposed to (or create) as a consequence of using new media. These measures should cover all aspects of content; for example, on social networking sites they will need to assess messages posted, chatting or IMing on the site, groups joined, and friends displayed, as well as a profile's text, photos, and videos. They may also

need to account for similar content accessed or created on different platforms (e.g., video viewed on television versus a cell phone) and assess multitasking (whatever the youth might also be doing at the time the content is consumed, e.g., homework, talking to friends).

The greatest challenge is likely to be developing efficient measurement strategies—ideally, items and scales that can be incorporated into surveys and do not require researchers to directly sample and content-analyze each participant's media use. For example, studies of exposure to sexual content on television have used surveys and asked youth which of a specific set of programs they watch, then content-analyzed those programs. Studies of online behavior may require digitally tracking the websites and web pages that are visited by each study participant (through software installed on their computers), since it may be difficult for youth to report exactly which websites they have visited. For example, a participant may know that he or she visited a video sharing site but not know which videos were viewed or be able to accurately report their titles or locations. The result of online tracking would potentially be a vast number of sites for which content would need to be coded. Similar issues are likely to arise for other new media and platforms, such as social networking sites and content accessed via cell phone. A more efficient method of estimating sexual content exposure might be possible for these media, but it may need to be developed.

A caveat to these conclusions is in order. Any review of emerging research literature runs the risk of becoming quickly outdated, and this is certainly the case for the present review. New media is not only a nascent area of research, but the phenomenon itself is rapidly changing. Some of the media types and platforms discussed herein were nonexistent or very rarely in use only a decade ago. It is likely that *newer* media will soon emerge. Thus, we draw conclusions about what is known and what we need to know even as we caution the reader that further review will likely be necessary in just a few years.

In summary, the emerging body of research on new media suggests promise for intervention programs targeting sexual health among youth and the possibility that these media are already influencing teens' sexual attitudes and behavior, both positively and negatively. But the clearest messages are that (1) adolescents are strongly involved with new media, (2) the platforms and content involved are quickly evolving, and (3) there is almost no evidence regarding the impact of most of these media. This is a challenge for

researchers but one that, if approached quickly and intelligently, may uncover some of the most effective tools to date to improve the sexual health and outcomes of youth.

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Appendix: Other Studies in Progress

Through the online database NIH REPORT, Internet searches, snowballing, and personal contacts, we identified several interventions that are in progress and for which evaluations are planned or under way. We provide these as examples of what is being attempted and as a trail to studies that may be published shortly after we issue our review. However, we note that it is unlikely that we uncovered all such studies.

Lynn Fiellin of Yale recently received funding to develop and test an interactive video game to reduce HIV risk among minority youth by teaching sex, drug, and alcohol negotiation and refusal skills. The research team will evaluate the efficacy of the game by conducting a randomized clinical trial among 330 minority youths, aged 9–14 years, attending an after-school and/or weekend youth program. They will be randomly assigned to play the interactive HIV prevention video game, *Retro-Warriors*, or a commercial, "off-the-shelf" video game. Subjects will play two sessions per week of their assigned game for four weeks. The primary outcome will be initiation of sexual activity, defined as the initiation of either vaginal or anal intercourse. Secondary outcomes include HIV risk behavior knowledge, social competency, self-efficacy, drug/alcohol use behaviors, and overall risk-taking behaviors.

Sonya Brady of the University of Minnesota is developing and conducting a feasibility study of an interactive sexual health website to promote condom use and other healthy decisionmaking in the context of sexual and romantic relationships. The planned website intervention will feature (1) moderated discussion between adolescent website users, whose identities are protected, and health professionals on the research team via a sexual health and relationship concerns message board; (2) continual updating of website content based on new barriers to condom use and relationship concerns identified by adolescents over time; (3) video clips of young role models who provide and clarify information, encourage motivation to engage in health-protective behavior, and demonstrate behavioral skills (e.g., negotiation); (4) forums for website users to privately and publicly evaluate video clips; and (5) searchable, easily navigable archives of video and text.

Sheana Bull of the University of Colorado at Denver is developing and evaluating an Internet-based social networking program for young adults embedded on MySpace. My_Network for Health_Space is planned as a site that will be incorporated into

MySpace.com. Features of My_Network for Health_Space will likely include (1) peer-to-peer HIV-related educational interactive chat rooms, forums, blogs, and testimonial components and (2) an animated weekly serial drama with multiple characters identifying and resolving challenges to HIV prevention over time. The efficacy of My_Network for Health_Space for maintaining abstinence, increasing condom use, and increasing testing for HIV among participants will be tested.

With funding from CDC, Leslie Snyder of the University of Connecticut has developed an online, single-player video game designed to promote condom use among young men aged 18–24. The game's effectiveness in changing behavior is currently being tested in a randomized control trial.

Marion Howard and colleagues (of Emory University and the Jane Fonda Center) have developed the Teen Health Series of computer-based sexual health lessons that link to supplemental Internet information. The lessons and links are to be used by teens in waiting rooms at clinics and are only 15 minutes in length. No formal evaluation has been published, but one is being drafted. Preliminary findings from a conference presentation suggest that this can be an effective format for reaching teens.[129]