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Social media use and risky behaviors in adolescents: A meta-analysis

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ABSTRACT

Introduction: This systematic review and meta-analysis examined the associations between social media use and risky behaviors during adolescence, and evaluated study characteristics (e.g., sample age, type of social media platform assessed) that may moderate these relationships.

Methods: A comprehensive search strategy identified relevant studies from PsycInfo, PubMed, Google Scholar, and Proquest Dissertations and Theses Global.

Results: The final sample included 27 independent cross-sectional studies with a total of 67,407 adolescents ($M_{age} = 15.5$, range: 12.6–18.0 years; 51.7% girls; 57.2% White). Results from random effects models indicated that there were positive, small-to-medium correlations between social media use and engagement in risky behaviors generally ($r = 0.21$, 95% CI = 0.16–0.25), substance use ($r = 0.19$, 95% CI = 0.12–0.26), and risky sexual behaviors ($r = 0.21$, 95% CI = 0.15–0.28). There were an insufficient number of independent samples available to conduct a random effect models for violence-related behaviors ($k = 3$). Moderator analyses suggested that studies assessing solely early social media platforms (e.g., Facebook/MySpace only) in relation to substance use had smaller effect sizes than substance use studies assessing a broader range of contemporary social media platforms. In addition, younger samples had larger effect sizes for studies focused on social media use and risky sexual behaviors.

Conclusions: The positive links identified between social media and risky behaviors during adolescence in this meta-analysis suggest that developmental theories of risk taking would benefit from incorporating the social media context. Longitudinal studies are needed to clarify directionality and make more specific practice and policy recommendations so that social media is a safe place in which adolescents can thrive.

Social media has become an important developmental context for adolescents since its advent and widespread societal adoption in the early-to-mid 2000s. The co-construction model (Subrahmanyam, Smahel, & Greenfield, 2006) emphasizes that online and offline contexts within which adolescents are immersed are strongly interconnected. Adolescents, therefore, are hypothesized to bring to the social media context their offline developmental issues related to identity, autonomy, peer relationships, sexuality, and risk taking and sensation seeking (Subrahmanyam et al., 2006). The prominence and significance of social media to adolescents, therefore, likely results from the increasing salience of identity exploration, self-expression, friendships, and peer acceptance that occurs during this

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developmental period (Gerwin, Kaliebe, & Daigle, 2018). Indeed, social media is nearly ubiquitous among adolescents, with recent reports indicating that 93–97% of 13–17 year-olds use at least one social media platform (Barry, Sidoti, Briggs, Reiter, & Lindsey, 2017; Pew Research Center, 2018b). On average, adolescents report using three different social media platforms, with some using as many as eight different platforms daily (Barry et al., 2017). Moreover, adolescents devote much of their free time to social media, using social media platforms for an average of nearly 3 h each day (Barry et al., 2017; Nesi & Prinstein, 2015). These usage patterns suggest that social media represents a compelling and integral component of adolescents' daily lives both online and offline. Indeed, there is an expansive literature linking social media use to important aspects of psychosocial development during adolescence, including self-esteem, social connectedness, peer victimization, internalizing problems, delinquent behaviors, and sexual self-exploration (Seabrook, Kern, & Rickard, 2016; Shapiro & Margolin, 2014; Subrahmanyam & Greenfield, 2008; Uhls, Ellison, & Subrahmanyam, 2017; Underwood & Ehrenreich, 2017; Valkenburg & Peter, 2011; Vannucci & Ohannessian, 2019).

Understanding the relationship between social media use and risky behaviors during adolescence is crucial given that changes to brain structure and function interact with an amplified sensitivity to delinquent peer influences to confer an increased propensity for risk taking that is unique to this developmental period (Casey, 2015; Shulman et al., 2016). Indeed, engagement in risky behaviors most often begins during adolescence, including those behaviors that expose youth to harm or significant risk of physical injury or death, such as substance use, unsafe sexual acts, and violence-related behaviors (Centers for Disease Control and Prevention, 2018; Steinberg, 2010). Moreover, a large proportion of adolescents engage in risky behaviors. In the U.S., in respect to use in the past 30 days, 20–30% report having consumed alcohol, 13–15% binge drinking, 5–14% using cigarettes or smokeless tobacco, 12–13% vaping, 14–20% using marijuana, and ~16% carrying a weapon (Johnston et al., 2018; Kann et al., 2018). Physical violence also is common, as one out of four adolescents report getting into at least one physical fight with peers within the past year (Kann et al., 2018). Adolescents who are sexually active often engage in unsafe sexual acts, with 34–46% not using a condom and 5–14% not using any pregnancy prevention method (Abma & Martinez, 2017; Kann et al., 2018). Despite the high prevalence of risky behaviors, overall trends suggest that several major risky behaviors have declined within the past 10–15 years among adolescents, including cigarette smoking, binge drinking, marijuana use, violence perpetration, and teen pregnancy (Johnston et al., 2018; Lewycka et al., 2018; Sedgh, Finer, Bankole, Eilers, & Singh, 2015). However, the prevalence of other forms of risky behaviors, including vaping and sexting, have increased markedly within this time frame, and engagement in unsafe sexual acts, such as a lack of condom use, has remained stable and pose threats to the health and wellbeing of adolescents (Johnston et al., 2018; Lewycka et al., 2018; Madigan, Ly, Rash, van Ousel, & Temple, 2018). These risky behaviors are linked to numerous adverse health outcomes, legal consequences, and premature mortality (Kann et al., 2018), highlighting the need to understand their relationship to adolescents' social media use.

1. Social media use and risky behaviors

The co-occurring trends of increased social media use and changes in risky behaviors among adolescents over the past decade may be related to each other, as the behavioral manifestation of adolescent risk taking and sensation seeking has been shown to change in relation to broader social and cultural factors throughout history (Crone & Konijn, 2018). According to the displacement hypothesis (Kraut et al., 1998), frequent social media use replaces time spent on health-related behaviors, such as in-person social interactions, extracurricular activities, and physical activity. As such, it is possible that rapid increases in social media use among adolescents may have displaced engagement in some risky behaviors, such as excess alcohol consumption and illicit drug use (Lewycka et al., 2018). With increases in parental monitoring and societal restrictions on access to most substances in Western cultures, it has been suggested that social media may provide a novel context in which adolescents' enhanced risk taking propensities are expressed (Crone & Konijn, 2018; Lewycka et al., 2018).

The Facebook influence model (Moreno & Whitehill, 2014) proposes peer influence mechanisms through which social media use may increase adolescents' susceptibility for risky behaviors (Moreno & Whitehill, 2014). In general, this model hypothesizes that the social media context amplifies peer influence processes that affect adolescents' cognitions and behaviors. The Facebook influence model (Moreno & Whitehill, 2014) proposes that interactions among individuals and the resulting social networks influence individual perceptions and construct communities who share and develop similar risk perceptions and behavioral norms, who then imitate behaviors perceived as being valued or rewarded. Social media use and the resulting online communities, therefore, are theorized to expose adolescents to pro-risky behavior attitudes via positive portrayals of risky acts in content posted by peers and other valued persons. Although adolescents primarily post positive, non-deviant content on social media (Pew Research Center, 2018a,b), risky behaviors posted by a minority of social media influencers and popular peers is proposed by the Facebook influence model (Moreno & Whitehill, 2014) to have greater reach, desirability, and influence in the social media context due to the publicness, widespread availability, and quantifiable reinforcement of this content. This social media-driven exposure, in turn, is hypothesized to influence adolescents' favorable attitudes toward risky behaviors and perceptions that these behaviors are normative and desirable by valued others. Adolescents then engage in risky behaviors both online and offline purportedly to imitate or conform to the social norms of valued or high-status individuals, receive social reinforcement, and foster a positive social identity.

According to "super peer" theory (Strasburger, 2007), media (vs. in person interactions) acts as a "super peer" by exerting an especially profound influence and inordinate pressure on adolescents to engage in risky behaviors that are depicted as normative. Furthermore, according to the Facebook influence model (Moreno & Whitehill, 2014), the social media context, in particular, has been proposed to amplify these peer influence mechanisms relative to traditional media or offline contexts as a result of an increased volume of content portraying risky behaviors, the quantifiable reinforcement for externalizing behaviors in the form of peer "likes" and comments, and exposure to a wider network of individuals outside of immediate peer groups. The social media context may also serve to exacerbate other developmental predictors of risky behavior, such as adolescent sensation seeking, through exposure to

social media content framing these risky behaviors as exciting and pleasurable (e.g., vaping trick videos).

Developmental neuroscience approaches to understanding risk taking during adolescence also may provide a useful framework to conceptualize how the social media context interacts with developing neural circuitry to exacerbate adolescents' inclinations toward risky behaviors. According to dual systems models (Casey, 2015; Luciana & Collins, 2012; Shulman et al., 2016), risky behaviors peak during adolescence as a result of a neural imbalance between an early-maturing, hyperactive socioemotional processing system and a relatively inefficient cognitive control system that develops more gradually. That is, adolescents' enhanced neural sensitivity to incentives and socio-emotional cues leads to increases in sensation seeking and pursuit of rewards, but adolescents' often experience difficulties in restraining these potentially harmful impulses as a result of an immature cognitive control system. Recent evidence further suggests that the heightened neural sensitivity of the socioemotional system also amplifies adolescents' desire to seek peer approval and enhances the anticipated reward value of risky behaviors in the presence of peers (Albert, Chein, & Steinberg, 2013).

These neurodevelopmental mechanisms have been hypothesized to operate within the social media context, underlying adolescents' enhanced sensitivity to online peer feedback and increased susceptibility to online peer influences on risky behaviors (Crone & Konijn, 2018; Sherman, Greenfield, Hernandez, & Dapretto, 2018; Sherman, Payton, Hernandez, Greenfield, & Dapretto, 2016). Specifically, adolescents are more likely to *like* photos of both neutral and risky behaviors (e.g., drinking) if the photos had many *likes* as compared to photos with very few *likes* on an Instagram-like platform, revealing that quantifiable peer endorsement on social media influences adolescents' behavior (Sherman et al., 2016). Adolescents' neural responses demonstrate that quantifiable reinforcement may be particularly rewarding, as increased activity in brain regions associated with reward processing, attention, and imitation was observed when adolescents *liked* photos and when viewing popular photos with many *likes* (Sherman et al., 2016, 2018). Similar to neural responses observed in offline contexts (Albert et al., 2013), decreased activation in brain regions associated with cognitive control occurred when adolescents, but not young adults, were viewing risky photos as compared to neutral photos on social media (Sherman et al., 2016, 2018). Taken together, these neurodevelopmental models suggest that the impact of social media use on risky behaviors may be especially robust during adolescence.

Another plausible explanation of an alternative directional hypothesis for the links between social media use and risky behaviors is that adolescents who are prone to risk taking or frequently engage in risky behaviors are drawn to social media-based interactions and content and, therefore, use social media more frequently to express and satisfy their risk taking needs. According to the co-construction model (Subrahmanyam et al., 2006), adolescents are active in their choice of online interactions and behaviors, use of social media platforms, and construction of online communities and cultures where they simultaneously influence others and are influenced by other social media users. This notion that adolescents actively use social media to co-construct online communities and cultures that reflect the developmental tasks facing them aligns with uses and gratification theories (Ruggiero, 2000; Sundar & Limperos, 2013), which propose that individuals are driven to use different social media platforms to satisfy their diverse needs. For adolescents who are prone to risky behaviors, such needs may include displaying their risky behaviors online to obtain positive peer feedback and approval, monitoring peers' engagement in risky behaviors and changes in social status, connecting with other deviant peers via groups and discussion boards, seeking information about risky behaviors, and organizing offline risky behaviors with others.

The anonymity, invisibility, perceived lack of consequences, and minimal adult oversight afforded by social media platforms also may provide compelling opportunities for adolescents to explore and facilitate engagement in risky behaviors that they would be more reticent to do in person (Nesi, Choukas-Bradley, & Prinstein, 2018). These hypotheses align with co-construction theory (Subrahmanyam et al., 2006) and the Facebook influence model (Moreno & Whitehill, 2014), which suggest that the social media context provides adolescents with freedom to express their identity or an idealized self for a broad audience and encourages adolescents to display aspects of themselves that they would not typically share offline such as risky behaviors. The media practice model (Steele & Brown, 1995) further hypothesizes that social media use represents a reflection of adolescents' current sense of identity and who they desire to be, which often is expressed as engagement in and display of risky behaviors on social media platforms (Eleuteri, Saladino, & Verrastro, 2017). Not only may the social media context provide a venue for novel risky behaviors, but this context may also afford adolescents who are prone to engaging in risky behaviors offline greater opportunities to express this aspect of their identity online.

2. The present study

There is a burgeoning body of literature examining the relationship between social media use and engagement in risky behaviors during adolescence in light of adolescents' pervasive use of social media, increased neurobiological propensity for risk taking, and enhanced susceptibility to peer influence. It is imperative to examine the magnitude of the associations between social media use and engagement in risky behaviors systematically across studies so that informed conclusions can be drawn to inform theory, clinical practice, and social policies. However, there have been few systematic reviews and meta-analyses that attempt to integrate these findings. One meta-analysis found that there was a small, positive association between online exposure to sexually explicit material and engagement in risky sexual behaviors, including having sexual intercourse without a condom, among youth and young adults aged 10–24 years (Smith et al., 2016). In the only other known meta-analysis (Curtis et al., 2018), findings indicated that more frequent alcohol-related social media engagement was associated with more alcohol use and alcohol-related problems with a medium effect size among young adults. Although these initial studies have illuminated important findings, no known studies have focused on general social media use in relation to a broader range of risky behaviors during adolescence.

The primary objective of the current study, therefore, was to conduct a systematic review and meta-analysis of unpublished and published, peer-reviewed studies examining the relationship between social media use and engagement in risky behaviors during adolescence. It was hypothesized that a small-to-medium positive association would be found for overall risky behaviors, as well as

engagement in substance use, risky sexual behaviors, and violence-related behaviors more specifically. The secondary study objective was to explore sample and study characteristics that may account for the between-study variability in the effect sizes. Based on extant theories of adolescent development and social media use (Gerwin et al., 2018; Nesi et al., 2018; Shulman et al., 2016), it was hypothesized that studies with younger samples, assessment of image-based social media platforms, and online data collection methods would have stronger positive associations between social media use and risky behaviors than studies with older samples, assessment of solely older social media platforms (e.g., Facebook, MySpace), and in-person data collection methods. Given that adolescent boys' emphasis on status-oriented goals may promote boys' tendencies to engage in risky behaviors to increase their social status and dominance within their peer group (Rose & Rudolph, 2006), it also was hypothesized that samples with a higher proportion of girls would have smaller positive associations between social media use and risky behaviors than samples with a higher proportion of boys. Other exploratory moderators evaluated were study race/ethnicity, geographic setting (western or non-western countries), year of data collection, social media assessment method, publication status, and article focus (whether the primary objective of the study was to examine the relationship between social media use and risky behaviors).

3. Methods

3.1. Literature search

This review adhered to the guidelines described in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, & Altman, 2010). Multiple search strategies were used to identify potentially eligible studies examining the association between social media use and risky behaviors during adolescence.

First, three electronic bibliographic databases were searched to identify an initial pool of potential studies, including PubMed, PsycInfo, and Proquest Dissertations and Theses Global. For each bibliographic database, advanced search options were used to create a search term algorithm to identify potentially relevant studies. The following search terms were entered into each search database: (social media OR social network* site* OR social network* platform* OR Facebook OR Instagram OR Twitter OR Snapchat OR MySpace OR YouTube OR Tumblr OR Pinterest OR Vine OR Reddit OR web 2.0) AND (risk* behav* OR sex* OR tobacco OR smok* OR cigarette OR vaping OR substance use OR alcohol OR binge drinking OR marijuana OR cannabis OR drug use OR addict* OR violent* OR weapon* OR fight* OR aggress*) AND (adolesc* OR teen* OR youth). This algorithm searched all fields, including the title, abstract, and keywords of articles. The database search results were restricted to articles that were published between January 1, 2000 and January 16, 2019. The year 2000 was selected as the earliest possible year to align with the launch of the Web 2.0 platform (Mingoia, Hutchinson, Wilson, & Gleaves, 2017; Williams, Hamm, Shulhan, Vandermeer, & Hartling, 2014). The citations and abstracts of studies identified in the database search were saved in either XML format (PubMed) or RIS format (PsycInfo, Proquest Dissertations and Theses Global), and then uploaded onto Rayyan, a web-based application to assist with systematic reviews (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016).

Additional search strategies were implemented to supplement the electronic database search and to ensure saturation of the literature. The reference sections of the eligible articles identified from the database search and recent review articles of social media use in adolescents (Best, Manktelow, & Taylor, 2014; Curtis et al., 2018; Eleuteri et al., 2017; Frost & Rickwood, 2017; Moreno & Whitehill, 2014; Uhls et al., 2017) were examined for potentially relevant studies. The “cited by” function in Google Scholar also was used to identify potentially relevant studies that cited each of the eligible articles identified from the database search. For studies identified through these methods, the citations and abstracts were imported into EndNote citation manager (Clarivate Analytics, Boston, MA) for further examination. Finally, authors of eligible studies were contacted via email to request any available unpublished data; one positive response was obtained.

3.2. Inclusion and exclusion criteria

The criteria listed below were used to determine whether studies were eligible for inclusion in this systematic review and meta-analysis examining the associations between social media use and risky behaviors in adolescents. Studies were required to meet Criteria 1–4. It was not necessary for studies to state explicitly that one of their study objectives was to examine the relationship between social media use and risky behaviors.

Criterion 1. Studies were included if the sample was comprised of adolescents between the ages of 12 and 18 years. Studies were excluded if the mean age of the sample was less than 12.0 years or greater than 18.0 years to avoid confounding findings with those from studies occurring in childhood or emerging adulthood. Studies also were excluded if they involved college students.

Criterion 2. Studies were eligible for inclusion if they included at least one measure of social media use. All measurement methods of social media use were eligible for inclusion, such as self-report, reports from parents, teachers, and peers, and objective measures of app usage tracked by cell phones or other electronic devices. Usage could be assessed by the time spent using social media (e.g., number of hours during a typical day), by the frequency with which adolescents use social media (e.g., number of visits per week or day), or by the frequency of behaviors indicating engagement with social media (e.g., number of posts made). These usage variables are considered complementary (Pew Research Center, 2018a; 2018b). Social media was defined as any interactive websites or internet applications (“apps”) through which users can generate and share content with others, create personalized user profiles, and develop online social networks (Obar & Wildman, 2015). Studies were included if they assessed social media use aggregated across multiple platforms or if they assessed usage of only one social media platform. Studies were excluded if they assessed only general Internet use, text messaging frequency, cyberbullying, or behavioral addiction symptoms stemming from social

media use. Studies that only assessed exposure to specific risky behaviors (e.g., alcohol, sexual references) online or via social media platforms were excluded because they do not provide an assessment of general social media usage.

Criterion 3. Studies were included if they had a measure of adolescents' engagement in at least one risky behavior. Risky behaviors were defined as those that expose individuals to harm or significant risk of physical injury or premature mortality, including substance use, unsafe sexual acts, and violence-related behaviors (Centers for Disease Control and Prevention, 2018). Substance use was considered to be use of tobacco, alcohol, marijuana, and/or other illicit drugs, as well as misuse of prescription pain medication (Centers for Disease Control and Prevention, 2018). Risky sexual behaviors were defined as those that contribute to unintended pregnancy, human immunodeficiency virus (HIV) infection, and other sexually transmitted infections (STIs), such as early age at first intercourse (prior to age 15), having multiple sexual partners, having concurrent sexual partners, having one night stands, using drugs or alcohol prior to having sexual intercourse, having sex in exchange for money, and lack of pregnancy prevention methods (Centers for Disease Control and Prevention, 2018). Studies also were included if they assessed risky online sexual behaviors, including sharing, posting or exchanging sexual content via electronic devices (sexting, cybersex), engaging in sexual communication with strangers online, and meeting with people online for the purposes of sexual activity either online or offline (Wolak & Finkelhor, 2011). Violence-related behaviors were operationalized as using a weapon, carrying a weapon, being in a physical fight, and engaging in dating violence (Centers for Disease Control and Prevention, 2018). All measurement methods of risky behaviors were eligible for inclusion, such as self-report, reports from parents, teachers, and peers, physiological measures of substance use, medical diagnoses (e.g., HIV, STIs), records of arrests or academic disciplinary actions for risky behaviors, and text messages or online activity. Although non-suicidal self-injury and suicide attempts may be considered violence-related behaviors (Centers for Disease Control and Prevention, 2018), they were excluded because they are conceptually linked more closely to internalizing problems (Marchant et al., 2017). Studies were excluded if they assessed general externalizing behaviors because not all externalizing behaviors expose adolescents to significant risk of harm, injury, or premature mortality (e.g., lying to parents).

Criterion 4. Eligible studies were required to provide enough quantitative information to calculate at least one effect size for the association between adolescents' social media use and engagement in risky behaviors. Therefore, qualitative studies and descriptive case study reviews were excluded. Published studies (e.g., peer-reviewed journal articles) and unpublished studies (e.g., doctoral theses, unpublished datasets, conference papers) were eligible for inclusion. Studies with insufficient data to calculate an effect size were excluded if the authors of these studies did not respond to multiple requests for the data or were unable to provide the necessary data. Studies also were excluded if they were not written in English due to resource limits in translating papers properly.

3.3. Study selection

Fig. 1 depicts a flow chart that visually represents the systematic literature search process. The identification of eligible studies was determined through an initial abstract processing and then a review of the full-texts of potentially eligible articles using the Rayyan web-based application for systematic reviews (Ouzzani et al., 2016).

Abstract processing. A total of 2152 abstracts were identified from the literature search. The lead author (AV) screened the title of all studies and removed the duplicates ($n = 324$), resulting in a total of 1828 potentially relevant studies. First, the lead author (AV) completed a brief review of the title and abstract of all studies and removed studies that were completely irrelevant to the areas of social media use and risky behaviors ($n = 1680$). Subsequently, two authors (AV, ES) independently examined the remaining abstracts ($n = 148$) to identify studies with potentially relevant data involving social media use and risky behaviors in adolescents. There was good interrater agreement for decisions regarding which abstracts should be included and excluded for a full-text article review ($\kappa = 0.77$). Disagreements were resolved through discussion of the criteria for study selection with another author (CMO). This abstract screening process identified 91 studies that were potentially eligible for inclusion.

Article processing. The electronic versions of the full-text articles from these 91 studies were retrieved and examined to determine whether each study met the selection criteria. Two authors (AV, ES) independently reviewed each full-text manuscript and had good interrater agreement regarding decisions to include or exclude the study ($\kappa = 0.74$). The vast majority of disagreements involved deciding what constituted social media use, as conceptualizations have changed over time and can differ markedly across studies (Criterion 2). Similar to the abstract processing, disagreements about these decisions were resolved through discussion of the study selection criteria with another author (CMO). Corresponding authors were contacted for studies that included measures of both social media use and risky behavior in adolescents, but did not provide enough quantitative information in the article to calculate a correlation coefficient ($n = 9$); five positive responses were obtained. Based on the study selection criteria described above, a total of 29 articles were included in this meta-analysis. The 62 excluded studies did not have a measure of general social media use ($n = 40$), did not utilize an adolescent sample ($n = 9$), did not assess risky behavior ($n = 6$), did not provide sufficient information to calculate an effect size ($n = 4$), were not published in English ($n = 1$), or were a review paper ($n = 1$). Of the 29 studies that were selected for inclusion, two studies were excluded because they provided data from a sample that was already included in the meta-analysis.

Final sample of studies. Table 1 summarizes the demographic characteristics, methods, and correlation coefficients for the studies included in the meta-analysis. This meta-analysis utilized data comprising 27 independent samples, 56 effect sizes, and 67,407 adolescents (51.7% girls; 57.2% White). The weighted mean age of participants was 15.5 years, with sample means ranging from 12.6 to 18.0 years. These studies were published between 2011 and 2018, with data collected between 2007 and 2016. Most of the studies were conducted in the United States ($n = 14$), with the rest conducted in European countries ($n = 8$), African countries ($n = 2$), Australia ($n = 1$), Canada ($n = 1$), and China ($n = 1$).

Although the inclusion criteria intentionally was broad enough to capture all forms of social media use and risky behavior measurement (e.g., objective assessments from app usage on cell phones, parent or teacher reports), all studies used self-report scales

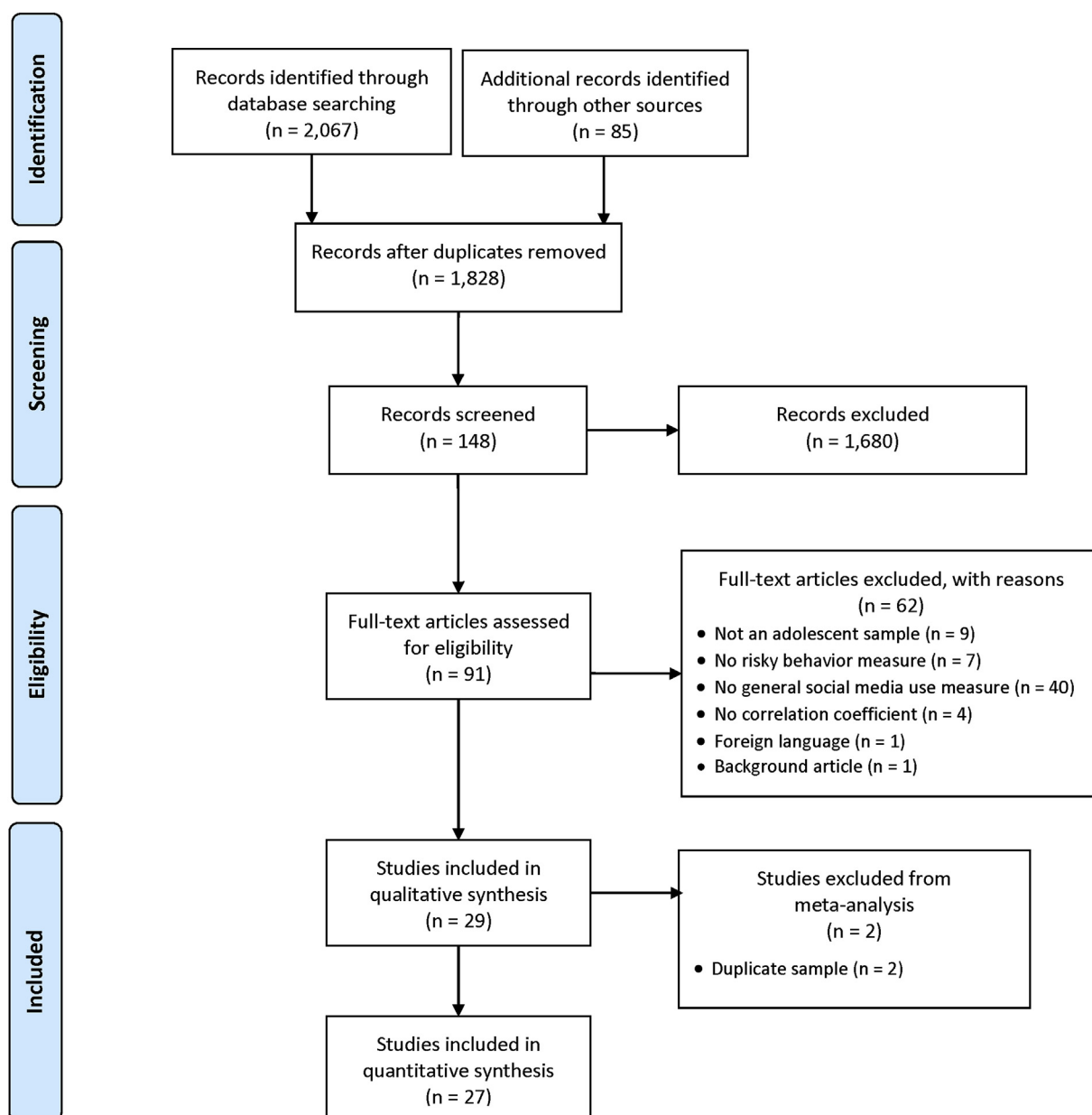


Fig. 1. PRISMA flow diagram for systematic review and meta-analysis of social media use and risky behaviors during adolescence.

to assess social media use and risky behaviors, with most studies using single item scales for both constructs. The vast majority of studies measured social media use by asking adolescents to report either their social media use frequency (e.g., how often they use social media, ranging from *never* to *almost constantly everyday*; $n = 13$) or their time spent using social media on a daily or weekly basis (i.e., hours; $n = 11$). Three studies assessed the presence or absence of whether adolescents used social media. Of the 56 effect sizes identified, 30 were specific to substance use outcomes, 22 to risky sexual behaviors, and 3 to violence-related behaviors. Substance use measures assessed nicotine product use, alcohol consumption, problematic drinking patterns, marijuana use, or illicit “hard” drug use. A range of risky sexual behaviors were assessed, such as lack of contraceptive or condom use during last intercourse, having multiple sexual partners, substance use prior to or during sexual encounters, sexually transmitted infection diagnosis, sexual exploitation (exchanging money or goods for sexual intercourse), and engagement in cybersex and sexting. The violence-related behaviors included weapon carrying and overt aggressive behaviors (e.g., initiating physical fights).

3.4. Data extraction and management

Data extraction was performed using a standardized Excel form with the following categories: Author(s), publication status (yes or

Table 1
Summary of studies included in the meta-analysis.

Authors (Publication Year)	<i>r</i>	Social Media Use Measure	Risky Behavior Measure	<i>N</i>	Country	Year ^a	Girls (%)	White (%)	Age (M)	Setting
Baker and Pelfrey (2016)	.11	Frequency of social networking site use	Soft drug use in the last 30 days (alcohol, cigarettes, marijuana)	3195	United States	2009	52.0	36.0	13.5	School
Brunborg, Andreas, and Kvaavik (2017)	.24	Daily time spent using social media (hours)	Binge drinking frequency in the past 12 months	727	Norway	2014	53.9	93.0	14.2	School
Doomwaard et al. (2014)	.17	Daily time spent using social media (hours)	Cybersex frequency in the past 12 months	1037	Netherlands	2011	47.3	90.2	13.9	School
Gommans et al. (2015)	.24	Frequency of electronic communication with friends in a typical week	Frequency of alcohol use in the past 4 weeks	2752	Netherlands	2009	50.8	81.5	14.3	School
Gregg et al. (2018)	.23	Frequency of electronic communication each week	Frequency of sending sexts	314	United States	2014	51.3	20.7	16.2	School
Huang et al. (2012)	.05	Use of social internet activities in the past week	Presence of smoking in the past month	2931	China	2007	49.8	0.0	15.8	School
Huang, Soto, Fujimoto, and Valente (2014)	.18	Frequency of Facebook and Myspace in the past month	Alcohol use status score (<i>never to past month binge drinker</i>)	1434	United States	2010	51.0	34.0	15.0	School
Kaufman et al. (2014)	.12	Frequency of social media use	Problem drinking during the past year (via AUDIT)	4485	South Africa	2012	55.7	4.0	15.8	School
Koutamanis et al. (2015)	.46	Frequency of social initiation activities on social media	Frequency of risky sexual online self-presentation	785	Netherlands	2012	52.2	91.1	12.6	Online
Landry (2016)	.16	Frequency of social media use	Frequency of sexual risk behaviors in the past 3 months	555	United States	2012	58.6	0.0	15.3	School
Landry, Gonzales, Wood, and Vyas (2013)	.20	Frequency of logging in to social media	No contraception use at last sexual intercourse	428	United States	2011	57.8	0.0	15.7	School
Larm, Åslunda, & Nilsson (2017)	.28	Frequency of online social network chatting	Problem drinking during the past year (via AUDIT-C)	2439	Sweden	2010	51.7	86.1	15.5	School
Macapagal et al. (2018)	.24	Presence of lifetime social media use	Number of lifetime condomless anal sex partners	200	United States	2016	0.0	51.0	16.6	Online
Merrill (2018)	.05	Time spent using social media daily (hours)	Frequency of lifetime sexual risk behaviors	10,930	United States	2015	51.2	44.5	16.0	School
Ohannessian (2014)	.27	Time spent using social media daily (hours)	Total alcohol consumption in the past six months	81	United States	2014	39.5	55.3	17.8	Online
Ohannessian and Vannucci (2016)	.23	Time spent using social media daily (hours)	Total alcohol consumption in the past six months	1058	United States	2016	50.9	51.7	12.8	School
Nesi and Prinstein (2018)	.12	Time spent using social media use daily (hours)	Soft drug use in the past year (alcohol, cigarettes, marijuana)	716	United States	2015	54.2	46.5	16.0	School
Nesi et al. (2017)	.02	Time spent using Facebook daily (hours)	Initiation of heavy episodic drinking	658	United States	2011	59.0	78.7	15.8	Online
Pegg, O'Donnell, Lala, and Barber (2018)	.22	Time spent using social media per week (hours)	Mean frequency of alcohol consumption, getting drunk, and binge drinking in the past six months	793	Australia	2014	54.5	84.2	17.3	School
Romo et al. (2017)	.27	Frequency of daily social media use per day	Presence of four or more lifetime sexual partners	333	United States	2014	66.3	2.4	16.0	Urban primary care clinics
Sampasa-Kanyinga and Chaput (2016)	.39	Time spent using social media use daily (hours)	Presence of binge drinking in the 30 days	10,072	Canada	2013	48.4	59.4	15.2	School
Self-Brown et al. (2018)	.11	Presence of any social media use		593	Uganda	2014	59.0	0.0	17.0	

(continued on next page)

Table 1 (continued)

Authors (Publication Year)	<i>r</i>	Social Media Use Measure	Risky Behavior Measure	<i>N</i>	Country	Year ^a	Girls (%)	White (%)	Age (M)	Setting
Spilkova, Chomynova, and Csemy (2017)	.14	Time spent using social media daily (hours)	Experience of sexual exploitation Presence of binge drinking in the past 30 days	4887	Czech Republic	2015	49.0	98.2	16.7	Community drop-in centers School
Stevens et al. (2017)	.26	Frequency of social media use	Lack of contraceptive use at last sexual intercourse	249	United States	2013	60.6	0.0	18.0	Community nonprofit organizations School
Tsitsika, Janikian, Schoenmakers, Tzavela, Ólafsson, Wójcik, Macarie, Tzavara, The EU NET ADB Consortium, & Richardson (2014)	.22	Average time spent using social networking sites on an typical weekday and weekend in the past 12 months (hours)	Frequency of engaging in aggressive behaviors (via the YSR)	13,284	Greece, Spain, Poland, Germany, Romania, Netherlands, and Iceland	2011	53.0	85.1	15.8	
van Oosten and Vandenbosch (2017)	.11	Presence of Instagram use	Frequency of sexy online self-presentations in the past two months	953	Netherlands	2015	49.3	91.1	14.9	Online
Whiteley, Brown, Swenson, Romer, DiClemente, Salazar, Vanable, Carey, & Valois (2011)	.26	Frequency of social internet use (social networking sites, instant messaging, chatting, email, reading news)	Sexual sensation seeking scale	1518	United States	2008	61.0	0.0	15.3	Community outreach programs

^a Year of data collection.

no), publication year, journal, article focus, sample size, geographic setting, data collection setting (online vs. in-person), demographic characteristics of the sample (mean age, proportion of girls, proportion of adolescents identifying as White), study design, year of data collection, social media use measure, risky behavior measure, measurement scale reliability (Cronbach's α), and the statistics describing the main findings examining the association between social media use and risky behavior. Of note, article focus was included as a potential moderator to examine publication bias, and was coded based on whether the primary study objective was to examine the relationship between social media use and risky behaviors. All studies were coded independently by two authors (AV, SG). The few coding discrepancies identified were discussed until an agreement was reached.

3.5. Meta-analytic approach

Effect size calculations. For the meta-analysis, Pearson's correlation coefficients (r) were used as the effect size indices to quantify the magnitude of the associations between social media use and engagement in risky behaviors. When studies reported other effect size measures, such as an odds ratio or a mean difference score, the effects were converted to Pearson's correlation coefficients using the methods described by Borenstein, Hedges, Higgins, and Rothstein (2009). When an article did not include sufficient information to compute effect sizes, correlation coefficients were requested from the corresponding authors and data were received for five out of nine requests. Only one effect size per study was used in the meta-analysis to ensure independence among effect sizes. When a study reported multiple effect sizes for the construct of risky behaviors for the same participants, the correlation coefficient for the most representative, common risky behavior for adolescents was selected for inclusion in the meta-analysis (Card, 2012). Whenever possible, artifact corrections for the unreliability of measures were applied to the correlation coefficients to obtain more accurate effect sizes between social media use and risky behaviors (Card, 2012). Of note, only seven corrected correlation coefficients were generated because the vast majority of constructs were assessed using single item measures, which precluded the ability to provide estimates of measurement reliability.

Combining and comparing effects across studies. Analyses were performed with Comprehensive Meta-Analysis version 3.0 (Biostat, Englewood, NJ). The correlation coefficients from each study were converted to the Fisher's z scale to obtain a normal sampling distribution (Corey, Dunlap, & Burke, 1998; Silver & Dunlap, 1987). These transformed Fisher's Z_r values were used in all analyses; the results were subsequently converted back to correlation coefficients for ease of interpretation (Borenstein et al., 2009; Card, 2012). Study effect sizes (Z_r values) were weighted by the inverse of their variance (Hedges & Vevea, 1998), which is a function of sample size, prior to combining effect sizes across studies to obtain a more precise estimate (Marín-Martínez & Sánchez-Meca, 2010). A random effects model was used to combine the effect sizes across studies, generating a weighted mean effect size and 95% confidence intervals for the overall association between social media use and risky behaviors. Subsequently, two separate random effects models were conducted for substance use ($k = 14$) and risky sexual behaviors ($k = 14$). There were an insufficient number of effect sizes to conduct a random effects model for violence-related behaviors ($k = 3$) (Davey, Turner, Clarke, & Higgins, 2011). Weighted mean effect sizes with confidence intervals that did not include zero were considered to be statistically significant (i.e., Z -test with p values $< .05$), with Cohen's (1988) guidelines used to interpret the magnitude of the mean correlation coefficient for significant associations ($r \approx 0.10$ as small, $r \approx 0.30$ as medium, and > 0.50 as large).

Heterogeneity of effect sizes across studies was evaluated using the Chi-square Q statistic and the I^2 index. The Q statistic, also referred to as the homogeneity statistic, evaluated whether the pooled effect sizes had a homogeneous distribution across studies; p values of $< .05$ indicated that there was significant heterogeneity of study effect sizes that were due to sources other than random sampling error (Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006). The I^2 index was calculated to complement the Q statistic, which represented the proportion of the total variation in study effect sizes that was due to true between-study differences rather than random sampling variation (Higgins & Thompson, 2002). Subsequently, moderator analyses were conducted to examine factors that may account for heterogeneity in study effect sizes.

Mixed-effect meta-regression models with estimation via full information maximum likelihood were conducted to assess the effects of moderators, which is preferred over random- and fixed-effects models when the Q statistic is significant (Borenstein et al., 2009; Card, 2012). Moderators were examined in separate meta-regression models (i.e., one at a time) due to concerns about statistical power, which included sample gender (% female), sample age (M), sample race (% White), geographic setting (western vs. non-western country), data collection year, survey modality (online vs. in-person paper survey), social media assessment (frequency vs. time spent), social media type (early vs. new/comprehensive), publication status (yes vs. no), and article focus (primary objective vs. not).

Publication bias. Several analytic approaches investigated the potential effect of publication bias, which may occur due to the selective publication of statistically significant results and can lead to inflated weight mean effect size estimates (Borenstein et al., 2009; Card, 2012). The rank correlation test using Kendall's tau (τ) examined the association between the study effect sizes and the variances of these effect sizes, with a non-significant correlation indicating the absence of publication bias (Begg & Mazumdar, 1994). Egger's linear regression intercept test also assessed the presence of publication bias by assisting with the interpretation of the funnel plots, with a non-significant result indicating that the funnel plot is symmetrical (i.e., no publication bias) (Egger, Smith, Schneider, & Minder, 1997). Funnel plots depict study effect sizes (x-axis) as a function of their standard errors (a reflection of the sample size; y-axis). Effect size estimates should be more precise with increasing sample size, and therefore study effect size estimates should center more closely around the weighted mean effect size at the top of the plot (as sample size increases) and be scattered symmetrically around the weighted mean effect size at the bottom of the plot (with smaller sample sizes). The funnel plot will appear asymmetrical in the presence of publication bias as a result of smaller samples reporting larger effect sizes (Egger et al., 1997). Finally, the trim-and-fill method (Duval & Tweedie, 2000) evaluated the number of studies that would need to be included above or below the weighted

Table 2

Summary of meta-analytic results examining the association between social media use and risky behaviors in adolescents.

Outcome	Sample		Weighted Mean Effect Size			Heterogeneity		Publication Bias	
	<i>k</i>	<i>N</i>	<i>r</i>	95% CI	Z value	<i>Q</i>	<i>I</i> ²	τ	<i>t</i>
Risky Behaviors	27	67,407	.21	.16, .25	8.23***	1055.40***	.97	.13	0.46
Substance Use	14	36,228	.19	.12, .26	5.26***	656.45***	.98	.07	0.45
Risky Sexual Behaviors	14	23,096	.21	.15, .28	6.10***	319.05***	.95	.16	1.94*

Notes. *k* = number of studies; *N* = sample size; *r* = weighted mean correlation coefficient; *Q* = homogeneity statistic, with significant values indicating heterogeneity among study effect sizes; *I*² = proportion of variability due to true between-study differences rather than random sample variation; τ = Kendall's tau rank-correlation test, with non-significant values indicating the absence of publication bias; *t* = Egger's test of funnel plot asymmetry, with non-significant values indicating the absence of publication bias.

p* < .05; *p* < .01; ****p* < .001.

mean effect size to make the funnel plot symmetrical and, if relevant, imputed the missing studies to generate an adjusted weight mean effect size that accounted for publication bias.

4. Results

Table 2 provides a summary of the findings for meta-analytic results examining the associations between social media use and risky behaviors during adolescence.

4.1. Associations between social media use and risky behaviors

Fig. 2 depicts the forest plot from the random-effects model for the association between social media use and engagement in risky

Forest Plot for the Association between Social Media Use and Risky Behaviors

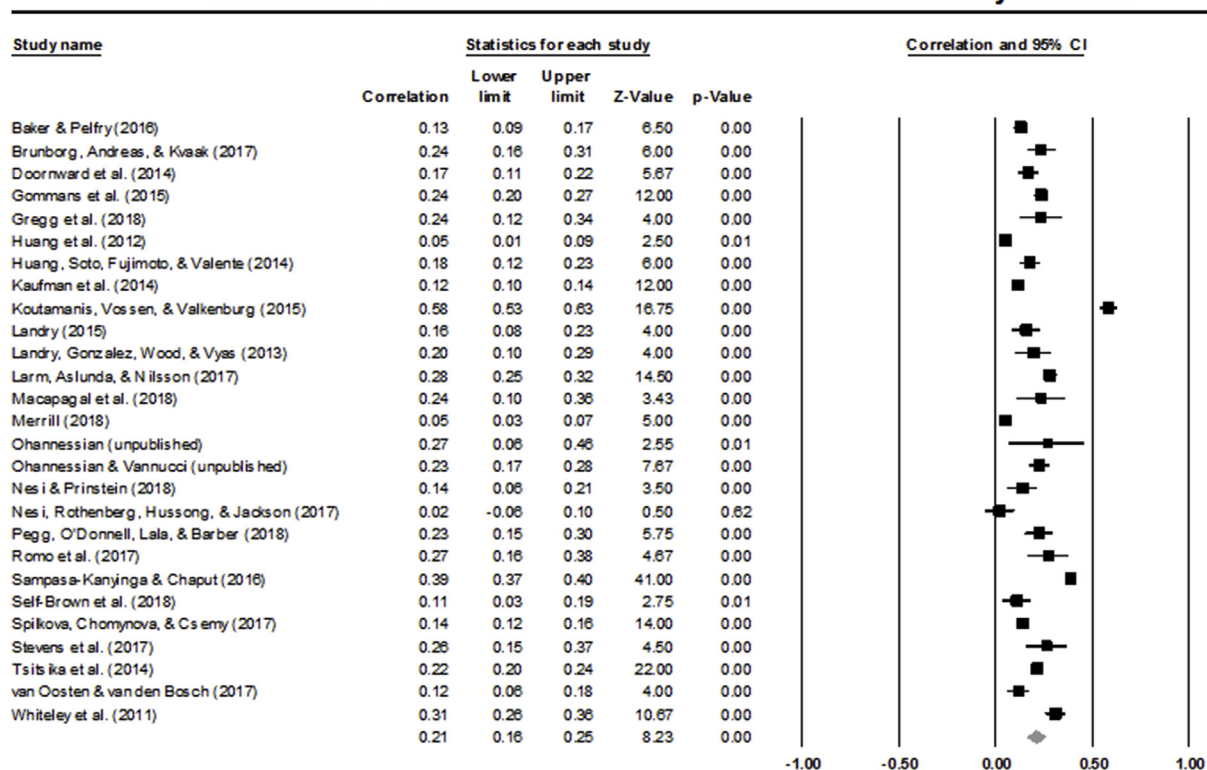


Fig. 2. Forest plot for the association between social media use and risky behaviors.

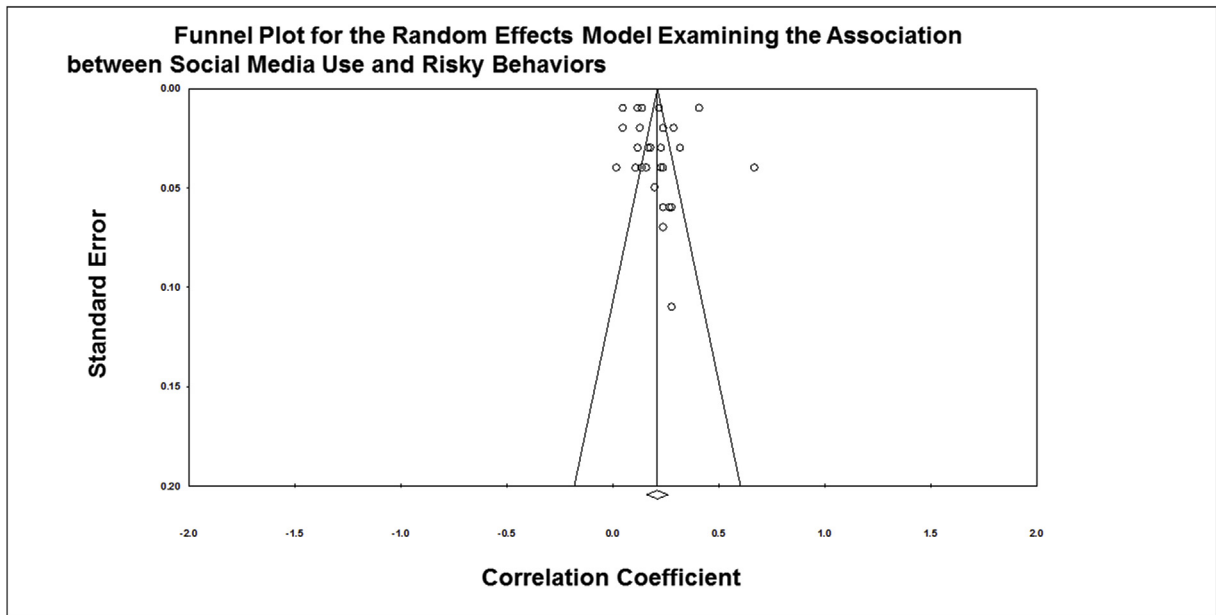


Fig. 3. Funnel plot for the random effects model examining the association between social media use and risky behaviors.

behaviors. The weighted effect size was $r = 0.21$ (95% CI: 0.16, 0.25), which was statistically significant ($Z = 8.23, p < .001$) and reflected a small-to-medium effect for the correlation between social media use and risky behaviors. The homogeneity statistic indicated that there was significant heterogeneity of effect sizes across studies beyond random sampling error ($Q_{26} = 1055.40, p < .001$), accounting for 97% of the variability in the correlation coefficients ($I^2 = 0.97$). Results from the mixed-effects meta-regression models indicated that there were no significant moderation effects for any of the study characteristics assessed ($ps > .05$; [Supplementary Table 1](#)).

There was some evidence of publication bias. The rank correlation method suggested that there was no significant correlation between the effect size and standard error across studies, Kendall $\tau = 0.13, p > .05$. This finding was confirmed by the Egger's test, which was not statistically significant, $t(25) = 0.46, p > .05$, indicating that there was no asymmetry in the funnel plot ([Fig. 3](#)). However, results from the trim-and-fill method for the random effects model indicated that nine studies needed to be imputed to the right of the mean to obtain symmetry in the funnel plot. When the studies were imputed, the adjusted weighted mean effect size accounting for publication bias was $r = 0.26$ (95% CI = 0.21, 0.32).

4.2. Associations between social media use and substance use

The weighted effect size for the association between social media use and substance use was $r = 0.19$ (95% CI: 0.12, 0.26), which was statistically significant ($Z = 5.26, p < .001$) and reflected a small-to-medium magnitude of effect ([Supplementary Fig. 1](#)). There was significant between-study heterogeneity in the effect sizes ($Q_{23} = 656.45, p < .001$), which accounted for 98% of the variability in the study correlation coefficients ($I^2 = 0.98$). Results from moderator analyses ([Supplementary Table 2](#)) indicated that the type of social media use platform significantly accounted for 26% of the between-study variability in the effect sizes ($B = -0.03, SE = 0.02, p < .05, R^2 = 0.26$). Specifically, the weighted effect size for studies assessing solely early forms of social media use (i.e., Facebook/MySpace only, internet-based social networking sites) was $r = 0.14$ (95% CI: 0.08, 0.20), whereas the weighted effect size for studies assessing a broader scope of contemporary social media platforms was larger in magnitude at $r = 0.23$ (95% CI: 0.18, 0.29).

There was some evidence for mild publication bias. Two indices suggested that there was no publication bias, as the rank correlation method indicated that there was no association between the effect size and standard error across studies (Kendall $\tau = 0.07, p > .05$) and Egger's test indicated that the funnel plot did not exhibit significant asymmetry ($t[12] = 0.46, p > .05$; [Supplementary Fig. 2](#)). Of note, however, the trim-and-fill method suggested that one study needed to be imputed to the right of the mean to obtain a symmetrical funnel plot. The adjusted weighted mean effect size accounting for publication bias was $r = 0.20$ (95% CI = 0.13, 0.27).

4.3. Associations between social media use and risky sexual behaviors

The weighted effect size from the random effects model examining the association between social media use and engagement in risky sexual behaviors was $r = 0.21$ (95% CI: 0.15, 0.28), which was statistically significant ($Z = 6.10, p < .001$) and reflected a small-to-medium effect ([Supplementary Fig. 3](#)). The homogeneity statistic indicated that there was significant heterogeneity in the magnitude of effect sizes across studies beyond random sampling error ($Q_{13} = 319.05, p < .001$), which accounted for 95% of the

between-study effect size variability ($I^2 = 0.95$). Sample age was identified as a significant moderator from the mixed-effects meta-regression models (Supplementary Table 3), accounting for 30% of the variability in the magnitude of study effect sizes ($B = -0.06$, $SE = 0.02$, $p < .05$, $R^2 = 0.30$). The implied effect size was $r = 0.41$ for studies with a mean sample age of 12.0 years; was $r = 0.23$ for studies with a mean sample age of 15.0 years; and was $r = 0.05$ for studies with a mean sample age of 18.0 years.

There was evidence of publication bias for two out of three indices. Although the rank correlation method suggested that there was no association between the effect size and standard error across studies (Kendall $\tau = 0.16$, $p > .05$), results from Egger's test indicated that the funnel plot exhibited significant asymmetry and therefore was suggestive of publication bias ($t[12] = 1.95$, $p < .05$; Supplementary Fig. 4). Moreover, trim-and-fill analyses suggested that five studies to the right of the mean effect size needed to be imputed to obtain symmetry in the funnel plot. When the studies were imputed, the adjusted weighted mean effect size accounting for publication bias being estimated as $r = 0.28$ (95% CI = 0.18, 0.36).

4.4. Associations between social media use and violence-related behaviors

There were an insufficient number of eligible studies ($k = 3$) available to calculate a weighted mean effect size for the association between social media use and engagement in violence-related behaviors. In a large-scale study of 9th and 10th grade students from seven European countries (Tsitsika et al., 2014), more frequent weekly use of social media in the year prior to assessment was associated with more frequent aggressive behaviors during the same time period ($r = 0.22$, $p < .001$). Findings from an unpublished cross-sectional study of 7th and 8th grade students from rural, suburban, and urban schools in the Northeastern U.S. (for study characteristics, see (Ohannessian and Vannucci, 2016) in Table 1) also suggested that more time spent using social media on a daily basis was associated with more frequent engagement in overt aggression toward peers in the past six months ($r = 0.23$, $p < .001$). Finally, adolescents who reported frequent social media use (weekly or more) were more likely to report carrying weapons than those with infrequent social media use (monthly or less) in a large U.S. sample of 6-12th grade students from a large Midwestern city ($r = 0.07$, $p < .001$) (Baker & Pelfrey, 2016).

5. Discussion

Adolescence is a developmental period characterized by extensive social media use, high rates of risky behaviors, and a heightened salience of peers (Gerwin et al., 2018; Kann et al., 2018; Pew Research Center, 2018b). This meta-analysis, therefore, sought to summarize the available research examining the relationship between general social media use and engagement in risky behaviors during adolescence. A total of 27 independent cross-sectional studies were eligible for inclusion in the meta-analysis, which represented more than 67,000 adolescents between the ages of 12 and 18 years from around the world.

Findings suggested that there were small-to-medium concurrent associations between higher levels of social media use and more frequent engagement in risky behaviors, including substance use and risky sexual behaviors. There were too few independent studies focused on violence-related behaviors to estimate a weighted mean effect size in a separate analysis, but the three existing studies suggested a similar direction and magnitude of effect (Baker & Pelfrey, 2016; Ohannessian and Vannucci, 2016; Tsitsika et al., 2014). Although there was some evidence of publication bias, the weighted mean effect sizes adjusting for publication bias indicated that the associations between social media use and risky behaviors were likely underestimated rather than inflated. These findings are consistent with the small-to-medium associations found previously in meta-analyses examining the relationship between other aspects of social media use and indicators of poor psychological adjustment, including psychological distress, depressive symptoms, alcohol consumption, and risky sexual behaviors, among youth and young adults (Curtis et al., 2018; Marino, Gini, Vieno, & Spada, 2018; McCrae, Gettings, & Purssell, 2017; Smith et al., 2016).

The positive link between social media use and numerous forms of risky behaviors found in studies that collected data between 2007 and 2016 does not support displacement hypothesis (Kraut et al., 1998), which proposes that social media use replaces time spent on offline health behaviors, including risky behaviors. Findings from this meta-analysis suggest that decreases in the prevalence of many offline risky behaviors, such as binge drinking, cigarette smoking, and violence perpetration, over the past decade may not be primarily related to the co-occurring increases in social media use during the same time frame. In line with the co-construction model (Subrahmanyam et al., 2006), social media use may be a contemporary social context that is interconnected with offline risky behaviors and the developmental propensity toward risk taking and sensation seeking during adolescence. Several studies in this meta-analysis found positive associations between social media use and risky online sexual acts (Gregg, Somers, Pernice, Hillman, & Kernsmith, 2018; Koutamanis, Vossen, & Valkenburg, 2015; van Oosten & Vandenbosch, 2017), which supports the notion that the social media context also may have contributed to a shift in the manifestation of adolescents' enhanced propensity for risk taking and sensation seeking (Crone & Konijn, 2018; Lewycka et al., 2018).

Transformed peer influence mechanisms may account for the positive relationship between social media use and risky behaviors during adolescence. According to the Facebook influence model (Moreno & Whitehill, 2014), exposure to social media content related to positive portrayals of risky behaviors contributes to the development of favorable attitudes toward risky behaviors as being normative and socially desirable. Recent studies support this hypothesis, as greater social media exposure to peers' social reinforcement of alcohol and e-cigarette content is associated with more positive perceptions about alcohol consumption and e-cigarette use among adolescents (Boyle, Smith, Earle, & LaBrie, 2018; Cho, Li, Shen, & Cannon, 2019). Adolescents then are hypothesized to engage in risky behaviors both online and offline to conform to receive social reinforcement and foster a positive social identity (Moreno & Whitehill, 2014). Indeed, adolescents with a reputation for digital status seeking, which refers to putting high effort into strategies to obtain more likes, followers, and retweets (e.g., carefully curated Instagram feed), are at increased risk for

substance use and risky sexual behaviors (Nesi & Prinstein, 2018). Furthermore, favorable attitudes and injunctive norms toward risky behaviors appear to mediate the relationship between exposure to peers' social media content about risky behaviors and higher levels of engagement in risky behaviors in longitudinal studies of adolescents (Davis et al., 2019; Nesi, Rothenberg, Hussong, & Jackson, 2017). Taken together, these findings suggest that peers' social media behaviors and their influence on adolescents' pro-risky behavior attitudes appear to serve as a viable mechanism that links social media use to risky behaviors.

The social media context also may exacerbate other risk factors for risky behaviors among adolescents. Findings from recent neuroimaging studies suggest that adolescents' normative neural imbalance between enhanced reward sensitivity and immature cognitive control circuitry is apparent when adolescents are exposed to quantifiable peer reinforcement of risky behavior content on an Instagram-like platform (e.g., viewing photos with many likes) (Sherman et al., 2016, 2018). As such, social media-driven exposure to risky behaviors may elicit decreased activation in cognitive control regions that make it difficult for adolescents to control their impulses to engage in risky behaviors both online and offline. Frequent social media use also has been shown to predict increases in depressive symptoms, school avoidance, and delinquent behaviors among adolescents (Vannucci & Ohannessian, 2019), each of which are linked to engagement in risky behaviors. Adolescents with a history of childhood maltreatment also are more likely to engage in problematic social media use behaviors (e.g., oversharing, posting sexually provocative content, online sexual solicitation, excessive reassurance seeking) and experience distress from encountering triggering content, which may confer greater vulnerability for risky behaviors (Noll, Shenk, Barnes, & Haralson, 2013; Worsley, McIntyre, Bentall, & Corcoran, 2018).

It is also plausible that adolescents who engage in risky behaviors are more likely to be drawn to using social media frequently. The co-construction model (Subrahmanyam et al., 2006) emphasizes that adolescents are active and intentional in their choice of social media interactions and behaviors and that developmental issues, such as identity exploration, risk taking, and sexuality, manifest as adolescents construct their online communities. As such, social media allows adolescents the freedom to express and cultivate online communities that reflect their current sense of identity and who they desire to be, which for many adolescents involves the portrayal of themselves engaging in or displaying positive content of risky behaviors (Eleuteri et al., 2017; Moreno & Whitehill, 2014). Similarly, uses and gratification theories (Ruggiero, 2000; Sundar & Limperos, 2013) propose that individuals are driven to use different social media platforms to satisfy their diverse needs. For adolescents who are prone to risky behaviors and desire peer acceptance, such developmental needs may manifest as adolescents displaying their risky behaviors online to obtain positive peer feedback and approval, connecting with other deviant peers via groups and discussion boards, seeking information about risky behaviors, and organizing offline risky behaviors with others.

Despite the presence of substantial heterogeneity in the study effect sizes, few moderation effects were identified. Methodological differences in the assessment of both social media use and engagement in risky behaviors across studies likely accounts for much of the observed heterogeneity. Notably, the type of social media platform accounted for 26% of the variability in the effect sizes across studies examining the relationship between social media use and substance use. Studies that assessed early forms of social media, such as Facebook and/or MySpace only, had smaller associations than studies that assessed a broader range of social media platforms that are currently popular among adolescents, such as Instagram and Snapchat. These findings support the media practice model (Steele & Brown, 1995) and uses and gratification theories (Ruggiero, 2000; Sundar & Limperos, 2013). According to these models, adolescents who are motivated to engage in substance use are drawn to using Instagram and Snapchat because their unique features allow for the documentation, display, and communication of substance use with peers. These platforms may be the most salient venues for seeking peer approval, increasing social status, and expressing idealized identities via substance use displays due to the compelling features (e.g., image filters, "likes," comments), privacy from adults, and lack of consequences (Eleuteri et al., 2017; Nesi et al., 2018; Vannucci & Ohannessian, 2019; Vannucci, Ohannessian, & Gagnon, 2018). The quantifiable peer endorsement of substance use photos in the form of "likes" also appears to promote peer influence effects among adolescents by eliciting increased activity in socioemotional neural processing systems and decreased activity in the neural regions implicated in cognitive control, which may enhance the anticipated reward value of substance use and impose difficulties with restraining impulses to engage in substance use (Sherman et al., 2016, 2018).

In the only other significant moderation effect, younger samples had larger effect sizes than older samples for studies focused on examining the association between social media use and risky sexual behaviors. Age accounted for nearly one third of the between-study variability beyond random sampling error, with the implied correlation being medium-to-large for studies with a mean sample age of 12 years and being small-to-negligible for studies with a mean sample age of 18 years. These findings contrast a prior meta-analysis examining the cross-sectional associations between problematic Facebook use and psychological distress among adolescents and young adults, which found that effect sizes were larger among older studies (Marino et al., 2018). However, the age moderation effects from the current study align with social development theories indicating that the salience of peers, and by extension the social media context and peer influence effects on risk taking, is at its peak during early adolescence and wanes slightly into late adolescence (Gerwin et al., 2018). Neurodevelopmental models of adolescent risk taking also support these age differences (Casey, 2015; Shulman et al., 2016; Steinberg, 2010), as the neural imbalance between the heightened sensitivity in the early-maturing socioemotional system and the reduced efficiency of the gradually maturing cognitive control system peak during early adolescence and become less robust in late adolescence. As such, the peer influence effects on sexual risk taking exerted via social media use may be exacerbated during early adolescence because youth at this early age have a diminished capacity to their control impulsive and risky sexual acts relative to older adolescents.

5.1. Strengths and limitations

This systematic review and meta-analysis is the first to summarize the extant literature regarding the relationship between social

media use and engagement in risky behaviors during adolescence. Major study strengths include the large and diverse sample of adolescents, the inclusion and analysis of several common risky behaviors (i.e., substance use, risky sexual acts, violence-related behaviors), and the examination of numerous moderation effects. However, findings from this meta-analysis should be considered in light of its limitations. All of the eligible studies were cross-sectional, and therefore it is not possible to make generalizations regarding causality or the direction of effect. The systematic review intended to include all measurement methods of social media use and risky behaviors in the meta-analysis, such as self-reports, reports from parents, peers, and teachers, and objective measures of these constructs (e.g., app use from cell phone data, HIV/STI diagnosis, physiological measures of substance use, academic disciplinary or legal records related to risky behaviors). Surprisingly, eligible studies only included retrospective self-report measures of both constructs, which reveals a major limitation in the extant literature. It is possible that there may be systematic biases inherent in self-reports of social media, as social media use could be either underestimated because it is an unconscious habit rather than an intentional decision or overestimated given the widespread cultural expectations that adolescents are using social media constantly (Junco, 2013). Most adolescents provide consistent reports of their engagement in risky behaviors over time, but retrospective self-reports of risky behaviors nonetheless are subject to social desirability and memory biases (Stueve & O'Donnell, 2000). In addition, the correlation coefficients adjusted for measurement unreliability whenever possible, but the vast majority of studies utilized single item, self-report measures that did not have reliability estimates to assess both social media use and engagement in specific risky behaviors. As such, the weighted mean effect sizes may reflect an attenuated estimate of the true population effect size with regard to the positive relationship social media use and risky behaviors during adolescence (Borenstein et al., 2009; Card, 2012). Although several unpublished studies were included in the meta-analysis, few positive responses were obtained to data requests and there was nonetheless evidence of publication bias for the meta-analyses focused on overall risky behaviors, substance use, and risky sexual acts. However, the effect size estimates adjusting for publication bias suggested that the magnitude of the associations were likely underestimated rather than inflated. Finally, there were few studies examining the relationship between general social media use and violence-related behaviors to conduct a separate meta-analysis for this domain, so conclusions drawn from these initial studies should be considered preliminary.

It also is important to consider that substantial differences across study methods likely contributed to the heterogeneity in the effect sizes across studies, which may have accounted for the lack of significant moderation effects. This hypothesis is supported by the significant moderation effects observed when conducting analyses for specific risky behaviors, including substance use and risky sexual acts. However, there was limited power to detect significant moderation effects given that there were only 14 studies that focused on each of these outcomes. Although the assessment method for social media use (i.e., social media use frequency vs. time spent using social media) was not related to systematic differences in study effect sizes in the moderation analyses, this variability in social media use assessment is nonetheless a limitation of the extant literature. There were several moderators that only were significant at a trend level in accounting for between-study variability in effect sizes, including age, social media type, and geographic setting of participants being from western or non-western countries for overall risky behaviors, as well as gender for substance use. Prior meta-analyses focused on the relationship between social media use and indices of psychological adjustment also have found evidence to suggest that these study characteristics may account for differences in study effect sizes (Curtis et al., 2018; Marino et al., 2018; McCrae et al., 2017). Future studies, therefore, should continue to examine these factors so that their potential effect across studies and risky behavior domains can be understood.

5.2. Implications and future directions

Findings from the current meta-analysis contribute to the existing debate regarding the relationship between social media use and psychosocial development during adolescence. Within the domain of risky behaviors, higher levels of social media use were associated concurrently with more frequent engagement in substance use, risky sexual acts, and violence-related behaviors with a small-to-medium magnitude of effect. Given the nearly ubiquitous use of social media among adolescents and the positive link to risky behaviors, it seems crucial that social development theories (Bandura, 2012; Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996; Rose & Rudolph, 2006) and neurodevelopmental theories of risk taking (Albert et al., 2013; Casey, 2015; Shulman et al., 2016) incorporate the social media context. Similarly, social media theories (Gerwin et al., 2018; Moreno & Whitehill, 2014; Nesi et al., 2018; Sundar & Limperos, 2013) would benefit from an increased focus on developmental differences and specific social media attributes given that age and type of social media platform assessed accounted for a substantial proportion (26–30%) of the variability in study effect sizes.

Moving forward, it is crucial that studies improve the measurement of social media use and risky behaviors, such as utilizing objective indices of social media use, observations from parents, peers, and teachers, and multiple self-report items of both constructs to generate reliable subscales. The use of cell phones and experience sampling methods for data collection may be ideally suited to examine the relationship between social media use and risky behaviors, as objective social media use measures can be passively collected and concurrent (vs. retrospective) online assessment of risky behavior use may minimize recall and social desirability biases. More reliable assessment across measurement methods would permit a more precise understanding of the magnitude of the relationships observed in this study and strengthen the conclusions and recommendations that can be generated from this literature. Longitudinal studies assessing proximal daily relationships and long-term associations between social media use and risky behaviors also are sorely needed to disentangle the direction of effects to advance theory and strengthen conclusions that can be made for clinical practice and policy efforts. In addition, future work should examine the mechanisms proposed to account for the relationship between social media use and engagement in risky behaviors, such as exposure to risky behavior content, influence of quantifiable peer reinforcement (e.g., “likes”) on portrayals of risky behaviors, digital status seeking behaviors, neurobiological responses during

social media-based peer influence paradigms, and motivations for social media use. Finally, it would be important to consider how social media platforms are being used as outlets for risky behaviors so that more specific recommendations can be made to ensure that social media platforms are a safe place for adolescents to optimize their development.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.adolescence.2020.01.014>.

References

- Abma, J. C., & Martinez, G. M. (2017). Sexual activity and contraceptive use among teenagers in the United States, 2011–2015. *National Health Statistics Reports*, (104), 1–23.
- Albert, D., Chien, J., & Steinberg, L. (2013). The teenage brain: Peer influences on adolescent decision making. *Current Directions in Psychological Science*, 22(2), 114–120. <https://doi.org/10.1177/0963721412471347>.
- Baker, T., & Pelfrey, W. V. (2016). Bullying victimization, social network usage, and delinquent coping in a sample of urban youth: Examining the predictions of general strain theory. *Violence & Victims*, 31(6), 1021–1043. <https://doi.org/10.1891/0886-6708.VV-D-14-00154>.
- Bandura, A. (2012). Social cognitive theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of social psychological theories* (pp. 349–373). Thousand Oaks, CA: SAGE Publications Inc.
- Barry, C. T., Sidoti, C. L., Briggs, S. M., Reiter, S. R., & Lindsey, R. A. (2017). Adolescent social media use and mental health from adolescent and parent perspectives. *Journal of Adolescence*, 61, 1–11. <https://doi.org/10.1016/j.adolescence.2017.08.005>.
- Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics*, 50(4), 1088–1101. <https://doi.org/10.2307/2533446>.
- Best, P., Manktelow, R., & Taylor, B. (2014). Online communication, social media, and adolescent wellbeing: A systematic narrative review. *Children and Youth Services Review*, 41, 27–36. <https://doi.org/10.1016/j.childyouth.2014.03.001>.
- Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. West Sussex, UK: John Wiley & Sons, Ltd.
- Boyle, S. C., Smith, D. J., Earle, A. M., & LaBrie, J. W. (2018). What “likes” have got to do with it: Exposure to peers’ alcohol-related posts and perceptions of injunctive drinking norms. *Journal of American College Health*, 66(4), 252–258.
- Brunborg, G. S., Andreas, J. B., & Kvaavik, E. (2017). Social media use and episodic heavy drinking among adolescents. *Psychological Reports*, 120(3), 475–490. <https://doi.org/10.1177/0033294117697090>.
- Card, N. (2012). *Applied meta-analysis for social science research*. New York, NY: Guilford Press.
- Casey, B. (2015). Beyond simple models of self-control to circuit-based accounts of adolescent behavior. *Annual Review of Psychology*, 66(1), 295–319. <https://doi.org/10.1146/annurev-psych-010814-015156>.
- Catalano, R. F., Kosterman, R., Hawkins, J. D., Newcomb, M. D., & Abbott, R. D. (1996). Modeling the etiology of adolescent substance use: A test of the social development model. *Journal of Drug Issues*, 26(2), 429–455. <https://doi.org/10.1177/002204269602600207>.
- Centers for Disease Control and Prevention (2018). Youth risk behavior surveillance system. Retrieved from Atlanta, GA <https://www.cdc.gov/healthyyouth/data/yrbbs/overview.htm>.
- Cho, H., Li, W., Shen, L., & Cannon, J. (2019). Mechanisms of social media effects on attitudes toward E-cigarette use: Motivations, mediators, and moderators in a national survey of adolescents. *Journal of Medical Internet Research*, 21(6), e14303.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Corey, D. M., Dunlap, W. P., & Burke, M. J. (1998). Averaging correlations: Expected values and bias in combined Pearson r s and Fisher’s z transformations. *The Journal of General Psychology*, 125(3), 245–261. <https://doi.org/10.1080/00221309809595548>.
- Crone, E. A., & Konijn, E. A. (2018). Media use and brain development during adolescence. *Nature Communications*, 9(1), 588. <https://doi.org/10.1038/s41467-018-03126-x>.
- Curtis, B. L., Lookatch, S. J., Ramo, D. E., McKay, J. R., Feinn, R. S., & Kranzler, H. R. (2018). Meta-analysis of the association of alcohol-related media use with alcohol consumption and alcohol-related problems in adolescents and young adults. *Alcoholism: Clinical and Experimental Research*, 42(6), 978–986. <https://doi.org/10.1111/acer.13642>.
- Davey, J., Turner, R. M., Clarke, M. J., & Higgins, J. P. (2011). Characteristics of meta-analyses and their component studies in the cochrane database of systematic reviews: A cross-sectional, descriptive analysis. *BMC Medical Research Methodology*, 11(1), 1–11. <https://doi.org/10.1186/1471-2288-11-160>.
- Davis, J. P., Pedersen, E. R., Tucker, J. S., Dunbar, M. S., Seelam, R., Shih, R., et al. (2019). Long-term associations between substance use-related media exposure, descriptive norms, and alcohol use from adolescence to young adulthood. *Journal Of Youth And Adolescence*, 48(7), 1311–1326. <https://doi.org/10.1007/s10964-019-01024-z>.
- Doornwaard, S. M., Bickham, D. S., Rich, M., Vanwesenbeeck, I., van den Eijnden, R. J., & Ter Bogt, T. F. (2014). Sex-related online behaviors and adolescents’ body and sexual self-perceptions. *Pediatrics*, 134(6), 1103–1110. <https://doi.org/10.1542/peds.2014-0592>.
- Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, 56(2), 455–463. <https://doi.org/10.1111/j.0006-341X.2000.00455.x>.
- Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, 315(7109), 629–634. <https://doi.org/10.1136/bmj.315.7109.629>.
- Eleuteri, S., Saladino, V., & Verrastro, V. (2017). Identity, relationships, sexuality, and risky behaviors of adolescents in the context of social media. *Sexual and Relationship Therapy*, 32(3–4), 354–365.
- Frost, R. L., & Rickwood, D. J. (2017). A systematic review of the mental health outcomes associated with Facebook use. *Computers in Human Behavior*, 76. <https://doi.org/10.1016/j.chb.2017.08.001> 676–600.
- Gerwin, R. L., Kaliebe, K., & Daigle, M. (2018). The interplay between digital media use and development. *Child and Adolescent Psychiatric Clinics of North America*, 27(2), 345–355. <https://doi.org/10.1016/j.chc.2017.11.002>.
- Gommans, R., Stevens, G. W., Finne, E., Cillessen, A. H., Boniel-Nissim, M., & ter Bogt, T. F. (2015). Frequent electronic media communication with friends is associated with higher adolescent substance use. *International Journal of Public Health*, 60(2), 167–177. <https://doi.org/10.1007/s00038-014-0624-0>.
- Gregg, D., Somers, C. L., Pernice, F. M., Hillman, S. B., & Kernsmith, P. (2018). Sexting rates and predictors from an urban midwest high school. *Journal of School Health*, 88(6), 423–433. <https://doi.org/10.1111/josh.12628>.
- Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random-effects models in meta-analysis. *Psychological Methods*, 3(4), 486. <https://doi.org/10.1037/1082-989X.3.4.486>.
- Higgins, J. P., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, 21(11), 1539–1558. <https://doi.org/10.1002/sim.1186>.
- Huang, G. C., Okamoto, J., Valente, T. W., Sun, P., Wei, Y., Johnson, C. A., et al. (2012). Effects of media and social standing on smoking behaviors among adolescents in China. *Journal of Children and Media*, 6(1), 100–118. <https://doi.org/10.1080/17482798.2011.633411>.

- Huang, G. C., Soto, D., Fujimoto, K., & Valente, T. W. (2014). The interplay of friendship networks and social networking sites: Longitudinal analysis of selection and influence effects on adolescent smoking and alcohol use. *American Journal of Public Health*, 104(8), e51–e59. <https://doi.org/10.2105/AJPH.2014.302038>.
- Huedo-Medina, T. B., Sánchez-Meca, J., Marín-Martínez, F., & Botella, J. (2006). Assessing heterogeneity in meta-analysis: Q statistic or I² index? *Psychological Methods*, 11(2), 193. <https://doi.org/10.1037/1082-989X.11.2.193>.
- Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2018). *Monitoring the Future national survey results on drug use, 1975–2017: Overview, key findings on adolescent drug use*. Ann Arbor: Institute for Social Research, The University of Michigan.
- Junco, R. (2013). Comparing actual and self-reported measures of Facebook use. *Computers In Human Behavior*, 29(3), 626–631. <https://doi.org/10.1016/j.chb.2012.11.007>.
- Kann, L., McManus, T., Harris, W. A., Shanklin, S. L., Flint, K. H., Queen, B., ... Thornton, J. (2018). Youth risk behavior surveillance—United States, 2017. *MMWR Surveillance Summaries*, 67(8), 1–114. <https://doi.org/10.15585/mmwr.ss6708a1>.
- Kaufman, Z. A., Braunschweig, E. N., Feeney, J., Dringus, S., Weiss, H., Delany-Moretlwe, S., et al. (2014). Sexual risk behavior, alcohol use, and social media use among secondary school students in informal settlements in Cape Town and Port Elizabeth, South Africa. *AIDS and Behavior*, 18(9), 1661–1674. <https://doi.org/10.1007/s10461-014-0816-x>.
- Koutamanis, M., Vossen, H. G., & Valkenburg, P. M. (2015). Adolescents' comments in social media: Why do adolescents receive negative feedback and who is most at risk? *Computers in Human Behavior*, 53, 486–494. <https://doi.org/10.1016/j.chb.2015.07.016>.
- Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Sherlis, W. (1998). *American Psychologist*, 59(9), 1017–1031. <https://doi.org/10.1037/0003-066X.53.9.1017>.
- Landry, M. (2016). *Social media use and sexual behavior: Examining the risks among latino adolescents*. Dissertation Abstracts International: Section B: The Sciences and Engineering ProQuest Information & Learning. Retrieved from <https://ezproxy.lib.uconn.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2016-17339-124&site=ehost-live>.
- Landry, M., Gonzales, F. A., Wood, S., & Vyas, A. (2013). New media use and sexual behavior among Latino adolescents. *American Journal of Health Behavior*, 37(3), 422–430. <https://doi.org/10.5993/AJHB.37.3.15>.
- Larm, P., Åslund, C., & Nilsson, K. W. (2017). The role of online social network chatting for alcohol use in adolescence: Testing three peer-related pathways in a Swedish population-based sample. *Computers in Human Behavior*, 71, 284–290. <https://doi.org/10.1016/j.chb.2017.02.012>.
- Lewycka, S., Clark, T., Peiris-John, R., Fenaughty, J., Bullen, P., Denny, S., et al. (2018). Downwards trends in adolescent risk-taking behaviors in New Zealand: Exploring driving forces for change. *Journal of Pediatrics and Child Health*, 54(6), 602–608. <https://doi.org/10.1111/jpc.13930>.
- Luciana, M., & Collins, P. F. (2012). Incentive motivation, cognitive control, and the adolescent brain: Is it time for a paradigm shift? *Child Development Perspectives*, 6(4), 392–399. <https://doi.org/10.1111/j.1750-8606.2012.00252.x>.
- Macapagal, K., Moskowit, D. A., Li, D. H., Carrión, A., Bettin, E., Fisher, C. B., et al. (2018). Hookup app use, sexual behavior, and sexual health among adolescent men who have sex with men in the United States. *Journal of Adolescent Health*, 62(6), 708–715. <https://doi.org/10.1016/j.jadohealth.2018.01.001>.
- Madigan, S., Ly, A., Rash, C. L., Van Ouytsel, J., & Temple, J. R. (2018). Prevalence of multiple forms of sexting behavior among youth: A systematic review and meta-analysis. *JAMA Pediatrics*, 172(4), 327–335. <https://doi.org/10.1001/jamapediatrics.2017.5314>.
- Marchant, A., Hawton, K., Stewart, A., Montgomery, P., Singaravelu, V., Lloyd, K., et al. (2017). A systematic review of the relationship between internet use, self-harm and suicidal behaviour in young people: The good, the bad and the unknown. *PloS One*, 12(8), e0181722. <https://doi.org/10.1371/journal.pone.0181722>.
- Marín-Martínez, F., & Sánchez-Meca, J. (2010). Weighting by inverse variance or by sample size in random-effects meta-analysis. *Educational and Psychological Measurement*, 70(1), 56–73. <https://doi.org/10.1177/0013164409344534>.
- Marino, C., Gini, G., Vieno, A., & Spada, M. M. (2018). The associations between problematic Facebook use, psychological distress and well-being among adolescents and young adults: A systematic review and meta-analysis. *Journal of Affective Disorders*, 226, 274–281. <https://doi.org/10.1016/j.jad.2017.10.007>.
- McCrae, N., Gettings, S., & Purcell, E. (2017). Social media and depressive symptoms in childhood and adolescence: A systematic review. *Adolescent Research Review*, 2(4), 315–330. <https://doi.org/10.1007/s40894-017-0053-4>.
- Merrill, R. A. (2018). Associations between media use, mental health, and risky sexual behaviors in adolescence. *Theses and Dissertations*, 2705 <https://scholarworks.uark.edu/etd/2705>.
- Mingoia, J., Hutchinson, A. D., Wilson, C., & Gleaves, D. H. (2017). The relationship between social networking site use and the internalization of a thin ideal in females: A meta-analytic review. *Frontiers in Psychology*, 8, 1–10. <https://doi.org/10.3389/fpsyg.2017.01351>.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery*, 8(5), 336–341. <https://doi.org/10.1016/j.ijsu.2010.02.007>.
- Moreno, M. A., & Whitehill, J. M. (2014). Influence of social media on alcohol use in adolescents and young adults. *Alcohol Research: Current Reviews*, 36(1), 91–100.
- Nesi, J., Choukas-Bradley, S., & Prinstein, M. J. (2018). Transformation of adolescent peer relations in the social media context: Part 2—application to peer group processes and future directions for research. *Clinical Child and Family Psychology Review*, 21(3), 295–319. <https://doi.org/10.1007/s10567-018-0262-9>.
- Nesi, J., & Prinstein, M. J. (2015). Using social media for social comparison and feedback-seeking: Gender and popularity moderate associations with depressive symptoms. *Journal of Abnormal Child Psychology*, 43(8), 1427–1438. <https://doi.org/10.1007/s10802-015-0020->.
- Nesi, J., & Prinstein, M. J. (2018). In search of likes: Longitudinal associations between adolescents' digital status seeking and health-risk behaviors. *Journal of Clinical Child and Adolescent Psychology*. <https://doi.org/10.1080/15374416.2018.1437733>.
- Nesi, J., Rothenberg, W. A., Hussong, A. M., & Jackson, K. M. (2017). Friends' alcohol-related social networking site activity predicts escalations in adolescent drinking: Mediation by peer norms. *Journal of Adolescent Health*, 60(6), 641–647. <https://doi.org/10.1016/j.jadohealth.2017.01.009>.
- Noll, J. G., Shenk, C. E., Barnes, J. E., & Haralson, K. J. (2013). Association of maltreatment with high-risk internet behaviors and offline encounters. *Pediatrics*, 131(2), e510–e517. <https://doi.org/10.1542/peds.2012-1281>.
- Obar, J. A., & Wildman, S. S. (2015). Social media definition and the governance challenge: An introduction to the special issue. *Telecommunications Policy*, 39(9), 745–750. <https://doi.org/10.2139/ssrn.2663153>.
- Ohannessian, C. M. (2014). Adolescent adjustment project. Retrieved from <https://adolescentadjustmentproject.org/>.
- Ohannessian, C. M., & Vannucci, A. (2016). The PANDA project: Predictors of anxiety and depression during adolescence. Retrieved from www.pandaresearchproject.org.
- van Oosten, J. M., & Vandenbosch, L. (2017). Sexy online self-presentation on social network sites and the willingness to engage in sexting: A comparison of gender and age. *Journal of Adolescence*, 54, 42–50. <https://doi.org/10.1016/j.adolescence.2016.11.006>.
- Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan: A web and mobile app for systematic reviews. *Systematic Reviews*, 5, 1–10. <https://doi.org/10.1186/s13643-016-0384-4>.
- Pegg, K. J., O'Donnell, A. W., Lala, G., & Barber, B. L. (2018). The role of online social identity in the relationship between alcohol-related content on social networking sites and adolescent alcohol use. *Cyberpsychology, Behavior, and Social Networking*, 21(1), 50–55. <https://doi.org/10.1089/cyber.2016.0665>.
- Pew Research Center (2018a). Teens' social media habits and experiences. Retrieved from Pew Research Center: <http://www.pewinternet.org/2018/11/28/teens-social-media-habits-and-experiences/>.
- Pew Research Center (2018b). Teens, social media, and technology 2018. Retrieved from Pew Research Center: <http://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/>.
- Romo, D. L., Garnett, C., Younger, A. P., Stockwell, M. S., Soren, K., Catallozzi, M., et al. (2017). Social media use and its association with sexual risk and parental monitoring among a primarily Hispanic adolescent population. *Journal of Pediatric and Adolescent Gynecology*, 30(4), 466–473. <https://doi.org/10.1016/j.jpag.2017.02.004>.
- Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*, 132(1), 98–131. <https://doi.org/10.1037/0033-2909.132.1.98>.
- Ruggiero, T. E. (2000). Uses and gratifications theory in the 21st century. *Mass Communication & Society*, 3(1), 3–37. https://doi.org/10.1207/S15327825MCS0301_02.

- Sampasa-Kanyinga, H., & Chaput, J. P. (2016). Use of social networking sites and alcohol consumption among adolescents. *Public Health*, 139, 88–95. <https://doi.org/10.1016/j.puhe.2016.05.005>.
- Seabrook, E. M., Kern, M. L., & Rickard, N. S. (2016). Social networking sites, depression, and anxiety: A systematic review. *JMIR Mental Health*, 3(4), e50.
- Sedgh, G., Finer, L. B., Bankole, A., Eilers, M. A., & Singh, S. (2015). Adolescent pregnancy, birth, and abortion rates across countries: Levels and recent trends. *Journal of Adolescent Health*, 56(2), 223–230. <https://doi.org/10.1016/j.jadohealth.2014.09.007>.
- Self-Brown, S., Culbreth, R., Wilson, R., Armistead, L., Kasirye, R., & Swahn, M. H. (2018). Individual and parental risk factors for sexual exploitation among high-risk youth in Uganda. *Journal of Interpersonal Violence*. <https://doi.org/10.1177/0886260518771685>.
- Shapiro, L. A. S., & Margolin, G. (2014). Growing up wired: Social networking sites and adolescent psychosocial development. *Clinical Child and Family Psychology Review*, 17(1), 1–18.
- Sherman, L. E., Greenfield, P. M., Hernandez, L. M., & Dapretto, M. (2018). Peer influence via instagram: Effects on brain and behavior in adolescence and young adulthood. *Child Development*, 89(1), 37–47. <https://doi.org/10.1111/cdev.12838>.
- Sherman, L. E., Payton, A. A., Hernandez, L. M., Greenfield, P. M., & Dapretto, M. (2016). The power of the like in adolescence: Effects of peer influence on neural and behavioral responses to social media. *Psychological Science*, 27(7), 1027–1035. <https://doi.org/10.1177/0956797616645673>.
- Shulman, E. P., Smith, A. R., Silva, K., Icenogle, G., Duell, N., Chein, J., et al. (2016). The dual systems model: Review, reappraisal, and reaffirmation. *Developmental Cognitive Neuroscience*, 17, 103–117. <https://doi.org/10.1016/j.dcn.2015.12.010>.
- Silver, N. C., & Dunlap, W. P. (1987). Averaging correlation coefficients: Should Fisher's z transformation be used? *Journal of Applied Psychology*, 72(1), 146–148. <https://doi.org/10.1037/0021-9010.72.1.146>.
- Smith, L. W., Liu, B., Degenhardt, L., Richters, J., Patton, G., Wand, H., ... Cooper, S. (2016). Is sexual content in new media linked to sexual risk behaviour in young people? A systematic review and meta-analysis. *Sexual Health*, 13(6), 501–515. <https://doi.org/10.1071/SH16037>.
- Spilkova, J., Chomynova, P., & Csemy, L. (2017). Predictors of excessive use of social media and excessive online gaming in Czech teenagers. *Journal of Behavioral Addictions*, 6(4), 611–619. <https://doi.org/10.1556/2006.6.2017.064>.
- Steele, J. R., & Brown, J. D. (1995). Adolescent room culture: Studying media in the context of everyday life. *Journal of Youth and Adolescence*, 24(5), 551–576. <https://doi.org/10.1007/BF01537056>.
- Steinberg, L. (2010). A dual systems model of adolescent risk-taking. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, 52(3), 216–224. <https://doi.org/10.1002/dev.20445>.
- Stevens, R., Gilliard-Matthews, S., Dunaev, J., Todhunter-Reid, A., Brawner, B., & Stewart, J. (2017). Social media use and sexual risk reduction behavior among minority youth: Seeking safe sex information. *Nursing Research*, 66(5), 368–377. <https://doi.org/10.1097/NNR.0000000000000237>.
- Strasburger, V. C. (2007). Super-peer theory. In J. J. Arnett (Ed.), *Encyclopedia of children, adolescents, and the media*. Thousand Oaks, CA: Sage Publications, Inc.
- Stueve, A., & O'Donnell, L. (2000). Inconsistencies over time in young adolescents' self-reports of substance use and sexual intercourse. *Substance Use & Misuse*, 35(6–8), 1015–1034.
- Subrahmanyam, K., & Greenfield, P. (2008). Online communication and adolescent relationships. *The Future of Children*, 18(1), 119–146.
- Subrahmanyam, K., Smahel, D., & Greenfield, P. (2006). Connecting developmental constructions to the Internet: Identity presentation and sexual exploration in online teen chat rooms. *Developmental Psychology*, 42(3), 395–406. <https://doi.org/10.1037/0012-1649.42.3.395>.
- Sundar, S. S., & Limperos, A. M. (2013). Uses and grats 2.0: New gratifications for new media. *Journal of Broadcasting & Electronic Media*, 57(4), 504–525. <https://doi.org/10.1080/08838151.2013.845827>.
- Tsitsika, A., Janikian, M., Schoenmakers, T. M., Tzavela, E. C., Olafsson, K., Wójcik, S., ... Richardson, C. (2014). Internet addictive behavior in adolescence: A cross-sectional study in seven European countries. *Cyberpsychology, Behavior, and Social Networking*, 17(8), 528–535. <https://doi.org/10.1089/cyber.2013.0382>.
- Uhls, Y. T., Ellison, N. B., & Subrahmanyam, K. (2017). Benefits and costs of social media in adolescence. *Pediatrics*, 140(S2), S67–S70. <https://doi.org/10.1542/peds.2016-1758E>.
- Underwood, M. K., & Ehrenreich, S. E. (2017). The power and the pain of adolescents' digital communication: Cyber victimization and the perils of lurking. *American Psychologist*, 72(2), 144–158. <https://doi.org/10.1037/a0040429>.
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health*, 48(2), 121–127. <https://doi.org/10.1016/j.jadohealth.2010.08.020>.
- Vannucci, A., & Ohannessian, C. M. (2019). Social media use subgroups differentially predict well-being during early adolescence. *Journal of Youth and Adolescence*, 48(8), 1469–1493. <https://doi.org/10.1007/s10964-019-01060-9>.
- Vannucci, A., Ohannessian, C. M., & Gagnon, S. (2018). Use of multiple social media platforms in relation to psychological functioning in emerging adults. *Emerging Adulthood*. <https://doi.org/10.1177/2167696818782309>.
- Whiteley, L. B., Brown, L. K., Swenson, R. R., Romer, D., DiClemente, R. J., Salazar, L. F., ... Valois, R. F. (2011). African American adolescents and new media: Associations with HIV/STI risk behavior and psychosocial variables. *Ethnicity & Disease*, 21(2), 216–222.
- Williams, G., Hamm, M. P., Shulhan, J., Vandermeer, B., & Hartling, L. (2014). Social media interventions for diet and exercise behaviours: A systematic review and meta-analysis of randomised controlled trials. *BMJ Open*, 4, e003926. <https://doi.org/10.1136/bmjopen-2013-003926>.
- Wolak, J., & Finkelhor, D. (2011). Sexting: A typology. Retrieved from Crimes against Children Research Center <http://www.unh.edu/ccrc/internet-crimes/papers.html>.
- Worsley, J. D., McIntyre, J. C., Bental, R. P., & Corcoran, R. (2018). Childhood maltreatment and problematic social media use: The role of attachment and depression. *Psychiatry Research*, 267, 88–93. <https://doi.org/10.1016/j.psychres.2018.05.023>.