



## Does social media use confer suicide risk? A systematic review of the evidence



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### ABSTRACT

Social media use has increased substantially over the past decade, as have suicidal thoughts and behaviors (STBs). This simultaneous rise has led to growing concerns that social media use confers suicide risk. To assess the validity of such claims, conducting an updated systematic review was essential. The aim of this review was to identify associations between aspects of social media use and STBs, with a focus on potential mechanisms underlying these relationships. An electronic keyword-based literature search was conducted in July 2020 using three databases, and 46 studies were included; PRISMA guidelines were followed in conducting this review. Frequency of social media and smartphone use tended to be associated with STBs. Sexting and suicide-related social media use were also positively associated with STBs. Findings were mixed regarding social media addiction and STBs, but strong associations emerged between smartphone addiction and STBs. More longitudinal research is needed to assess causality and to identify potential mechanisms underlying associations between patterns of digital use and STBs. A discussion of these findings, along with calls to action for research, is included to inspire future directions that will move this area of research forward in the coming decade.

### 1. Introduction

Suicide is the second leading cause of death in the United States in adolescence and young adulthood, ages 18 to 34, and the fourth leading cause of death in middle adulthood, ages 35 to 45 (NIMH, 2019). Even among adults who do not die by suicide, rates of suicidal ideation and attempts are elevated, with the highest prevalence in youth who are 18–25 years old, followed by adults, ages 26 to 49 (NIMH, 2019). Of particular concern is that rather than decreasing, suicide rates have shown an upward trajectory in the past two decades, rising by 33% across age groups from 1999 to 2017 (Hedegaard, Curtin, & Warner, 2018). Accompanying this gradual decline in mental health has been a steady rise in social media use, particularly among young adults. Today, social media use is highly prevalent: In the United States, it is estimated that 84% of young adults (ages 18–29) and 81% of slightly older adults (ages 30–49) use social media (Auxier & Anderson, 2021). In both age groups, YouTube and Facebook are the most popular social networks, followed by Instagram (Auxier & Anderson, 2021). Moreover, social media is now a part of many users' daily routine: Roughly 70% of Facebook users and 60% of Instagram users report visiting these sites at least once a day (Auxier & Anderson, 2021).

Given the concomitant rise in social media use and suicidal thoughts and behaviors (STBs), there has been growing concern that social media use may be imparting suicide risk (e.g., Twenge, Cooper, Joiner, Duffy, & Binau, 2019). In line with this idea, data from a large nationally representative sample of adolescents and adults show that the sharpest increases in serious psychological distress in the last two decades occurred at the outset of the 2010s (Twenge et al., 2019). This period followed a series of events that facilitated expanded access to social media and the Internet: Facebook offering access to all after 2006 (Jones, 2015), the introduction of the smartphone in 2007 (Jones, 2015), and the launch of Instagram and Snapchat in 2010 and 2011, respectively (Jones, 2015). Stronger evidence of a potential causal link between patterns of social media use and declining mental health comes from experimental and longitudinal investigations on social media use and depression. Frequency of social comparison on social media, for example, is longitudinally associated with future depressive symptoms above and beyond prior depressive symptoms (Nesi & Prinstein, 2015). Problematic use of social media (Li et al., 2018), of smartphones (Bickham et al., 2015), and of the Internet (Ciarrochi et al., 2016) consistently predicts depressive symptoms over long periods of time. Additionally, evidence suggests that these negative effects may be particularly impactful on vulnerable

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individuals. Youth with higher (versus lower) depressive symptoms (Rideout & Fox, 2018) and with (versus without) internalizing disorders (Nesi et al., 2019) are more likely to report various negative experiences on social media, including engaging in negative social comparison and feeling excluded on social media. Depressive symptoms have also been shown to predict increases in social media addiction over time (Raudsepp & Kais, 2019). Such findings suggest that certain patterns of social media use may impart independent risk for negative mental health outcomes, above and beyond known risk factors, particularly on vulnerable individuals – potentially because they tend to use social media in more maladaptive ways.

Much less research has focused on social media use and suicide-related outcomes. Although some cross-sectional studies find that certain aspects of social media use are associated with STBs (Liu, Huang, Yu, Li, & Zhu, 2020; Sampasa-Kanyinga & Lewis, 2015), the claim that social media use contributes to suicide risk may be premature. A systematic examination of the extant evidence is needed to begin to take stock of what we actually know about the link between social media use and STBs. Previous systematic reviews have focused on the link between social media and STBs, but two of these limited inclusion criteria to studies with adolescent samples (Memon, Sharma, Mohite, & Jain, 2018; Sedgwick, Epstein, Dutta, & Ougrin, 2019a). Although the third review included studies with young adults, ages 18 to 25, only research conducted up to January 2015 was reviewed (Marchant et al., 2017). However, most of the research on this topic has been conducted in the past five years. An updated review of studies across age groups is therefore needed. Such a review will address not only the question of causality but also the extent to which the link between social media use and STBs extends to adults, for whom suicide rates have also been rising in the past decade.

The primary aim of this review is to identify aspects of social media use that are associated with STBs, across age groups, with a focus on potential mechanisms underlying these relationships. Prevailing theories of suicidal behavior propose that the development of suicidal ideation – and the progression from ideation to attempts – occurs through various social and cognitive factors. Investigating such factors in the social media context may help improve our understanding of why certain aspects, or patterns, of social media use may be harmful. Therefore, a secondary aim of this review is to draw attention to the social-cognitive mechanisms of action that have been investigated thus far in the relationship between patterns of social media use and STBs. Doing so will shed light on the scope of our current knowledge on a) whether and how social media may impact suicide risk, and b) whether and how suicidal individuals are using social media differently, and what impact this use may have on their mental health. At the end of this review, we offer recommendations on how to move this area of research forward for the ultimate goal of protecting the well-being of vulnerable individuals.

## 2. Methods

### 2.1. Study eligibility

All steps of this systematic review were conducted in alignment with the preferred reporting guidelines for meta-analyses and systematic reviews (PRISMA; Liberati et al., 2009). To be included in the review, a study had to meet five criteria: (i) be original peer-reviewed research, whether experimental or observational, (ii) include data on pattern, type, or level of social media or smartphone use as predictor or outcome, (iii) include data on suicidal ideation or suicide attempt as predictor or outcome, (iv) have collected the data on these variables of interest directly from individuals having these experiences, and (v) be written in English. Although the precise definition of social media is debated in the field, for this review, we adopted Carr & Hayes's (2015, p. 50) conceptualization, which defines social media as “Internet-based, disentrained and persistent channels of masspersonal communication facilitating perceptions of interactions among users, deriving value primarily from

user-generated content.” This definition suggests that social media have five discrete characteristics: they are Internet-based, disentrained (i.e., supporting asynchronous communication), socially driven (i.e., facilitating the perception of interactions), user generated (i.e., enabled through interaction with others), and masspersonal (i.e., including ability to broadcast communication to large audiences). These five characteristics guided the second inclusion criterion in our review. Additionally, given that an aim of this review was to examine the relationship between social media use and suicide-related variables across age groups, no age constraints were placed.

Studies were excluded in five cases: first, (i) if the type of digital use examined did not, in large part, involve social media or smartphone use. We thus excluded studies focused solely on Internet use and studies with very broad definitions of digital use that included many Internet behaviors beyond social media and smartphone use. We chose this approach because the aim of this study was to examine what we know specifically about social media and smartphone use and its relationship with suicidal thoughts and behavior. Additionally, studies were excluded if they focused solely on (ii) cyberbullying, given that this digital behavior is qualitatively different from other more naturally occurring social media uses and its relationship with STBs was the focus of a recent meta-analysis (see John et al., 2018). Also excluded were (iii) intervention studies, given that we were more interested in naturally occurring patterns of social media use and their relationship with suicide-related variables, and (iv) studies on *non-suicidal* self-injury, a behavior that has different motivations and consequences than *suicidal* behavior (Bentley, Nock, & Barlow, 2014). To limit risk of bias, we also excluded studies (v) whose data did not come directly from individuals experiencing suicidal thoughts and behaviors (e.g., studies on trends in suicide-related queries in search engines).

### 2.2. Search strategy & study selection

An electronic keyword-based literature search was conducted by the first author on July 21, 2020, without time limits, using three databases: PubMed (including Medline), APA PsycINFO, and Web of Science. Per recommendations for systematic reviews (McGowan & Sampson, 2005), search strategies were developed and refined in consultation with an information scientist at the primary author's university library. A combination of keywords and MeSH terms related to the variables of interest were included and searched in titles and abstracts. Search terms related to digital use (social media, facebook\*, instagram\*, snapchat\*, twitter, tweet\*, sns, social networking site\*, hashtag\*, smartphone\*, mobile\*, internet, digital, screentime, “screen time”, “electronic communication”) were combined with the term *suicid\** and searched on all three databases (see Appendix A for details on separate searches for each database). Reference lists of related systematic reviews and meta-analyses were also examined for any studies not captured in the search.

All studies to be screened were imported into the reference management software Zotero, where duplicate entries were removed. Reference information for the remaining papers, including titles and abstracts, was exported into an Excel file. We prepared this Excel file for use in the screening process by adding columns for each possible recommendation (“include,” “exclude,” or “maybe include – needs full-text review”), as well as one column per exclusion and inclusion criterion. Two reviewers (NM and EA) independently screened the studies in this Excel file by title and abstract, marking each with one of the three recommendations. For records marked for exclusion, a reason for exclusion (matching one of the seven exclusion criteria) was documented by each reviewer. Reviewer recommendations were subsequently compared, and discrepancies were resolved by consensus. Any discrepancies that could not be resolved by consensus were discussed with an expert reviewer (RM), and a final decision was reached. A record was kept of all titles recommended for exclusion, including reasons for exclusion. Studies recommended for inclusion and full-text review were then accessed, downloaded, and reviewed to ensure eligibility criteria were met.

### 2.3. Data extraction

Three independent reviewers were involved in the data extraction process. Studies deemed for inclusion were first grouped by theme (i.e., type of digital use pattern), then divided equally in two sets, which were assigned to two pairs of reviewers (NM and EA on the first set; NM and JM on the second set). For each study included in the review, two reviewers independently extracted sample characteristics (i.e., age, sex, race, sexual orientation, urban/rural population) and study characteristics (i.e., location, study design used, recruitment strategy, platforms assessed, predictors and outcomes and how they were measured, covariates adjusted for, and key study findings). Any potential mechanisms tested or proposed in each study were also identified and extracted at this step. A detailed data extraction sheet was created by the first author for this review and used for data extraction by all reviewers.

Data extraction sheets were subsequently compared, and any inconsistencies in data extraction and quality ratings were discussed by the pair of reviewers and an expert reviewer (RM) and resolved by consensus. Tables with all study information extracted in this step were created (see Tables 1–3), and characteristics of the studies included in this review are summarized below, in the Results section.

### 2.4. Quality assessment

Each study was independently rated for methodological quality by two reviewers (i.e., similarly to the data extraction process, EA and NM rated the first set; JM and NM rated the second set). A detailed quality assessment sheet was created by the first author and used by each reviewer. The sheet contained four sections – one per study design (i.e., cross-sectional, cohort, case-control, qualitative) – with specific guiding questions to help reviewers assess different domains of bias. These questions came from three pre-existing quality assessment tools: the National Institute of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (NIH) the Quality Assessment of Case-Control Studies tool (NIH), and the Critical Appraisal Skills Programme (CASP) Qualitative Studies Checklist (Singh, 2013). We chose these tools because they show evidence of careful development by experts and assess fundamental domains of bias, including participant selection, measurement, confounding, and reporting. Additionally, these tools have been previously used for quality assessment in prior reviews of social media and mental health research (e.g., Keles, McCrae, & Grealish, 2020; Marchant et al., 2017).

Risk of selection bias was largely judged based on whether the sample was clearly defined (including age, sex, race, urban/rural location, and time period in which they participated), the participation rate was at least 50%, the recruitment criteria were applied uniformly to all participants and in the same time frame, and there was a sample size justification. Risk of measurement bias was largely determined by assessing the quality of measures used in each study. Given the wide variety of exposure and outcome measures used, we took a more nuanced approach to this set of quality ratings and created a system whereby each measure was given a quality rating of high, medium/high, medium, medium/low, or low. Rules for rating measure quality were discussed and determined collaboratively by all four co-authors (i.e., EA, JM, NM, RM) in advance (For a list of the rules, see Appendix B, Table B.1). Finally, risk of confounding bias was determined by assessing whether basic confounders (i.e., demographics) and other potential confounding variables discussed in the literature were taken into account. For cohort studies, whether the outcome variable was measured at baseline and adjusted for during analyses was also taken into account. Risk of bias ratings for all of these categories appear in Appendix B, Tables B.2-B.5.

After providing a risk of bias rating for each study, reviewers then took into account each study's strengths and weaknesses as a whole and gave an overall methodological quality rating (Poor/Fair, Fair, Fair/Good, Good). Reviewers' quality rating sheets were subsequently compared, and any discrepancies were discussed and resolved by

consensus. Any discrepancies that could not be resolved by consensus were discussed with an expert reviewer (RM), and a final decision was reached. (See Table 2 and Appendix B, Tables B.2-B.5).

### 2.5. Data synthesis

The large clinical and methodological range (i.e., various research aims, populations studied, and methods used) of the included studies prohibits meta-analysis; we thus employed a narrative synthesis of the data. Guidelines from the Cochrane Consumers and Communication Review Group (Ryan, 2013) were followed to conduct the synthesis. Per guideline recommendations, studies were first assessed for thematic similarities and differences. Given that each study appeared to have focused on one of five overarching patterns of social media use, studies were thus organized by pattern of social media use. Within several of these groups, sub-themes emerged; thus, studies in three of the five overarching groups were further organized by subtheme. Then, within each sub-theme or standalone theme, we assessed studies by findings, looking for similarity and divergence. Where findings diverged, we examined potential reasons, including such key sample characteristics as age as well as measurement differences. This process and its results are detailed in the subsequent sections.

## 3. Results

### 3.1. Description of included studies

A flow diagram illustrating the study selection process is presented in Fig. 1. A total of 45 independent studies were included in the review. These studies were described in 44 articles; one research team (Scherr & Reinemann, 2016) wrote one article describing two separate studies. An overview of the characteristics of included studies appears in Tables 1 and 2

Overall, the location of the studies varied widely. Studies were conducted in the United States ( $n = 13$ ), Korea ( $n = 8$ ), Germany ( $n = 6$ ), Japan ( $n = 5$ ), China ( $n = 4$ ), Australia ( $n = 4$ ), France ( $n = 1$ ), Taiwan ( $n = 1$ ), Mexico ( $n = 1$ ), Canada ( $n = 1$ ), Spain ( $n = 1$ ), and Malaysia ( $n = 1$ ). Roughly one-third of the studies had very large sample sizes (i.e., greater than 1000 participants), with the average sample size in those studies being 27,110. The average sample size of the other two-thirds of the studies was 471. Many studies ( $n = 20$ ) used adolescent samples, and others used adult samples ( $n = 17$ ) and mixed samples of both adults and adolescents ( $n = 8$ ). A little less than half of the studies ( $n = 22$ ) showed equal representation between males and females; of the remaining 23 studies, females were overrepresented in 18 and males in only 5 of them. Only 9 studies had a complete description of the race/ethnicity of the sample, and only 2 studies reported on sexual orientation. Demographic characteristics for each study sample are presented in Table 1.

Studies varied by theme, platforms assessed, and by mediators tested. Five main categories of digital patterns emerged: frequency/use of social media and smartphones ( $n = 13$ ); social media and smartphone addiction ( $n = 7$ ); digital interaction, online ( $n = 9$ ) and on text ( $n = 4$ ); perception/impact of online experiences ( $n = 2$ ); and suicide-related social media use ( $n = 13$ ). (See Table 2). Most studies assessed social media or smartphone use in general terms or inquired about use of leading social networks (i.e., Facebook, Instagram); only two studies focused on Weibo (Cheng, Kwok, Zhu, Guan, & Yip, 2015; Liu et al., 2020), and only three assessed more niche social media platforms (Choi & Noh, 2019; Eichenberg, 2008; Sueki et al., 2012). Only four studies tested potential mechanisms in the relationship between patterns of digital use and STBs; these mechanisms were social capital and self-esteem (Choi & Noh, 2019), suicide-related social media behaviors (Liu et al., 2020), interpersonal problems and depression (Cheng et al., 2015), and positive mental health (Brailovskaia, Teismann, & Margraf, 2020).

Studies also varied by design and measurement of key variables. None of the studies used experimental designs; all were observational. Among

**Table 1**  
Sample characteristics.

	Sample Size	Age Range (M, SD)	Sex	Race/Ethnicity	Sexual Orientation	Urban/Rural Population	Recruitment Source/Strategy	Platforms Assessed
Shafi (2019)	112	12-17 (14.6, 1.5)	82.1% female	75.9% Non-Hispanic White	NR	Urban	Data extracted during retrospective chart review in a hospital psychiatric unit	Chart search terms included Facebook, SnapChat, Twitter, and Social Media
Gansner (2019)	218	12-20 (15.6, NR)	62% female	59.6% White, Non-Hispanic; 17.9% Latino; 12.4% Black; 6.4% Biracial; 3.7% Asian	NR	Urban	Participants recruited from a hospital psychiatric unit	Facebook, Twitter, MySpace, Instagram, Tumblr were included in a list of types of media that may have been involved in a "digital media-related admission"
Kim (2017)	2099	12-15 (NR, NR)	47% female	NR; study conducted in Korea	NR	NR; sample from 125 randomly selected schools across Korea	Data drawn from one wave of the Korean Youth Panel Survey (KYPS), a government-funded longitudinal assessment	Non-specific; assessed use of online messenger services, email, online communities/clubs, online bulletin boards
Sampasa-Kanyinga (2015)	753	NR (15, 0.2)	51.5% male	NR; study conducted in Ottawa, Canada	NR	Urban	Data drawn from one wave of the Ontario Student Drug Use and Health Survey, a biennial population survey of Ontario students in grades 7 through 12	Facebook, Twitter, MySpace, Instagram
Harris (2014)	1016	18-76 (30.37, 10.54)	62.3% female	82.2% White	NR	NR; multiple methods of contact	Recruited from several sources, including university departments (email invitation with survey link sent and distributed to staff and students) and Google ads	Defined social networking as "including not only sites such as Facebook, MySpace, and Twitter, but also chat/IM, and related online activities with a broad social purpose, but not including bulletin board services or forums as they are typically anonymous and content specific"
Chen (2020)	2200	NR; grades 7-12 (NR, NR)	49.7% female 48.6% male	NR; study conducted in China	NR	Urban	Randomly selected from secondary schools in two districts in China	Mobile phone use
Lee (2020)	62276	12-18 (various; reported per group)	50.8% male	NR; study conducted in Korea	NR	More than 90% of each of the four sub-samples identified as urban	Data drawn from one wave of the Korea Youth Risk Behavior Survey (KYRBS), a self-reported anonymous online survey of a nationally representative sample of Korean adolescents	Non-specific social networking on smartphones
Kim, Min, Ahn, An, & Lee (2019a)	62,276	12-18 (15, 1.75)	50.8% male	NR; study conducted in Korea	NR	47.9% urban, 44.4% small city, 7.8% rural	Data drawn from one wave of the KYRBS	Non-specific social networking on smartphones
Lee et al. (2019)	58052	13-18 (15.12, 0.03)	51.92% male	98% Korean, 1.56% multicultural	NR	NR; sample from 400 schools across Korea	Data drawn from one wave of the KYRBS	Smartphone use
Oshima (2012)	17920	NR (early adol: 13.7, 0.9) (late adol: 16.6, 0.9)	Early: 51.4% male Late: 52.1% female	NR; study conducted in Japan	NR	NR; sample recruited from schools in Mie and Kochi Prefectures in Japan	Recruited from public junior high schools in two prefectures in Japan	Mobile phone use (sending emails and texting)
Brailovskaia (2020)	209	18-41 (23.01, 4.45)	72.2% female	NR; study conducted in Germany	NR	Urban	Randomly selected from pool of individuals who had previously consented to be contacted for future research at a German university	Facebook
Jasso-Medrano (2018)	374	18-24 (20.01, 1.84)	58.6% female	NR; study conducted in Mexico	NR	Urban	Recruited from a university in Mexico	WhatsApp & Facebook
Walburg (2016)	286		41.1% male		NR	Urban		Facebook

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Table 1 (continued)

	Sample Size	Age Range (M, SD)	Sex	Race/Ethnicity	Sexual Orientation	Urban/Rural Population	Recruitment Source/Strategy	Platforms Assessed
Arrivillaga (2020)	2196	NR (16.5, 1.11) 12-19 (14.6, 1.65)	59.8% female 54.1% female	NR; study conducted in southern France NR; study conducted in southern Spain	NR	NR; sample from 10 high schools from southern Spain but areas not specified	Recruited from a high school in southern France Recruited from public secondary schools in southern Spain	Smartphone use
Wan Ismail et al. (2020)	525	NR (21.13, 1.25)	66.9% male 33.1% female	68.8% Malay, 17.1% Chinese, 9% Indian, 5.1% Other	NR	Urban	Randomly selected from public universities in Malaysia	Smartphone use
Kim, Min, Kim, & Min (2019b)	608	NR (22.8, 2.2)	69.6% female	NR; study conducted in South Korea	NR	NR; sample from a Korean university	Randomly selected from a pool of college students in South Korea	Smartphone use
Sohn (2018)	416	NR (17.9, 0.8)	55.3% male	NR; study conducted in South Korea	NR	Rural	Recruited from a vocational high school with an agricultural specialization in South Korea	Smartphone use
Tseng (2015)	391	12-18 (NR, NR)	54.7% female	NR; study conducted in Taiwan	NR	Urban	Randomly selected from public schools in Taiwan	Non-specific Web communication
Kim (2020)	223,542	12-18 (NR, NR)	52.5% male	NR; study conducted in Korea	NR	NR; sample from 800 schools across Korea	Data drawn from the KYPS	Non-specific; social media activities assessed included messenger/chatting, blogging, etc.
Brown (2019)	52	16-20 (16.6, 0.96)	87% female	NR; German-speaking sample	NR	NR	Randomly selected from a larger dataset of Instagram users posting with a set of NSSI-related hashtags	Instagram
Scherr & Reinemann, 2016	2002	18-99 (48.92, 17.32)	51.3% female	NR; study conducted in Germany	NR	Sample representative of German population, 18 and older, living in private households	Sample was part of a large-scale research project on media and suicide	Non-specific online health forum and support groups
Scherr & Reinemann, 2016	1265	14-93 (36.26, 15.11)	61.3% female	NR; study conducted in Germany	NR	NR	Sample was part of a large-scale research project on media and suicide	Non-specific online health forums and support groups
Teo (2019)	587	18+ (40, 12)	80.8% male	18.9% racial/ethnic minority	NR	NR	Recruited through Facebook ads broadly targeting participants with "interests relevant to military veterans"	Facebook
Berryman (2018)	467	NR (19.66, 3.92)	71.7% female 27.8% male 0.5 unanswered	60.2% White, 16.5% Latino/a or Hispanic, 10.1% African American or Black, 6.6% Asian American, 6.2% Other	NR	NR; sample from a university in the southeastern region of the U.S.	Recruited from a university in the southeastern region of the U.S.	Non-specific social media use
Choi (2019)	1500	19+ (43.42, 13.09)	49.3% female	NR; study conducted in South Korea	NR	Both; nationally representative sample	Recruited from a nationally representative online panel of South Korean adults	"Social media such as Facebook, Twitter, Instagram, Line, Band, Kakaotalk"
Turban (2020)	283	NR (35.1, 9.2)	69.6% male	67.8% Non-Hispanic White, 20.1% Other, 9.9% Non-Hispanic Black/African American	NR	NR	Data drawn from the Survey of the Experiences of Returning Veterans (SERV) study; military veterans recruited through the Internet (e.g., Facebook, YouTube), media outlets, Veterans Affairs (VA),	Non-specific; posting images online

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Table 1 (continued)

	Sample Size	Age Range (M, SD)	Sex	Race/Ethnicity	Sexual Orientation	Urban/Rural Population	Recruitment Source/ Strategy	Platforms Assessed
Glenn (2020)	33	18+ (20.4, 2.4)	84.8% female	60.6% White, 18.2% Asian, 9.1% African American, 6.1% Multiracial, 3% Other	NR	Urban; sample from Charlottesville, Virginia	listservs, and word of mouth Recruited from the University of Virginia psychology department's participant pool and surrounding community	Mobile texting
Milton (2019a)	1369	Sample 1: 16–25 (NR, NR) Sample 2: 16–25 (NR, NR)	Sample 1: 50% female, 50% male Sample 2: 50.4% male, 49.6% female	Study conducted in Australia; 2.14% (in sample 1) and 3.43% (in sample 2) Aboriginal or Torres Strait Islander descent	NR	In each sample, approximately 75% in major cities and 25% in regional, rural, or remote areas	Randomly selected through random digit dialing	Non-specific; general social media use
Frankel (2018)	6021	41% < 15 and 59% > 16 (NR, NR)	50.6% male	68.1% White	NR	Mix of urban and rural	Data drawn from one wave of the statewide Pennsylvania and city-based Philadelphia Youth Risk Behavior Survey (YRBS)	Mobile texting and email
Dake, Price, Maziarz, & Ward (2012) (United States)	1289	Sample evenly split between middle and high school students (NR, NR)	51% male 48% female	87% White, 5% Hispanic, 4% African American, 4% Other/Mixed	NR	NR	Stratified random sample from high schools and middle schools in the midwestern region of the U.S.	Mobile texting
Nesi (2019)	433	11-18 (14.6, NR)	61.7% female	66.5% White, 19.6% Hispanic/Latinx, 10.2% African American	NR	NR	Recruited adolescents who had been hospitalized in a psychiatric inpatient facility at an academic medical hospital in the northeastern U.S.	Non-specific; assessed experiences on social media
Katsumata (2008)	590	NR (13.7, 0.78)	50.7% male 49.3% female	NR; study conducted in Japan	NR	Suburban	Recruited students from two junior high schools after one of the authors gave a drug abuse prevention lecture there	Non-specific; assessed email and mobile/online communication
Arendt (2019)	729	18-29 (24.15, 3.23)	81.6% female 16.7% male 1.7% other or unanswered	72% white	NR	NR	Qualtrics panel of participants recruited from Internet gaming websites	Instagram, online chatting (non-specific), forums (non-specific)
Dunlop (2011)	791	14-24 (NR, NR)	51% female	70% non-hispanic white, 13% hispanic, 10% black, 7% other	NR	52% suburban, 28% urban, 20% rural	Randomly selected through random digit dialing	Non-specific social networking website ("e.g., Facebook or MySpace"), YouTube, and non-specific online forums
Swedo (2020)	9773	7th to 12th grade students (NR, NR)	50.3% female	83.8% White Non-Hispanic	10.9% gender/sexual minority	NR	Recruited from public schools in a county in Ohio, U.S., where a suicide cluster had occurred	Snapchat, Instagram, Facebook, Twitter, Other, YouTube, Tumblr
Liu (2020)	569	NR (21.94, 3.31)	86.3% female 13.7% male	NR; participants recruited from Chinese social media platform Weibo	NR	NR	Recruited participants who had commented on a suicide note posted on Weibo in a specified period of time	Weibo
Cheng (2015)	989	18+ (24.2, 4.9)	61.7% male 38.3% female	NR; participants recruited from Chinese social media platform Weibo	NR	NR	Recruited from multiple sources, including post on research team's Weibo account and	Weibo, instant messaging, blogs (non-specific), forums (non-specific)

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Table 1 (continued)

	Sample Size	Age Range (M, SD)	Sex	Race/Ethnicity	Sexual Orientation	Urban/Rural Population	Recruitment Source/ Strategy	Platforms Assessed
Sueki (2015)	1000	20-29 (24.9, 2.9)	61.3% female	NR; study conducted in Japan	NR	NR	on psychology professor's highly-trafficked Weibo page, and through randomly sent invitations to Weibo users with a registered non-official Weibo account	Twitter
Chan (2017)	1010	<17-29 (20.79, NR)	54% female	NR; study conducted in Hong Kong	NR	Urban	Randomly selected through random digit dialing	Facebook, Twitter, online forums and blogs, WhatsApp
Sueki (2014)	5495	20-49 (35.5, 7.8)	43.3% female	NR; study conducted in Japan	NR	NR	Internet survey panels	Non-specific; "disclosing one's suicidal ideation" online
De Luca (2019)	26292	18-35 (SI: 24.27, 7.17) (No SI: 25.58, 7.99)	SI: 66.9% female No SI: 62.4% female	72% Non-Hispanic White (SI: 30.1% rac/eth minority) (No SI: 28.3% rac/eth minority)	SI: 10.1% LGB No SI: 5.6% LGB	NR	Data drawn from the National Research Consortium of Counseling Centers in Higher Education's 2011 Undergraduate and Graduate Student Coping with Stressful Experiences dataset, for which students were recruited from 73 four-year colleges in the U.S.	Online help-seeking sources, including blogging, email, social networking (e.g., Facebook, Twitter), text message, and video chat
Seward (2016)	713	18-71 (31.48, 13.53)	77.1% female	78.5% White, 13.9% Asian, 7.6% Other	NR	42.2% urban, 36.3% other developed region, 17.5% rural, 3.9% remote areas	Recruited through Google and Facebook ads	Online help-seeking sources, including non-specific social networking sites ("e.g. Twitter, Facebook"), online forums, and professionally run online support sites
Eichenberg (2008)	164	<30 (NR, NR)	50% male 50% female	NR; participants recruited from most frequented German-language forum	NR	NR	Recruited through a post on the most frequented German-language forum	Selbstmordforum.de
Sueki (2012)	301	16-30 for roughly 75% of sample (NR, NR)	54.5% female 45.5% male	NR; participants recruited from leading German and Japanese suicide-related forums	NR	NR	Recruited through a post on the home page of suicide message boards	Suicide message boards
Mok (2016)	102	18-24 (20.33, 2.11)	73.5% female 25.5% male 1% other	69.6% White	NR	NR	Recruited from various sources, including the University of Melbourne's student portal, free online classifieds websites, online forums, and Facebook	Suicide-related communities online

observational studies, 38 were cross-sectional, and 7 longitudinal (6 cohort; 1 case control); one included a qualitative component. Regarding measurement of patterns of digital use, only a handful of studies used validated measures, such as the Korean Smartphone Addiction Proneness Scale (Kim, Lee, Lee, Narm, & Chung, 2014) and the Motivation for Using Suicide Bulletin Board Systems scale (Eichenberg, 2008). Given the dearth of validated instruments for digital constructs, most studies used items created by the researchers – most were single items, while some were multiple items with, at times, accompanying reliability information. Regarding measurement of STBs, several studies used validated

instruments, such as the Suicidal Behaviors Questionnaire-Revised (SBQ-R; Osman, Bagge, Gutierrez, 2001) and the Scale of Suicide Ideation (Beck, Kovacs, & Weissman, 1979). Most used one-item measures assessing the presence or absence of ideation or attempts; some of these items were taken from large epidemiological surveys, such as the Youth Risk Behavior Survey (YRBS), and some were constructed by the researchers.

Overall, methodological quality of the studies was acceptable. Quality ranged from good (n = 4) to fair/good (n = 9) to fair (n = 23) to poor/fair (n = 9). Studies rated good, fair/good, and fair tended to have used

**Table 2**  
Study characteristics.

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
<b>Theme No. 1: Frequency/Use of Social Media &amp; Smartphones</b>						
<b>Social media frequency &amp; use</b>						
Shafi (2019) (United States)	Retrospective case-control, 112 inpatient adolescents (ages 12–17)	<b>Suicidal ideation</b> (1 item, PHQ-9; Kroenke, Spitzer, & Williams, 2001), <b>suicide risk</b> (1 item, “rate suicide risk,” Suicide Status Form-II; Romanowicz, O’Connor, Schak, Swintak, & Lineberry, 2013); <b>social media use</b> (1 item)	Demographics (age, sex), hospitalizations, abuse/neglect, depression severity & diagnosis	Social media users (versus non-users) had trending, but not significantly, greater odds of increased suicidal ideation and suicide risk.	none	CC, P/F
Gansner (2019) (United States)	Cross-sectional, 218 psychiatrically hospitalized adolescents (ages 12–20)	<b>Past-year suicidal ideation</b> , planning, attempts (YRBS), <b>digital-related admission</b> (survey response or record review)	none	Adolescents with (vs. without) digital-related admissions were more likely to report past-year suicide planning ( $\chi^2 = 6.79, p < .01$ ) but not ideation or attempts.	relational conflict online (proposed)	CS, F
Jasso-Medrano (2018) (Mexico)	Cross-sectional, 374 young adults (ages 18–24)	<b>Social media freq.</b> (1 item on estimated daily hours on social media), <b>past 2-week frequency of negative risk and protective factors for suicidal behavior</b> (Positive and Negative Suicidal Ideation Inventory; (Osman, Gutierrez, Kopper, Barrios, & Chiros, 1998)	n/a	Social media frequency was not associated with past 2-week suicidal ideation.	social media use to escape negative affect, elicit emotional support & learn coping (proposed)	CS, F/G
Berryman (2018) (United States)	Cross-sectional, 467 young adults (M 19.66, SD 3.92)	<b>Hours online</b> (1 items on hours spent on social media on the average day), <b>suicidal ideation</b> (unclear)	Demographics (age, gender), academic performance, histrionic personality, social functioning indicators, social desirability	Number of hours spent on social media on the average day was not associated with suicidal ideation.	none	CS, P/F
Kim (2017) (Korea)	Cohort, 2099 adolescents (ages 12–15)	<b>At T1: Social media freq.</b> (4 items, 2007 Korean Youth Panel Survey). <b>At T2: Suicidal feelings</b> (1 item, 2008 Korean Youth Panel Survey, “Sometimes I feel suicidal for no apparent reason”)	Sociodemographics, social capital, daily hrs of computer use, sleep, delinquent peer network, bullying victimization, academic stress	Adolescents with higher (vs. lower) levels of social media use had greater odds of reporting suicidal feelings (OR 1.36, CI 1.10–1.67, $p < .01$ ).	school atmosphere, neighborhood attachment (proposed)	CH, F
Sampasa-Kanyinga (2015) (Canada)	Cross-sectional, 753 adolescents (grades 7–12)	<b>Daily social media freq.</b> (1 item, 2013 Ontario Student Drug Use and Health Survey), <b>suicidal ideation</b> (1 item, same survey)	Sociodemographics, self-rated mental health, unmet need for mental health, distress	Daily social media lasting longer than 2 h was associated with ideation (RRR 5.93, SE 2.56, CI 2.38–14.75, $p = .001$ ).	none	CS, F/G
Harris (2014) (Australia)	Cross-sectional, 1016 (18–76, M 30.37, SD 10.54)	<b>Suicide risk</b> (Suicide Behaviors Questionnaire-Revised; Osman 2001), <b>online behaviors</b> (hrs on 11 activities), <b>relationship building online</b> (Online Relationship Building Scale; (Harris, McLean, & Sheffield, 2009)	Gender	Users with high (vs. low/no) suicide risk reported more time spent online every week, higher use of forums (and, for women, social networking sites), and higher likelihood of going online for relationship-building purposes.	none	CS, F
<b>Smartphone frequency</b>						
Chen (2020) (China)	Cross-sectional, 2200 adolescents (grades 7 to 12)	<b>Past-month mobile phone intensity</b> (2 items, avg hrs/day and avg hrs/at night in bed before sleep), <b>lifetime suicidal ideation and attempts</b> (2 items), current suicide plan (yes/no), <b>interpersonal problems</b> (4 items on relationship quality), <b>depression</b> (Chinese version of CES-D; Radloff, 1977)	Sociodemographics (age, gender, single-child household, mother’s education, father’s education), academic pressure, depression	High-intensity mobile phone use was associated with ideation (OR 1.07, CI 1.01–1.12, $p < .05$ ) and attempts (OR 1.17, CI 1.09–1.27, $p < .01$ ), and indirectly associated with ideation, planning, and attempts through a) interpersonal problems, b) depression, and c) interpersonal relationships and depression.	depression, interpersonal problems (tested) loneliness (proposed)	CS, F/G
Lee (2020) (Korea)	Cross-sectional, 62,276	<b>Smartphone freq. &amp; overuse</b> (1 item, hours a day on smartphone; overuse is 5+ hours), <b>main</b>	Sociodemographics characteristics (age, sex,	Social media (vs. studying-related) group significantly more likely	none	CS, F

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
	adolescents (ages 12–18)	<b>smartphone activity</b> in past month (1 item, 4 groups: studying-related, social networking, gaming, entertainment), <b>past-year suicidal ideation</b> (1 item, 2017 Korea Youth Risk Behavior Web-Based Survey [KYRBS])	residence, SES), sleep hours, physical activity	to report ideation (AOR 1.49, CI 1.32–1.69). Smartphone freq. and negative consequences highest in social media group; compared to studying-related group, greater odds of smartphone overuse for social media (AOR 4.57, CI 4.20–4.98), entertainment (AOR 2.60, CI 2.40–2.81), & gaming (AOR 2.24, CI 2.05–2.45) groups.		
Kim, Min, Ahn, An, & Lee (2019a) (Korea)	Cross-sectional, 62,276 adolescents (ages 12–18)	<b>Smartphone freq.</b> (1 item, 2017 KYRBS, hrs spent on smartphone on avg school day; 4 use groups created), <b>main smartphone activity</b> in past month (1 item, KYRBS; answers classified as <i>process</i> , e.g., studying, games, movies, or <i>social</i> , e.g., chat, communities, email, social media), <b>past-year attempt</b> (1 item)	Sociodemographics (age, sex, SES), sleep, stress, alcohol, smoking, experience of violence, relational conflicts due to smartphone use, academic difficulties due to smartphone use	Daily smartphone use of 3–4 (vs. less than 1) hrs (AOR 1.09, CI 1.06–1.12) and of 5+ hrs (AOR 1.79, CI 1.74–1.84) was associated with greater odds of past-year attempt. When main smartphone activity was social, only 5+ hrs had higher odds of attempt (AOR 1.65, CI 1.59–1.71).	stress caused by relational conflicts due to phone use, lower-quality relationships due to non-verbal cues (proposed)	CS, F
Lee et al. (2019) (Korea)	Cross-sectional, 58,052 adolescents (ages 13–18)	<b>Daily smartphone freq.</b> (1 item from 2017 KYRBS, 2 groups created: less/more than avg), <b>past-year suicide attempts</b> (1 item, KYRBS)	SES, daily drinking & smoking, academic performance, multicultural family status	Those who used smartphone more (vs. less) than the average had greater odds of a suicide attempt (OR 1.19, CI 0.54–2.61).	teasing, discrimination due to foreign status (proposed)	CS, F
Jasso-Medrano (2018) (Mexico)	Cross-sectional, 374 young adults (ages 18–24)	<b>Mobile phone use frequency</b> (1 item), <b>frequency of past 2-week negative risk and protective factors for suicidal behavior</b> (Positive and Negative Suicidal Ideation Inventory; (Osman, Gutierrez, Kopper, Barrios, & Chiros, 1998)	Depression taken into account in structural equation model	Frequency of mobile phone use was not associated with past 2-week suicidal ideation.	social media use to escape negative affect (proposed)	CS, F/G
Oshima (2012) (Japan)	Cross-sectional, 17,920 early (7th–9th grade) & late (10th–12th grade) adolescents	<b>Mobile phone freq.</b> after lights out (1 item), <b>current suicidal feelings</b> (1 item; those who said “yes” or “possibly yes” on life not being worth living were considered as having suicidal feelings)	Demographics (age, sex), alcohol use, drug use, sleep length	Using mobile phone after lights out almost daily (vs. never) was associated with greater odds of suicidal feelings for early (AOR 1.62, CI 1.31–1.99) and late adolescents (AOR 1.22, CI 1.04–1.42).	negative emotions, stress induced by mobile use; lower sleep quality (proposed)	CS, F
<b>Theme No. 2: Addiction to (aka Problematic Use of) Social Media &amp; Smartphones</b>						
<b>Social media addiction</b>						
Brailovskaia (2020) (Germany)	Cohort, 209 adults (ages 18–41)	<b>At T1 &amp; T2 (1 yr later): Facebook addiction</b> (Bergen Facebook Addiction Scale; (Andreassen, Torsheim, Brunborg, & Pallesen, 2012), <b>positive mental health</b> (PMH scale; (Lukat, Margraf, Lutz, van der Veld, & Becker, 2016). <b>At T2 only: lifetime suicide-related outcomes</b> (1 item, Suicidal Behaviors Questionnaire-Revised; Osman 2001)	Demographics (age and gender), positive mental health	T1 Facebook addiction predicted T2 suicide-related outcomes (B 0.07, SE 0.02, CI .03-.11); indirect effect through positive mental health (indirect effect: B 0.04, SE 0.01, CI 0.01–0.06).	positive mental health (tested)	CH, F
Jasso-Medrano (2018) (Mexico)	Cross-sectional, 374 young adults (ages 18–24)	<b>Social media freq.</b> (1 item) & <b>addiction</b> (Social Network Addiction Questionnaire; Escurra 2014), <b>past 2-week frequency of risk and protective factors for suicidal behavior</b> (Positive and Negative Suicidal Ideation	Depression taken into account in structural equation model	Social media addiction, but not freq. or mobile use, was associated with suicidal ideation ( $\rho$ .16, $p < .01$ ) and was greater among those with (vs. without) ideation ( $z$ –18.69, $p < .01$ ). With	social media use to escape negative affect, elicit emotional support & learn coping (proposed)	CS, F/G

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
		Inventory; (Osman, Gutierrez, Kopper, Barrios, & Chiros, 1998)		depression taken into account, inverse association between social media addiction and recent 2-week ideation (b = -.21, p < .01).		
Walburg (2016) (France)	Cross-sectional, 286 adolescents (M 16.50, SD 1.11)	<b>Facebook addiction</b> (Internet Addiction Test; (Widyanto & McMurran, 2004), <b>suicide ideas</b> (3 items proposed by (Garrison, Addy, Jackson, McKeown, & Waller, 1991) to complete the CES-D, "I had the impression that life is not worth living," "I wanted to hurt myself," "I wanted to kill myself")	School-related burnout, depressive symptoms	Problematic (vs. non-problematic) Facebook users had higher levels of suicide ideas; suicide ideas was a marginally significant predictor of problematic Facebook use (b 0.12, p = .10), adjusting for school-related burnout & depressive symptoms.	Facebook as escape from self (proposed)	CS, F
<b>Smartphone addiction</b>						
Arrivillaga (2020) (Spain)	Cross-sectional, 2196 adolescents (ages 12–19)	<b>Smartphone addic.</b> (Smartphone Addiction Scale-Short Version [Spanish]; Lopez-Fernandez, 2017), <b>ideation</b> (Frequency of Suicidal Ideation Inventory [Spanish]; Alvarez 2020), <b>emotional intelligence</b> (Wong & Law Emotional Intelligence Scale [Spanish]; Pacheco, Rey, & Sánchez-Álvarez, 2019)	Demographics (gender, grade)	There was a significant effect of smartphone addition on ideation (b 0.11, p < .001), and this relationship was stronger at lower (b 0.16, p < .001) than higher (b 0.07, p < .01) levels of emotional intelligence.	difficulty with emotion regulation, smartphone use to avoid negative emotions (proposed)	CS, G
Wan Ismail et al. (2020)(Malaysia)	Cross-sectional, 525 college students (M 21.1, SD 1.25)	<b>Smartphone addiction</b> (Malay version of Smartphone Use Proneness Scale for Youth; Ching et al., 2015), <b>suicidal ideation</b> (Malay version of SBQ-R)	Demographics (age, sex), daily hours spent online & on phone, Internet addiction, sleep	Smartphone addiction was associated with suicidality (r .10, p < .05) but did not predict suicidality after adjusting for covariates.	none	CS, G
Kim, Min, Kim, & Min (2019b)(Korea)	Cross-sectional, 608 college students (M 22.8, SD 2.2)	<b>Smartphone addiction</b> (Smartphone Addiction Proneness Scale; Kim 2014. Smartphone overuse if scored at high or moderate, vs. normal, risk), <b>past-year suicidal ideation</b> (1 item)	Socio-demographics (age, sex, SES), major, drinking and smoking	The smartphone overuse (vs. normal use) group had greater odds of reporting ideation (OR 2.24, CI 1.52–3.31). Ideation was significantly associated with all domains of smartphone addiction, including withdrawal (b 1.26, SE 0.24), tolerance (b 0.57, SE 0.23), interference (b 0.99, SE 0.27), and virtual life orientation (b 0.77, SE 0.12).	none	CS, F
Sohn (2018)(South Korea)	Cross-sectional, 416 adolescents (M 17.9, SD 0.8)	<b>Smartphone addiction</b> (Smartphone Addiction Proneness Scale; Kim 2014), <b>suicidal ideation</b> (Suicidal Ideation Questionnaire; Shin, 1992)	Gender, Internet addiction, bullying victimization or perpetration, depression, impulsivity	Smartphone addiction was associated with suicidal ideation (OR 2.40, CI 1.1–5.4).	none	CS, G
<b>Theme No. 3: Digital Interaction, Online and on Text</b>						
<b>Social Media Interaction</b>						
Tseng (2015) (Taiwan)	Cross-sectional, 391 adolescents (ages 12–18)	<b>Web communication importance</b> (16 items), <b>lifetime suicidal ideation</b> & plans (Self-injurious Thoughts and Behaviors Interview [SITBI]; Nock 2007)	Demographics, depressive symptoms	Web communication importance was associated with lifetime ideation for boys (OR 2.75, CI 1.18–6.38), but not girls, and was not associated with suicide plans.	emotional support, pos/neg communic. (proposed)	CS, F/G
Kim (2020)(Korea)	Cross-sectional, 223,542 adolescents (ages 12–18)	<b>Types of digital uses</b> (1 item, 2010 KYRBS, on services used most frequently online), <b>past-year suicidal ideation and attempts</b> (2 items, 2010 KYRBS)	none	Most freq. digital uses differed between boys and girls (x <sup>2</sup> 9144; p < .01), with boys endorsing gaming (58.1%) and girls blogging (22.1%) and	none	CS, F

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
Brown (2019) (Germany)	Cross-sectional, 52 posters under NSSI hashtags (16–20)	<b>Current ideation</b> (1 item), <b>past-month Instagram activity</b> (4 aspects extracted from Instagram: # of followers, # following, # pictures posted, # comments received)	Demographics (gender, age, job status), lifetime attempts not associated with predictor/outcome so not included	chatting (20.3%); past-year ideation and attempts highest in youth who used the Internet mostly for porn, followed by chatting & blogging. Aspects of Instagram activity were not associated with current ideation among Instagram posters of NSSI content.	reading active suicidal thoughts online (proposed)	CS, F/G
Scherr & Reinemann, 2016 (Study 1; Germany)	Cross-sectional, 2002 adults (18–99)	<b>use of online health forums or online support groups</b> (1 item assessing extent), <b>suicidality</b> (16 items from German suicide assessment scale; (Pöldinger, 1968)	Cross-sectional data weighted re: sex, age, education to adjust for differences between sample & census data	Small to medium forum-suicidality associations across 6 age groups, with highest in the 50–59 age group ( $n = 283, r = .29, p < .01$ ).	none	CH, P/F
Scherr & Reinemann (2016) (Study 2; Germany)	Cohort, 1265 (14–93)	<b>use of online health forums or online support groups</b> (1 item assessing extent), <b>suicidality</b> (16 items from German suicide assessment scale; (Pöldinger, 1968)	Cross-lagged panels adjusted for baseline predictors	Baseline suicidality predicted forum use a month later, $b 0.07, p < .01$ , but forum use did not predict suicidality a month later.	none	CH, F
Teo (2019) (United States)	Cross-sectional, 587 military veterans (M 40, SD 12)	<b>Online social interaction freq.</b> (1 item, adapted from Health and Retirement Study and Pew Research), <b>Facebook use freq.</b> (1 item), <b>suicidal thoughts</b> and urges (Depressive Symptom Inventory-Suicidality Subscale; Joiner, Pfaff, & Acres, 2002)	Sociodemographics, social contact freq., social media used & why, psychiatric history, lifetime ideation and attempts	Frequency of Facebook social interaction was not associated with current suicidal thoughts and urges, and neither was frequency of general Facebook use or of offline interaction.	quality of social interaction (proposed)	CS, F/G
Berryman (2018) (United States)	Cross-sectional, 467 young adults (M 19.66, SD 3.92)	<b>Vaguebooking</b> (3 items on vague posts designed to elicit attention & concern), <b>social media importance</b> (10 items; Social Media Use Integration Scale; Maree, 2017), <b>suicidal ideation</b> (unclear)	Demographics (age, gender), academic performance, histrionic personality, social functioning indicators, social desirability	Vaguebooking, but not social media importance, was predictive of ideation (Wald statistic = 6.55, $p < .05$ ).	none	CS, P/F
Choi (2019) (South Korea)	Cross-sectional, 1500 adults (M 43.42, SD 13.09)	<b>Social media freq.</b> (3 items on how often users communicate online), <b>suicidal ideation</b> (3 items adapted from the Beck Scale of Suicide Ideation), <b>social capital</b> (3 items adapted from other research), <b>self-esteem</b> (4 items adapted from other research)	Sociodemographics (gender, age, education, income)	No significant direct relationship between social media use and ideation; significant indirect effect between use and ideation through self-esteem ( $b -0.02, SE 0.01, CI -0.05, -0.01$ ), but not social capital, and through social capital and self-esteem ( $b -0.02, SE 0.01, CI -0.04, -0.01$ ).	social capital (tested) self-esteem (tested)	CS, F
Turban (2020) (United States)	Cross-sectional, 283 US military veterans (M 35.1, SD 9.2)	<b>Lifetime sexting</b> (1 item), <b>lifetime posting sexually explicit media</b> of oneself online (1 item), <b>lifetime suicidal ideation</b> , passive and active (unclear)	Sociodemographic data (age, gender, employment status, education)	Neither sexting nor posting sexually explicit images or videos of oneself online was associated with suicidal ideation.	none	CS, P/F
Texting Glenn (2020) (United States)	Cross-sectional, 33 past-attempters (M 20.4, SD 2.4)	<b>Suicidal history</b> (SITBI; Nock, Holmberg, Photos, & Michel, 2007), <b>classification of suicide risk episodes</b> (lab interview; identified 2-week high-, medium-, low-risk episodes), <b>text msg data</b>	none	There was no demonstrated decreased social engagement (i.e., lower ratio of sent vs. received text messages or counts of text messages) before suicide attempts. Sexting higher in 2014 vs. 2012; those with (vs. w/o) STBs had greater odds of two-way sexting (AOR 1.86, CI 1.00–3.46) & sending	none	CS, F/G
Milton (2019) (Australia)	2 cross-sectional, 1369 in 2012 & 1400 in 2014 (16–25)	<b>STBs</b> (suicidality subscale of Psychiatric Symptom Freq. Scale; Lindelow, Hardy, & Rodgers, 1997), <b>sexting beliefs &amp; past-year sexting</b> (4 items)	Demographics, health & well-being indices, Internet use		none	CS, F

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
Frankel (2018) (United States)	Cross-sectional, 6021 youth (41% <15; 59% >16)	<b>Past-year suicide attempts</b> (1 item from YRBS; y/n), <b>past-month consensual sexting</b> (2 items)	Sex, bullying, depressive symptoms, alcohol & smoking, ever had sex, ever had sex x alcohol use	sexes (AOR 2.21, CI 1.19–4.10), but not receiving sexts or no sexting. Consensual sexting was more likely in those who reported attempts (OR 1.96, 95% CI 1.22, 3.17) and other risky behaviors, such as current alcohol use & ever having sex (OR 7.74, CI 5.37–11.14).	none	CS, F
Dake, Price, Maziarz, & Ward (2012) (United States)	Cross-sectional, 1289 (6th-to-12th graders)	<b>Suicidal ideation &amp; attempts</b> (YRBS items), <b>sexting</b> (unclear)	Demographics	Adolescents with past-year ideation (AOR 3.37, CI 2.02–5.61) & attempts (AOR 5.27, CI 2.67–10.40) had greater odds of sexting.	feeling coerced to send intimate pictures (proposed)	CS, P/F
<b>Theme No. 4: Perceptions/Impact of Online Experiences</b>						
Nesi (2019) (United States)	Cross-sectional, 433 psychiatrically hospitalized adolescents (ages 11–18)	<b>Lifetime suicide attempts</b> (1 item from SITBI), <b>recent 2-week positive and negative social media experiences</b> (10 items)	none	More girls with (vs. w/o) attempts compared themselves negatively on social media ( $\chi^2$ 4.70, $p$ = .03), used social media to distract from tough emotions ( $\chi^2$ 8.04, $p$ < .01), viewed pro-suicide social media content ( $\chi^2$ 9.7, $p$ < .01), and got in a fight on social media ( $\chi^2$ 6.51, $p$ < .05). More boys with (vs. w/o) attempts felt excluded on social media ( $\chi^2$ 7.88, $p$ < .01) and viewed pro-suicide content on social media ( $\chi^2$ 15.52, $p$ < .01).	none	CS, F
Katsumata (2008) (Japan)	Cross-sectional, 590 adolescents (M 13.7, SD 0.78)	<b>Lifetime suicidal desire</b> (1 item), <b>anxiety about not getting email replies</b> (1 item), <b>hurtful experiences</b> related to messaging online (1 item)	Gender	Anxiety about not receiving email replies (AOR 2.06, CI 1.33–3.20) and hurtful experiences online (AOR 1.71, CI 1.03–2.84) were associated with greater odds of lifetime suicidal desire.	none	CS, P/F
<b>Theme No. 5: Suicide-Related Social Media Use</b>						
<b>Exposure to &amp; engagement with suicide-related social media content</b>						
Arendt (2019) (United States)	Cohort, 729 youth recruited from Internet gaming sites (ages 18–29)	<b>Time 1: Exposure to self-harm content on Instagram</b> (1 item; just once, more than once, never), <b>lifetime suicidal ideation</b> (1 item, YRBS), <b>general suicide risk</b> (6 items, Suicide Probability Scale [SPS]; Eltz et al., 2007). <b>Time 2: Past-month ideation</b> (1 item from YRBS), <b>past-month suicide risk</b> (6 items, SPS)	Sociodemographics (age, gender, race, education), self-harm exposure via other sources (paper, conversation, video, online news site, chat or forum), baseline ideation	Being exposed to self-harm on Instagram <i>just once</i> was associated with ideation, concurrently (b 0.09, $p$ = .04) and one month later (b 0.21, $p$ < .01). Being exposed to self-harm on Instagram <i>more than once</i> was associated with suicidal ideation concurrently (b 0.16, $p$ < .01) and marginally one month later (b 0.09, $p$ = .059). Similar results for suicide risk.	none	CH, F
Dunlop (2011) (United States)	Cohort, 791 youth (ages 14–24)	<b>At baseline (2008) &amp; T2 (2009): Lifetime suicidal ideation</b> (1 item, adapted from YRBS). <b>At T2 only:</b> Sources of suicide reports (1 item on freq. of exposure from various sources, including peers/family, newspaper, news site,	Sociodemographics (gender, age, race, residence, SES), know someone who died by suicide or attempted, hopelessness, freq. of news exposure, social media use, blogging, daily hrs TV or Internet	The only source of suicide stories that was associated with ideation was online forums (OR 2.58, CI 1.19–5.57, $p$ < .05).	encourage-ment by forum members to attempt suicide (proposed)	CH, P/F

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
Swedo (2020) (United States)	Cross-sectional, 9773 adolescents (7th-to-12th-grade students; age not reported)	video, social media, forum, elsewhere online) <b>Seeing and posting cluster-related content on social media during cluster</b> (1 item each), <b>past &amp; current suicidal ideation</b> (2 items, adapted from SBQ-R), <b>past &amp; current attempt</b> (2 items on attempting, one assessing wanting to die & the other not wanting to die, modified from SBQ-R)	Sociodemographics (sex, grade, race, gender, sexual minority), risk factors for SI/SA during cluster (losing someone to suicide during cluster school year; pre-cluster SI/SA; exposure to vigils, memorials, online news; <i>13 Reasons Why</i> before or during cluster)	67.9% of students saw and 12% posted suicide cluster-related content on social media during the cluster. Seeing (AOR 1.30, CI 1.1–1.7) and posting (AOR 1.70, CI 1.4–2.0) cluster-related content on social media was associated with ideation during the cluster, but seeing memorials, vigils, or news related to the cluster was not. Posting, but not seeing, such content was associated with attempting suicide during the cluster (AOR 1.70, CI 1.2–2.5).	differential identification (proposed)	CS, F/G
Liu (2020)(China)	Cross-sectional, 569 social media users with ideation (M 21.94, SD 3.31)	<b>Ideation</b> (Adult Suicidal Ideation Questionnaire; Reynolds, 1991), <b>past-year suicide-related social media behavior freq.</b> (6 items, 2 each on attending to, commenting/reposting, talking about suicide and suicide-related news on social media)	none	Those with ideation with (vs. without) a history of attempts had more freq. suicide-related social media behaviors (SRSMB), including attending to ( $t = -1.94$ ), commenting/reposting ( $t = -2.12$ ) & talking about ( $t = -5.12$ ) suicide or suicide-related news; indirect effect of ideation on attempt via SRSMB (indirect effect 0.22, CI 0.09–0.36).	attending to and engaging with suicide-related social media content (tested)	CS, F/G
<i>Distress disclosure on social media</i> Cheng (2015) (China)	Cross-sectional, 989 Weibo users (M 24.2, SD 4.9)	<b>Past-year Weibo suicide communication</b> (1 item on whether user expressed ideation on Weibo), <b>social media use freq.</b> (5 items), <b>suicidal ideation</b> (subscale from the Suicide Probability Scale; Liang & Yang, 2010)	Demographics (age, education)	The Weibo suicide communication (WSC) group (vs. non-WSC) had higher ideation and use of forums and blogs, but not of messaging & Weibo; indirect effect of vulnerable personality traits (i.e., neuroticism, low agreeableness) on WSC via negative affectivity and suicide ideation (0.05, CI 0.003–0.10).	none	CS, F
Sueki (2015) (Japan)	Cross-sectional, 1000 youth (ages 20–29)	<b>Suicide-related Twitter use</b> (4 items, 4 groups: no Twitter, inactive user, active with/w/o suicidal tweets), <b>Twitter use aspects</b> (have account, tweet daily, past-month & lifetime suicide-related tweeting), <b>lifetime ideation, planning, attempts</b> (3 items)	Demographics (sex, age, education, marital status, income, job status), alcohol use, hospital visits, depression and anxiety	Tweeting “want to die” associated with lifetime suicide planning (OR 2.55, 1.56–4.17) and attempts (OR 1.67, CI 0.95–2.94), and “want to commit suicide” with lifetime planning (OR 1.92, 1.07–3.46) and attempts (OR 3.48, CI 1.89–6.42).	none	CS, F
Chan (2017)(China)	Cross-sectional, 1010 youth (ages <17–29)	<b>Distress disclosure online</b> (1 item, whether made disclosure on online platforms such as blogs, forums, social networking sites), <b>suicidal ideation</b> (1 item, YRBS)	Demographics (age, sex)	Disclosing distress online was associated with a higher lifetime prevalence of suicidal ideation (OR 1.53, CI 1.04–2.25).	none	CS, F
Sueki (2014) (Japan)	Cohort, 5494 adults (ages 20–49)	<b>Past-month &amp; lifetime disclosure of ideation to an anonymous other online</b> (1 item each, measured at T0), <b>suicidal ideation</b>	Sociodemographics (education, marital status, income), T1 mental health scores, alcohol use &	Past-month (b 0.55, CI 0.23–0.88) & lifetime (b 0.37, CI 0.17–0.57) disclosure of ideation	none	CH, F

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Table 2 (continued)

Lead Author & Year (Study Location)	Study Design & Sample Size (Ages)	Relevant Variables Measured (Instrument Used)	Covariates Adjusted for	Relevant Findings	Potential Mechanisms (Tested or proposed)	Quality Rating
<b>Help-seeking &amp; forum use</b>		(Scale for Suicide Ideation; Beck et al., 1979. Measured at T1, 1 week later, and T2, 7 weeks later)	smoking, psychiatric hospital visit, hours online/day, coping	online predicted increases in ideation from T1 to T2.		
De Luca (2019) (United States)	Cross-sectional, 26,292 adults (ages 18–35)	<b>Importance of sources of help in most stressful past-year period</b> (1 item on importance of in-person & online sources), <b>past-year suicidal ideation</b> (1 item)	Demographics (age, gender, race, sexual orientation), connectedness, risk behaviors	Those with (vs. w/o) past-year ideation were less likely to say help-seeking sources were important in past-year most stressful period. In those with ideation, females (vs. males) more likely to say online help-seeking (OR 1.75, CI 1.39–1.56) at least somewhat important.	none	CS, F
Seward (2016)(Australia)	Cross-sectional, 713 adults (emerging, 18–25, and older, 26–71)	<b>Intention to seek help for ideation from various sources</b> (1 item, adapted from General Help-Seeking Questionnaire; Wilson, Deane, Ciarrochi, & Rickwood, 2005), <b>suicide risk</b> (Suicidal Affect-Behavior-Cognition Scale; Harris et al., 2015)	Demographics (sex, age, race), hours online	As suicide risk level rose, face-to-face help-seeking fell for adults; for emerging adults, online help-seeking rose as risk level rose, mostly on social media. Low perceived family support contributed to social network help-seeking.	none	CS, G
Eichenberg (2008) (Germany)	Cross-sectional, 164 suicide forum users (<30)	<b>Forum use habits &amp; reasons for use</b> (unclear), <b>suicidal ideation before first forum visit and at present</b> (unclear)	none	Both constructive (e.g., seeking help) and destructive (e.g., suicide preparation) motives for forum use were identified; forum users reported reduction in suicidal thoughts after forum use.	none	CS, P/F
Sueki (2012) (Japan & Germany)	Cross-sectional, 301 suicide forum users (adolescents & older adults; ages unclear)	<b>Motivation for using suicide forums</b> (Motivation for Using Suicide Bulletin Board Systems [aka forums] scale; Eichenberg, 2008), <b>strength of suicidal ideation before first forum visit and now</b> (2 items)	none	Forum users reported constructive (e.g., seeking help) and destructive (e.g., suicide preparation) motives for forum use; participants reported decrease in suicidal thoughts with forum use. No differences in motives for use & self-reported change in ideation due to use between users in Japan and Germany.	none	CS, P/F
Mok (2016) (Australia)	Cross-sectional, 102 youth with ideation (18–24)	<b>Participation in an online suicide-related community</b> (1 item); <b>strength of suicidal ideation</b> (2 items) <b>and behaviors</b> (2 items) <b>before first visit &amp; now</b>	Suicidal thoughts before first going online to suicide-related communities	Decrease in self-reported intensity of STBs with forum use; forum aspects unrelated to STBs. Positive (social support) & negative (worsening ideation due to content exposure) online experiences reported.	acquired reasons to live; acquired knowledge of suicide methods (proposed)	CS+Q, F

Note. For quality ratings: CS = cross-sectional category, CC = case-control category, CH = cohort category, CS+Q = cross-sectional with a qualitative component, G = Good, F/G = Fair/Good, F=Fair, P/F=Poor/Fair.

higher-quality measures of exposures and outcomes and to have appropriately considered confounding variables. Studies rated poor/fair may have failed to report specifically how they measured constructs or used outdated or problematic measures, to have ignored key confounders, and to have not applied selection criteria uniformly, all of which may have biased results. That more than three-quarters of the studies had sufficient methodological quality created confidence in the results while also pointing to areas of improvement for this body of research. Risk of bias ratings in each of the three domains or potential bias, which informed the

overall quality ratings, can be found in Appendix B (Table B.2-B.5); overall quality ratings are displayed in Table 2.

### 3.2. Summary of findings, by digital use theme

#### 3.2.1. Theme no. 1: frequency/use of social media & smartphones

3.2.1.1. Social media frequency & use. Seven studies examined the association between overall frequency/use of social media and STBs in

**Table 3**  
Interpersonal, cognitive, and other intrapersonal mechanisms, proposed or tested.

Lead Author & Year (Study Loc.)	Interpersonal Mechanism (proposed or tested)	Cognitive Mechanism (proposed or tested)	Other Intrapersonal Mechanism (proposed or tested)
<b>Theme No. 1: Frequency/Use of Social Media &amp; Smartphones</b>			
<i>Social media frequency &amp; use</i>			
Gansner 2019 (United States)	relational conflict online (proposed)		
Choi 2019 (South Korea)	social capital (tested)		self-esteem (tested)
Kim, 2017 (Korea)	school atmosphere (proposed), neighborhood attachment (proposed)		
<i>Smartphone frequency &amp; use</i>			
Chen 2020 (China)	interpersonal problems (tested), loneliness (proposed)		depression (proposed)
Kim, Min, Ahn, An, & Lee, 2019a (Korea)	lower-quality relationships due to nonverbal cues (proposed)		stress caused by relational conflicts due to phone use (proposed)
Lee et al. (2019) (Korea)	teasing and discrimination due to foreign status (proposed)		
Oshima (2012) (Japan)	negative emotions & stress due to digital interaction (proposed)		lower sleep quality (proposed)
<b>Theme No. 2: Addiction to (aka Problematic Use of) Social Media &amp; Smartphones</b>			
<i>Social media addiction</i>			
Brailovskaia (2020) (Germany)			positive mental health (tested)
Jasso-Medrano (2018) (Mexico)	social media use for emotional support (proposed)		social media use to escape negative affect (proposed) and to learn new coping skills (proposed)
Walburg (2016) (France)			Facebook as escape from self (proposed)
<i>Smartphone addiction</i>			
Arrivillaga (2020) (Spain)			difficulty with emotion regulation; use to avoid negative emotions (proposed)
<b>Theme No. 3: Digital Interaction, Online and via Text</b>			
<i>Social Media Interaction</i>			
Tseng (2015) (Taiwan)	emotional support; valence of communication (proposed)		
Brown (2019) (Germany)	reading active suicidal thoughts online (proposed)		
Teo (2019) (United States)	quality of social interaction (proposed)		
<i>Texting</i>			
Dake, Price, Maziarz, & Ward, 2012 (United States)			feeling coerced to send intimate pictures (proposed)
<b>Theme No. 5: Suicide-Related Social Media Use</b>			
<i>Exposure to &amp; engagement with suicide-related social media content</i>			

**Table 3 (continued)**

Lead Author & Year (Study Loc.)	Interpersonal Mechanism (proposed or tested)	Cognitive Mechanism (proposed or tested)	Other Intrapersonal Mechanism (proposed or tested)
Dunlop (2011) (United States)	encouragement by forum members to attempt suicide (proposed)		
Swedo (2020) (United States)	differential identification (proposed)		
Liu (2020) (China)		attending to and engaging with suicide-related social media content (tested)	
<i>Help-seeking &amp; forum use</i>			
Mok (2016) (Australia)		acquired knowledge of suicide methods (proposed)	acquired reasons to live (proposed)

adolescents (Kim, 2017; Sampasa-Kanyinga & Lewis, 2015; Shafi et al., 2019), adults (Berryman, Ferguson, & Negy, 2018; Harris, McLean, & Sheffield, 2014; Jasso-Medrano & López-Rosales, 2018), or both (Gansner et al., 2019). Regarding *frequency* of general social media use (i.e., time spent on social media), findings were mixed: Three studies found it to be positively associated with STBs, including ideation (Sampasa-Kanyinga & Lewis, 2015) and suicidal feelings (Kim, 2017) in adolescents, and suicide risk in adults (Harris et al., 2014). Two studies, however, found no association between frequency and STBs (Berryman et al., 2018; Jasso-Medrano & López-Rosales, 2018). Additionally, two studies that simply assessed the presence/absence of use found no associations between social media use and STBs in adolescents or adults (Gansner et al., 2019; Shafi et al., 2019).

All seven studies were cross-sectional, except for one, which had a retrospective case-control design (Shafi et al., 2019). Social media frequency/use in these studies was assessed with one-item measures in all studies except one, which did not report how social media use was measured (Gansner et al., 2019). STBs were assessed with single items from validated instruments (Shafi et al., 2019) or from epidemiological surveys (Gansner et al., 2019; Kim, 2017; Sampasa-Kanyinga & Lewis, 2015). One study used a validated scale (SBQ-R) that assessed suicide risk via combined questions about suicidal ideation, attempts, disclosure, and anticipated likelihood of making a suicide attempt (Harris et al., 2014), and another used a validated scale of negative risk and protective factors associated with suicidal behavior (PANSI; Jasso-Medrano & López-Rosales, 2018). One study did not report how suicidal ideation was measured (Berryman et al., 2018).

**3.2.1.2. Smartphone frequency.** Six studies examined smartphone frequency and STBs, using adolescent samples (Chen et al., 2020; Kim, Min, Ahn, An, & Lee, 2019a; Lee, Ahn, Min, & Kim, 2020; Lee, Kim, Han, & Kim, 2019; Oshima et al., 2012) and young adult (Jasso-Medrano & López-Rosales, 2018) samples. In all but one (Jasso-Medrano & López-Rosales, 2018), there was a positive association between smartphone frequency and STBs.

Smartphone frequency was generally positively associated with suicidal ideation – including current, past-year, and lifetime ideation. In one study, adolescents who reported using a mobile phone after lights out almost daily (versus never) had greater odds of current suicidal ideation, defined as thoughts that life is no longer worth living, AOR 1.62, (Oshima et al., 2012). In another, smartphone use for mainly social networking (versus mainly studying-related) purposes was associated with greater odds of past-year suicidal ideation, AOR 1.49, CI 1.32–1.69 (Lee et al., 2020), as well as greater odds of smartphone overuse, AOR 4.57, CI

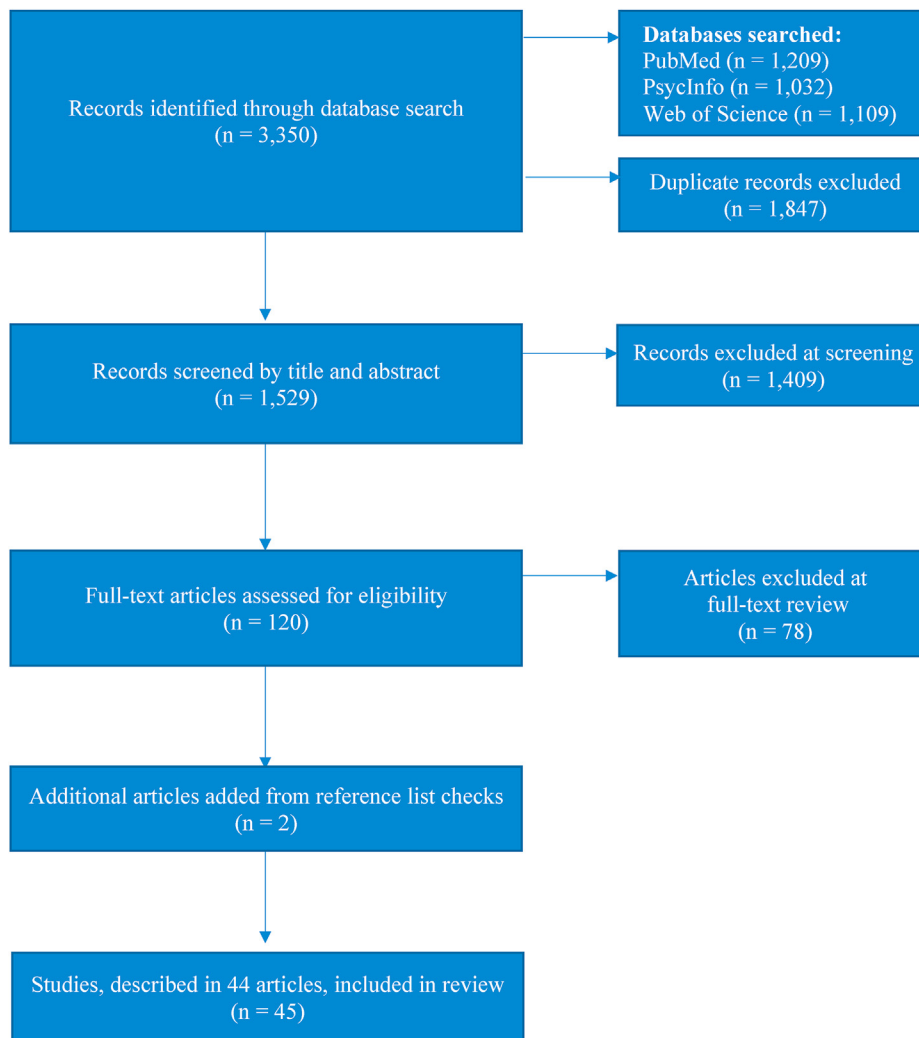


Fig. 1. Study selection process.

4.20–4.98, defined as use that lasts longer than 5 h a day (Lee et al., 2020). High-intensity mobile phone use (i.e., high use during day and night in bed) in the past month was associated with lifetime suicidal ideation,  $OR = 1.07, p < .05$  (Chen et al., 2020). One study did not find an association between mobile phone use frequency and past 2-week suicidal ideation (Jasso-Medrano & López-Rosales, 2018).

Smartphone frequency was also positively associated with suicide attempts. High-intensity mobile phone use in the past month was associated with lifetime attempts,  $OR = 1.17, p < .01$  (Chen et al., 2020). Similar results emerged in relation to past-year attempts among adolescents: Those with greater-than-average (vs. lower-than-average) daily smartphone use had greater odds of a past-year attempt,  $OR 1.19, p < .001$  (Lee et al., 2019) in one study; in another, greater odds of a past-year attempt were found among those with five or more hours,  $AOR 1.79$ , and three-to-four hours,  $AOR 1.09$ , versus those with less than 1 h of daily smartphone use (Kim, Min, Ahn, An, & Lee, 2019a). In further analyses, Kim, Min, Ahn, An, & Lee, 2019a assessed the main purpose of smartphone use in the past month; in those whose main purpose was social (e.g., messaging and chat, communities, email, social media), only those reporting five or more hours of use (versus those reporting 1 h or less) had higher odds of past-year suicide attempts,  $AOR = 1.65$ .

All six studies on smartphone use and STBs were cross-sectional. To measure smartphone frequency, five studies used single-item measures taken from the Korean version of the YRBS (Kim, Min, Ahn, An, & Lee, 2019a; Lee et al., 2019) or written by the research team (Lee et al., 2020;

Oshima et al., 2012; Jasso-Medrano & López-Rosales, 2018); one used two items written by the research team (Chen et al., 2020). To assess STBs, five used single-item measures, either written by the research team (Lee et al., 2020; Oshima et al., 2012) or taken from the Korean version of the YRBS (Chen et al., 2020; Kim, Min, Ahn, An, & Lee, 2019a; Lee et al., 2019); one used a validated scale (PANSI; Jasso-Medrano & López-Rosales, 2018).

### 3.2.2. Theme no. 2: addiction to (aka problematic use of) social media & smartphones

#### 3.2.2.1. Social media addiction.

Social media addiction (a term used interchangeably with “problematic social media use” in the literature) is defined as compulsive use of social media that leads to social, occupational, or psychological impairment and is characterized by the six components of addictions – i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse (Andreassen, 2015; Griffiths, 2005). Three studies assessed the link between social media addiction and STBs in adults and adolescents, cross-sectionally (Jasso-Medrano & López-Rosales, 2018; Walburg, Mialhes, & Moncla, 2016) and longitudinally (Brailovskaia et al., 2020). Overall, findings regarding social media addiction and STBs were mixed.

In the one longitudinal study of adults, Facebook addiction predicted suicidal ideation/attempts in adults one year later,  $b = 0.07, CI = -0.01-0.08$ , adjusting for demographics but not for baseline ideation/



attempts (Brailovskaia et al., 2020). The other two cross-sectional studies found positive bivariate associations between social media addiction and suicide-related outcomes: Social media addiction, but not frequency, was associated with suicidal ideation in young adults (Jasso-Medrano & López-Rosales, 2018), and adolescents who were (vs. were not) addicted to social media had higher levels of “suicide ideas” (Walburg et al., 2016). With depression taken into account, however, a structural equation model showed a negative relationship between social media addiction and recent two-week suicidal ideation,  $\beta = -.21, p < .01$ , in one study (Jasso-Medrano & López-Rosales, 2018); adjusting for depression, current suicide ideas only marginally predicted Facebook addiction,  $\beta = 0.12, p = .10$ , in the other (Walburg et al., 2016).

All three studies used validated measures of social media addiction. In terms of STBs, some of the measures used were slightly problematic. One study used one item – taken from a validated measure – for “suicide-related outcomes,” which lacked specificity (Brailovskaia et al., 2020). Another used items from a modified depression measure that may have mixed suicidal and non-suicidal thoughts to create a “suicide ideas” variable (Walburg et al., 2016). The third used a validated subscale of a measure for suicidal ideation (Jasso-Medrano & López-Rosales, 2018).

**3.2.2.2. Smartphone addiction.** Four studies examined smartphone addiction and its relationship with suicidal ideation in adolescents (Arrivillaga, Rey, & Extremera, 2020; Sohn, Oh, Lee, & Potenza, 2018) and young adults (Kim, Min, Kim, & Min, 2019b; Wan Ismail et al., 2020). All four studies found positive associations between smartphone addiction and suicidal ideation; in one study, however, smartphone addiction was no longer a significant predictor of suicidal ideation after adjusting for covariates, including demographics, Internet addiction, and sleep duration (Wan Ismail et al., 2020).

All four studies were cross-sectional and used validated (and translated and validated) measures of smartphone addiction. Three used validated (and translated and validated) measures of current suicidal ideation (Arrivillaga et al., 2020; Sohn et al., 2018; Wan Ismail et al., 2020), and one used a one-item measure, created by the researchers, of past-year suicidal ideation (Kim, Min, Kim, & Min, 2019b).

### 3.2.3. Theme no. 3: digital interaction, online and on text

**3.2.3.1. On social media.** Nine studies examined associations between aspects of interaction on social media and STBs. In terms of STBs, six focused on suicidal ideation – three in adolescents (Brown et al., 2019; Kim, Kim, Choi, Kim, & Kim, 2020; Tseng & Yang, 2015) and four in adults (Berryman et al., 2018; Choi & Noh, 2019; Teo, Chan, Saha, & Nicolaidis, 2019; Turban, Shirk, Potenza, Hoff, & Kraus, 2020). Two examined “general suicidality,” in both adolescents and adults (Scherr & Reinemann, 2016). Overall, there was an association between some aspects of digital interaction and STBs, but not others.

In adolescents, some associations between social media interaction and STBs differed by gender. In one study, the second- and third-highest proportions of past-year STBs were found among those who reported chatting and blogging as their most frequent activity online; girls endorsed blogging and chatting, and boys endorsed gaming, as their most frequent online activity (Kim et al., 2020). In another study, Web communication was associated with suicidal ideation only for boys,  $OR = 2.75, p < .05$ , not girls (Tseng & Yang, 2015). In adolescents and adults, a longitudinal study found that general suicidality predicted use of health forums and support groups online, but not the other way around, one month later (Scherr & Reinemann, 2016). In one of the few studies with a large sample of older adults, higher social media interaction was protective against suicidal ideation, predicting lower ideation via higher social capital and self-esteem (Choi & Noh, 2019).

Other studies found no associations between aspects of social media interaction and STBs. Among adolescent posters of self-harm content on Instagram, posting images was not associated with suicidal ideation, and

neither were other aspects of Instagram interaction, including number of comments received or follower/following counts (Brown et al., 2019). In adult military veterans, there was no relationship between Facebook interaction frequency and current suicidal ideation (Teo et al., 2019), or between posting sexually explicit images/videos of oneself online and lifetime suicidal ideation (Turban et al., 2020). Suicidal ideation was also not associated with social media importance in adults, but vaguebooking – i.e., posting vague social media posts designed to elicit attention and concern from readers – was (Berryman et al., 2018).

Eight of the nine studies were cross-sectional, and one (Scherr & Reinemann, 2016) was longitudinal. Three used validated measures of STBs (Scherr & Reinemann, 2016; Teo et al., 2019; Tseng & Yang, 2015), although one used an outdated measure from 1968 to measure general suicidality (Scherr & Reinemann, 2016) – and this measure assessed various constructs, including lifetime and current suicidal ideation and attempts, current hopelessness, recent loss of contact with others, and living situation (with family or acquaintances). Two did not report how suicidal ideation was measured (Berryman et al., 2018; Turban et al., 2020), and three used single- (Brown et al., 2019; Choi & Noh, 2019) and two-item (Kim et al., 2020) measures for STBs.

**3.2.3.2. On text.** Five cross-sectional studies examined the link between texting and STBs, two of them in adolescents (Dake, Price, Maziarz, & Ward, 2012; Frankel, Bass, Patterson, Dai, & Brown, 2018) and three in mixed samples of adolescents and young adults (Glenn, Nobles, Barnes, & Teachman, 2020; Milton et al., 2019). Across several studies, one form of texting (i.e., sexting) emerged as a problematic behavior associated with STBs.

In adolescents, sexting was associated with greater odds of past-year suicidal ideation,  $AOR 3.37, CI 2.02–5.61, p < .05$  (Dake, Price, Maziarz, & Ward, 2012), and attempts,  $AORs$  ranging from 1.96 to 5.27 (Dake, Price, Maziarz, & Ward, 2012; Frankel, Bass, Patterson, Dai, & Brown, 2018). In young adults and adolescents, the prevalence of various sexting behaviors increased from 2012 to 2014, as indicated by the same study conducted twice, with different samples, two years apart (Milton et al., 2019), with approximately a third of each sample (selected using random digit dialing) reporting engaging in sexting. Regarding sexting beliefs, the majority in both samples reported feeling pressure to sext and that sexting is a serious problem for youth, often with negative consequences, including messages usually being seen by more than just those to whom they are sent (Milton et al., 2019). Additionally, in this study, those with (versus without) STBs had greater odds of engaging in consensual sexting,  $AOR 1.86, CI 1–3.46, p = .048$ , and sending sexts,  $AOR 2.21, CI 1.19–4.10, p = .01$ , but not of receiving sexts or reporting no sexting.

One study with adolescents and young adults sought to examine whether text message characteristics would differ during periods of higher (versus lower) suicide risk (Glenn et al., 2020). Contrary to hypotheses, no demonstrated decrease in social engagement (i.e., lower ratio of sent vs. received text messages or counts of text messages) was indicated in periods preceding suicide attempts.

Texting-related variables were assessed with text message data collection and coding (Glenn et al., 2020), or with items adapted from other studies (Milton et al., 2019) or written by the researchers (Frankel et al., 2018), and one study did not report how texting was measured (Dake, Price, Maziarz, & Ward, 2012). STBs were assessed with validated measures (Glenn et al., 2020; Milton et al., 2019) or single items from the YRBS (Dake, Price, Maziarz, & Ward, 2012; Frankel et al., 2018).

### 3.2.4. Theme no. 4: perception/impact of online experiences

Two cross-sectional studies examined the prevalence and impact of online experiences, in clinical (Nesi et al., 2019) and community (Katsumata, Matsumoto, Kitani, & Takeshima, 2008) samples of adolescents. In both studies, negative perceptions of various online experiences were associated with STBs.

A greater proportion of girls with (versus without) a suicide attempt

history reported getting in a fight on social media, comparing themselves negatively to others on social media, using social media to distract from difficult situations or emotions, and viewing pro-suicide content on social media (Nesi et al., 2019). A greater proportion of boys with (versus without) a suicide attempt history reported feeling left out or excluded on social media and viewing pro-suicide content on social media (Nesi et al., 2019). In a school-based survey study, lifetime suicidal desire was associated with anxiety about not getting email replies, AOR 2.06, CI 1.33–3.20, and with having hurtful experiences online, AOR 1.71, CI 1.03–2.84 (Katsumata et al., 2008).

For both studies, researchers constructed their own questionnaires assessing social media experiences. To measure STBs, one study used a single item for suicide attempts from a validated measure (Nesi et al., 2019), and the other study used a single item, written by the research team, to assess lifetime suicidal desire (Katsumata et al., 2008).

### 3.2.5. Theme no. 5: suicide-related social media use

**3.2.5.1. Suicide-related social media content exposure.** Four studies investigated exposure to and engagement with suicide-related social media content in adolescents and young adults, both longitudinally (Arendt, Scherr, & Romer, 2019; Dunlop, More, & Romer, 2011) and cross-sectionally (Liu et al., 2020; Swedo et al., 2020). Findings were mixed in terms of exposure and STBs, and there was a positive association between engagement and STBs.

Regarding exposure, a longitudinal study of young adults (from Internet gaming sites) found that exposure to self-harm content on Instagram once and more than once in the past month were both concurrently associated with suicidal ideation; both predicted increases in suicidal ideation one month later, although more-than-once exposure did so only marginally (Arendt et al., 2019). Additionally, a study that assessed exposure to various sources of suicide stories, online and off, found that the only source concurrently associated with suicidal ideation in adolescents and young adults was online forums, OR 2.58, CI 1.19–5.57,  $p < .05$ , not social networking sites (Dunlop et al., 2011). Moreover, in adolescents, seeing cluster-related content was associated with suicidal ideation, AOR 1.30, CI 1.1–1.7,  $p < .01$ , but not suicide attempts, during a suicide cluster (i.e., when suicides cluster closely together in time and by geographic location), whereas seeing cluster-related memorials, vigils, or news was not (Swedo et al., 2020).

Engagement with suicide-related social media content was more consistently associated with STBs. Posting cluster-related content was associated with both suicidal ideation, AOR 1.70, CI 1.4–2.0,  $p < .001$ , and suicide attempts, AOR 1.70, CI 1.2–2.5, during the school year when the cluster occurred in adolescents (Swedo et al., 2020). Another study comparing young adults by suicide risk found that those with a history of suicide attempts (versus those with suicidal ideation only and without attempts) reported engaging in more frequent commenting, reposting, and talking about suicide or suicide-related news on social media (Liu et al., 2020).

Social media content exposure/engagement was assessed with single (Arendt et al., 2019; Dunlop et al., 2011; Swedo et al., 2020) or multiple (Liu et al., 2020) items, created by the researchers. STBs were assessed with validated measures (Liu et al., 2020), items adapted from a validated measure (Swedo et al., 2020), or items from the YRBS (Arendt et al., 2019; Dunlop et al., 2011).

**3.2.5.2. Distress disclosure on social media.** Four studies investigated distress disclosure on social media and its relationship to STBs in adults, cross-sectionally (Chan et al., 2017; Cheng et al., 2015; Sueki, 2015) and longitudinally (Sueki, Yonemoto, Takeshima, & Inagaki, 2014). Across studies, distress disclosure online was associated with STBs.

Distress disclosure on blogs, forums, microblogs, and social networking sites was associated with lifetime suicidal ideation, OR 1.53, CI 1.04–2.25,  $p < .05$  (Chan et al., 2017), and tweeting such distress

expressions as “want to die” and “want to commit suicide” was associated with lifetime suicide planning, ORs 2.55 and 1.92, and attempts, ORs 1.67 and 3.48 (Sueki et al., 2015). Additionally, online users of the Chinese microblog Weibo who used it to express suicidal ideation (versus used it for other reasons) had higher suicidal ideation and reported more frequent use of forums and blogs, but not of instant messaging and Weibo (Cheng et al., 2015). A longitudinal study designed to examine the effect of such disclosures on suicidal ideation found that past-month,  $b = 0.55$ , CI 0.23–0.88,  $p < .001$ , and lifetime,  $b = 0.37$ , CI 0.17–0.57,  $p < .001$ , disclosure of suicidal ideation online predicted increases in suicidal ideation eight weeks later (Sueki et al., 2014).

Distress disclosure was measured with items constructed by the researchers in all four studies. STBs were assessed with validated measures (Cheng et al., 2015; Sueki et al., 2014), YRBS items (Chan et al., 2017), or items written by the researchers (Sueki et al., 2015).

**3.2.5.3. Help-seeking online & suicide forum use.** Five studies investigated online help-seeking in adults (De Luca, Lytle, Yan, & Brownson, 2020; Seward & Harris, 2016) and forum use in adolescents and adults (Eichenberg, 2008; Mok, Jorm, & Pirkis, 2016; Sueki et al., 2012). Overall, while online help-seeking and suicide forum use appear to be important for distressed adults and adolescents, there were mixed findings regarding their impact on STBs.

Some studies indicated that online help-seeking, on social networking sites and forums, is important to suicidal youth. In one study of adults, ages 18–71, suicide risk was negatively associated with willingness to seek help for suicidal thoughts from offline sources; in emerging adults, ages 18–25, however, suicide risk was positively associated with help-seeking online, mostly on social networks (Seward & Harris, 2016). In another study, among adults with past-year suicidal ideation, females (versus males) were more likely to report that online help-seeking, OR 1.75, CI 1.39–1.56, was at least moderately important in helping them deal with their most stressful past-year period (De Luca et al., 2020). Lack of perceived family support and a history of seeking new personal relationships online were both predictors of online help-seeking in adults (Seward & Harris, 2016). While both help-seeking motives and harmful motives (e.g., suicide preparation) were associated with forum use (Eichenberg, 2008; Sueki & Eichenberg, 2012), there was a general perception among forum users that their suicidal thoughts decreased with forum use (Eichenberg, 2008; Mok et al., 2016; Sueki & Eichenberg, 2012). However, in a mixed methods study, forum users reported both positive and negative experiences in forums, including greater perceived social support and worsened suicidal ideation (Mok et al., 2016).

Help-seeking and forum use were measured in a variety of ways, including using a validated scale (Sueki & Eichenberg, 2012) or items adapted from a validated scale (Seward & Harris, 2016), and using single items written by the researchers (De Luca et al., 2020; Mok et al., 2016). One study did not report how usage habits/predictors were measured (Eichenberg, 2008). STBs were measured with a validated scale (Seward & Harris, 2016), and single items written by the researchers (De Luca et al., 2020; Mok et al., 2016; Sueki et al., 2012), and one study did not report how STBs were measured (Eichenberg, 2008).

### 3.3. Social-cognitive mechanisms tested and proposed

Only four studies tested mediators in the relationship between patterns of digital use and STBs. These studies examined four different patterns – social media frequency, smartphone use frequency, social media addiction, and suicide-related social media use – and found explanatory mechanisms in their relationship with STBs.

First, Choi and Noh (2019) tested social capital and self-esteem as mediators in the relationship between social media interaction frequency and suicidal ideation, cross-sectionally, in adults. There was an indirect effect of social media interaction frequency on suicidal ideation, through self-esteem (but not through social capital) and through social capital and

self-esteem, using serial mediation. These indirect effects showed unstandardized beta coefficients of  $-.02$ . Second, in a cross-sectional study, [Chen et al. \(2020\)](#) tested the mediating mechanisms of depression and interpersonal problems in the relationship between high-intensity mobile phone use and STBs. There was an indirect effect of mobile phone use on suicidal ideation, planning, and attempts through interpersonal problems, through depression, and through interpersonal relationships and depression ([Chen et al., 2020](#)). Third, in a longitudinal study, positive mental health was tested as a mediator in the relationship between Facebook addiction and STBs ([Brailovskaia et al., 2020](#)). There was full mediation, such that higher baseline Facebook addiction predicted higher levels of STBs a year later through lower baseline positive mental health ([Brailovskaia et al., 2020](#)). Finally, [Liu et al. \(2020\)](#) hypothesized that three suicide-related social media behaviors (i.e., attending to suicide-related social media content, commenting/reposting such content, and talking about suicide on social media) may heighten suicide risk. In line with this hypothesis, these three suicide-related social media behaviors were found to mediate the relationship between suicidal ideation and attempts, cross-sectionally, indirect effect  $0.22$ , CI  $0.09-0.36$ ,  $p < .01$ .

Other interpersonal and intrapersonal mechanisms were proposed, but not tested, across various studies. These are listed in [Table 3](#).

#### 4. Discussion

Research on social media and mental health has exponentially increased in the last five years. The present systematic review is the first attempt to synthesize findings on a range of patterns/aspects of social media use and their relationship to suicidal ideation and attempts across all age groups. Findings from this review suggest that certain patterns of social media and smartphone use are associated with STBs. We discuss these below, proposing directions for future research along the way. We then discuss mechanisms examined in these studies and offer recommendations for testing novel mechanisms, grounded in prevailing theories of suicide, to improve our understanding of why and how patterns of social media and smartphone use may impact suicide risk.

##### 4.1. Overall frequency/use & STBs: largely positive association for frequency, but not use

Overall, findings suggest that there tend to be positive associations between measures of overall digital use (i.e., social media and smartphone frequency) and STBs, but not always and not when the digital variable examined is too general (i.e., presence/absence of use). Of the 12 studies on frequency of social media and smartphone use, 8 found a positive relationship with STBs, with generally small effect sizes; of the 2 studies on overall social media use in terms of presence/absence, none found an association between use and STBs. These findings suggest that a general use variable may be too broad and non-specific to yield meaningful results. Even frequency of social media use may be too general to have a direct effect with STBs, however, given the small magnitude of the effects and the handful of studies that did not find significant associations. Echoing similar insights from the literature on social media and depression, it is likely that simply using social media is not inherently harmful; rather, *how* social media is used may be more informative in terms of mental health outcomes ([Davila et al., 2012](#)).

Still, it is interesting that greater frequency – measured in a linear fashion or conceptualized as more than 2 h or greater time spent than average – was repeatedly associated with higher odds of STBs. This finding mirrors findings from the depression literature: A recent meta-analysis found that two indices of social media frequency (i.e., duration of use and social media checking frequency) were associated with higher levels of depression, also with small effect sizes ([Yoon, Kleinman, Mertz, & Brannick, 2019](#)). Frequency may often be linked with STBs because it may map onto problematic patterns of social media use; that is, long periods of time spent on social media may be indicative of online

addiction. That frequency is generally linked with STBs, however, does not necessarily mean that spending long periods of time on social media and smartphones increases suicide risk. Given the cross-sectional nature of these studies, it may, instead, be that individuals with higher suicide risk are turning to social media and smartphones more frequently than those with lower risk – and this use may be positive, negative, or neutral in terms of mental health outcomes. Indeed, one study that compared individuals by suicide risk found that those with higher (versus lower/no) risk reported spending more time online each week ([Harris et al., 2014](#)). This was especially true for women and men with higher (versus lower/no) suicide risk, who were more likely to engage in social interaction online (i.e., social networking sites and forums for women; forums for men) over many other non-interactive digital behaviors. Given that suicidal individuals often tend to experience low levels of support in their lives (as was the case in this sample too), turning to social media may be a compensatory strategy. In line with this idea, men and women of higher (versus lower/no) suicide risk in this study scored higher on almost all facets of online relationship building ([Harris et al., 2014](#)). Whether such compensation efforts are effective and improve, or harm, well-being in the long run, however, is an important area of investigation that needs empirical attention.

##### 4.2. Addictive use & STBs: mixed findings

Overall, there was a positive association between smartphone addiction and suicidal ideation, with small to medium effect sizes; findings regarding social media addiction and STBs, however, were less consistent. A longitudinal study showed that Facebook addiction predicted suicide-related outcomes one year later in adults ([Brailovskaia et al., 2020](#)); however, baseline suicide-related outcomes were not adjusted for, precluding an appropriate conclusion about the true impact of addiction on STBs a year later. Two cross-sectional studies examining current or recent (past two-week) suicidal ideation and social media addiction found positive bivariate associations between the two; when depression was accounted for, however, the relationship was either no longer significant ([Walburg et al., 2016](#)) or became inverse ([Jasso-Medrano & López-Rosales, 2018](#)).

These findings are surprising, given the consistency with which social media addiction has been positively associated with depression, anxiety, and other forms of psychopathology in the literature (see [Hussain & Griffiths, 2018](#)). Several considerations may help explain these mixed findings. First, suicidal ideation tends to fluctuate more than depressive symptoms in a given period of time. Assessing it only once and in a brief, discrete window of time (e.g., current, recent) may thus lead to less precision and more variability in responses and show a weaker association with social media addiction than does depression. Second, like all addictions, compulsive social media use may impart reinforcing short-term benefits (e.g., avoidance of painful emotions) but take a psychological toll in the long term. A cross-sectional study may be better able to capture short-term benefits than longer-term psychological costs; longer periods of assessment, or more frequent assessments, may help elucidate these mixed findings. Third, measurement of suicidal ideation was slightly problematic, with the use of items that may have mixed suicidal and non-suicidal thoughts. Fourth, it is worth noting that all seven studies on social media and smartphone addiction and STBs were each conducted in different cultural contexts, with three in Asia ([Kim, Min, Kim, & Min, 2019b; Sohn et al., 2018; Wan Ismail et al., 2020](#)), three in Europe ([Arrivillaga et al., 2020; Brailovskaia et al., 2020; Walburg et al., 2016](#)), and one in Mexico ([Jasso-Medrano & López-Rosales, 2018](#)). There may be important cultural differences in these samples that may have contributed to mixed findings. For example, some research suggests that associations between motives for use (i.e., regulation of negative affect) and social media addiction are stronger in Western countries ([Marino, Gini, Vieno, & Spada, 2018](#)). Such possibilities should be explored in future studies.

### 4.3. Digital interaction & STBs: positive associations for some aspects of interaction

Several insights emerged from studies examining digital interaction and STBs. First, there were mixed findings regarding frequency of different aspects of digital interaction and STBs. STBs were associated with blogging and chatting, especially among girls with suicidal ideation and attempts (Kim et al., 2020), and with Web communication among boys (Tseng & Yang, 2015). STBs were not associated with other aspects of digital interaction, such as Instagram metrics (e.g., number of followers/following, number of pictures a user posted, and number of comments each picture received) among adolescents who post self-harm content on Instagram (Brown et al., 2019), or with frequency of social interaction among military veterans (Teo et al., 2019). These findings suggest that when it comes to social interaction online, relying on frequency assessments may not be enough; rather, qualitative aspects of interaction may be more informative for suicide risk. Indeed, findings from the depression literature suggest that when online interaction is examined in terms of quality, it tends to be more strongly associated with mental health outcomes. For example, more negative and less positive digital interactions are generally associated with depression (Davila et al., 2012; Feinstein, Bhatia, Hershenberg, & Davila, 2012). A similar pattern may be observed when it comes to STBs.

Indeed, perception of negative digital interactions was associated with STBs, although only two studies examined valence of interactions. More girls with (versus without) a suicide attempt history reported recently having negative social interactions on social media (Nesi et al., 2019), and suicidal ideation was associated with “hurtful experiences online” and anxiety about not getting email replies (Katsumata et al., 2008). These findings suggest a second insight regarding digital interaction and STBs: that suicidal individuals may have or perceive more negative interactions online, compared to their non-suicidal peers. Existing evidence suggests that among depressed individuals, perception of negative interactions may indeed play a role in the social media context, as depressed individuals tend to report that they receive less social support from their social media networks than they objectively do (Park et al., 2016). Recent longitudinal evidence also suggests that depressive symptoms are a risk factor for reporting more peer victimization on Facebook (Frison, Subrahmanyam, & Eggermont, 2016). It may be that individuals with depressive psychopathology perceive more subtle types of negative interaction online, such as apparent exclusion, and the same may be the case for suicidal individuals. Cues-filtered-out theories suggest that the absence of nonverbal cues in digital environments can negatively impact interpersonal communication, resulting in less warmth, more self-involvement, shallower impressions of others, and thus disinhibition and hostility (Walther & Parks, 2002). Information processing biases that influence the perception and thought of depressed and suicidal individuals (Cha, Wilson, Tezanos, DiVasto, & Tolchin, 2019) may also amplify the negative impact of these inherent challenges present in the digital space, creating a context rife for perception of non-support and hostility. These possibilities should be examined further in the future.

Third, findings suggested that for suicidal individuals, social media may also present spaces for positive interactions online. Boys with (versus without) a suicide attempt history were more likely to report receiving social support or encouragement online (Nesi et al., 2019). This finding is in line with the hyperpersonal model of communication (Walther, 1996), which suggests that under certain conditions, the same reduced nonverbal cues of the digital context can actually facilitate social interaction and intimacy. One such condition may be related to unmet belonging needs. Given the role of unmet belonging needs in suicidal ideation (Van Orden et al., 2010), digital and social media may present opportunities to offset low offline support and interact in a “safer” environment online. Indeed, some evidence suggests that the need to compensate for lower social competence offline (Casale & Fioravanti, 2015) and social anxiety (Lee-Won, Herzog, & Park, 2015) may at times

drive social media use. In line with these ideas, one longitudinal study included in the review found that general suicidality predicted use of health forums and support groups online, but not the other way around, one month later (Scherr & Reinemann, 2016). Taken together, these findings suggest that although social media can facilitate perceptions of negative interactions for the suicidal individual, some digital spaces may also provide much-needed social support, as discussed further below, and may thus be sought out by suicidal individuals.

### 4.4. Sexting & STBs: positive association

Sexting emerged as a problematic behavior, consistently associated with STBs among adolescents and young adults, with effect sizes ranging from small to large. Sexting is not only on the rise but also often perceived as problematic for youth (Milton et al., 2019). Youth reported feeling pressure to sext, which may be a reflection of how social media may, at times, amplify normative developmental pressures. This idea is in line with the transformation framework of adolescent peer relations and social media, a theoretical framework that suggests that traditional relationship constructs are transformed in the digital context due to certain aspects of the digital environment (Nesi, Choukas-Bradley, & Prinstein, 2018). In the context of sexting, the constant availability and asynchronicity provided via texting may be creating pressure to engage in new interpersonal behaviors (i.e., sexting) perceived as necessary to sustain romantic relationships and even social standing. Indeed, research suggests that underlying sexting is often a desire for peer approval (Lippman & Campbell, 2014). As teens navigate intimate relationships, smartphones and social media may create additional self-presentation pressures, which may impact mental health.

Precisely how sexting is related to STBs is unclear. One consequence of sexting may be an amplification of a sense of “mobile entrapment,” or pressure to constantly respond to digital communications perceived to sustain relationships – which is, in reality, associated with relationship dissatisfaction (Hall & Baym, 2012). For the suicidal individual, entrapment in such interpersonal contexts may heighten distress. There may also be direct interpersonal consequences: Research suggests that forwarded sexts may result in damage to one’s reputation, especially for girls (Lippman & Campbell, 2014) and provide fodder for bullying (Van Ouytsel, Van Gool, Walrave, Ponnet, & Peeters, 2017). These consequences may especially impact the uniquely vulnerable suicidal individual, a possibility that future studies should examine.

### 4.5. Suicide-related social media use & STBs: positive association

Results showed that exposure to suicide-related content on social media (Arendt et al., 2019; Swedo et al., 2020) and forums (Dunlop et al., 2011) is associated with suicidal ideation in adolescents and young adults. In fact, one study suggested that higher (versus lower) suicide risk may involve a greater tendency to attend to suicide-related social media posts (Liu et al., 2020). Engaging with such posts – whether by commenting, posting, or re-posting – is also associated with STBs, in adolescents and young adults (Liu et al., 2020; Swedo et al., 2020). Taken together, these findings suggest that exposure to and engagement with suicide-related content on social media is linked with STBs. Whether this risk is a result of the exposure or is pre-existing (and predisposes individuals to attend to and engage with such online content) is unclear.

To better understand the directionality of these effects – and whether they are bidirectional – future studies need to examine how, specifically, such exposure and engagement affect suicide risk over time, in those with and without ideation. Separating these two populations is important, as there is a possibility that such content may differentially impact vulnerable individuals. Conditional media effects models propose that the psychological impact of media is moderated by individual vulnerabilities (Valkenburg & Peter, 2013). Cognitive and dispositional vulnerabilities present in the suicidal individual could lead to stronger social media impacts. For example, the disposition-content congruency

hypothesis suggests that media effects are stronger for content that is partly congruent (versus incongruent) with one's disposition (Klapper, 1960; Valkenburg & Peter, 2013), as congruent content can be related to existing schemas and processed with greater ease. Social media content that presents suicide as an option is congruent with the cognitions, attitudes, and motivations of the suicidal individual, who often experiences life as not worth living; such content may, therefore, have a greater psychological impact and strengthen suicide-linked attitudes and motivations. Related, media priming theories suggest that such content can have an impact on cognitions, emotions, and behavior through spreading activation in the brain's semantic network (Valkenburg & Peter, 2013); as familiar cognitions are activated by the content, other related cognitions and also related emotions and behaviors may also be activated. Thus, for the suicidal individual, such content could activate and reinforce easily accessible cognitions and emotions related to suicide. Such possibilities warrant further study.

Findings also suggested that STBs were associated with another type of suicide-related social media use: expressions of distress and help-seeking interactions. Across studies, STBs were associated with distress disclosure, whether via blogs, forums, or social networking sites (Chan et al., 2017) such as Twitter (Sueki, 2015). These findings mirror findings from the depression and social media literature: In one study, MySpace users who blogged had higher depressive symptoms than those who did not (Baker & Moore, 2008a). The motivation for such disclosures for suicidal individuals, however, is unclear. Some studies included in this review suggested that the purpose may be help-seeking (De Luca et al., 2020; Seward & Harris, 2016); others found that they may be associated with harmful motives, such as suicide preparation (Eichenberg, 2008; Mok et al., 2016; Sueki et al., 2012). The impact too of such disclosures remains unclear. While forum users self-reported that their suicidal thoughts had decreased since initial forum use (Eichenberg, 2008; Mok et al., 2016; Sueki et al., 2012), a longitudinal study found the opposite – that disclosure of suicidal ideation to an anonymous other online predicted increases in suicidal ideation eight weeks later (Sueki et al., 2014). These findings suggest that while suicidal individuals may generally perceive forums as beneficial, there may be a negative impact of forum use that is not adequately captured in self-reports. One possibility is that forum use provides immediate relief from the contributing factors of suicidal ideation but does not alter them. In the aforementioned study on MySpace, for example, although levels of depression did not change in a two-month period among MySpace bloggers, feelings of social integration and online relationship satisfaction significantly increased (Baker & Moore, 2008b). Similarly, forum use may be providing immediate benefits such as social support at times of need for suicidal individuals but may be ineffective in helping them change the causes of their suicidal distress. Prolonged use may thus contribute to a feeling of effortful attempts toward change that are ultimately futile. In this way, prolonged use may actually strengthen suicidal ideation. Future studies should elucidate motives for distress disclosure on social media and observe how suicidal users use forums to assess ways in which their use, as a whole, contributes to or alleviates suicidal distress.

#### 4.6. Mechanisms of action: why patterns of digital use may confer suicide risk

Forty-six studies, included in this review, tested associations between patterns of social media and smartphone use and STBs. To improve our understanding of why these two factors are often linked and how certain aspects of social media use may be contributing to suicide risk, mechanisms explaining these relationships need to be examined. Yet only four studies tested social and cognitive mechanisms in the relationship between patterns of digital use and STBs. Findings from these four are discussed here, along with recommendations for extending investigation on social-cognitive mechanisms, based on prevailing models of suicidal behavior.

##### 4.6.1. Cognitive mechanisms

First, Liu et al. (2020) hypothesized that suicide-related social media behaviors may heighten suicide risk through cognitive pathways. The study was based on social learning theory, which suggests that new behaviors are acquired through observing others and that successive steps in observational learning include processes of attention, retention, and production (Liu et al., 2020). Based on these ideas, three successive behaviors were examined: attending to, commenting/reposting, and talking about suicide-related news or content. The researchers hypothesized that with each successive step, users would more deeply process suicide-related information, strengthening encoding and personal identification with suicide, as users would spend time imagining themselves in the suicide-related stories of others. Moreover, the researchers proposed that in this way, these processes would ease the transition from suicidal ideation to attempt. In support of such hypotheses, a significant indirect effect of suicidal ideation on attempts was found. Although this study was not designed to test causality, it pioneered an important research direction: examining cognitive mechanisms in the association between social media use and STBs.

Decades' worth of suicide research has shown that cognition plays a key role in suicide risk, with STB-themed cognitive risk factors – such as attentional bias for STB-themed content – being some of the most robust cognitive risk factors (Cha, Wilson, Tezanos, DiVasto, & Tolchin, 2019). One important future direction is extending the focus on attentional bias to STB-themed content in the social media context. Theoretically, attentional bias for STB-related information is thought to exacerbate suicidal ideation and facilitate the transition to suicidal behavior (Wenzel & Beck, 2008), an idea that is also supported empirically (Cha, Najmi, Park, Finn, & Nock, 2010). The cognitive model of suicidal behavior proposes that such an attentional bias will lead to difficulty disengaging from suicide-related stimuli when one is in a state of hopelessness, and the individual will fixate attention on suicide as the only escape until a certain threshold of distress is reached, precipitating suicidal behavior (Wenzel & Beck, 2008).

This theoretical account gives rise to several potential hypotheses about attentional bias as a cognitive mechanism in the relationship between social media use and STBs. First, social media may serve as a context in which one could, over time, acquire or strengthen such a bias. A post about suicide might be more likely to draw the attention of an individual with suicidal ideation, given the greater personal relevance; with each visit online, this individual may then be easily drawn to discussion threads and conversations about suicide, which may serve as suicide-related cues that perpetuate ideation and facilitate persistent practice directing attention to suicide-related cues. A longitudinal study could examine whether greater consistent engagement in such suicide-related social media behavior predicts increases in measures of attentional bias toward suicide-related stimuli. A second hypothesis is that such use may be more likely to confer suicide risk if a vulnerable individual is in the habit of turning to social media to alleviate negative affective states; in a state of a hopelessness, turning to social media could easily lead to exposure to such content and turn into fixation.

##### 4.6.2. Interpersonal mechanisms

Two studies examined interpersonal mechanisms. Chen et al. (2020) proposed that excessive smartphone/mobile phone use might lead to interpersonal problems, which might decrease interpersonal security and thus increase social anxiety and depression. These ideas were tested in a cross-sectional study, which showed that high-intensity mobile phone use predicted STBs through interpersonal problems, through depression, and through interpersonal relationships and depression (Chen et al., 2020). Choi and Noh (2019) proposed that greater frequency of social media interaction may be protective against suicidal ideation by enhancing social capital and self-esteem; indeed, these two mediators explained the relationship between social media interaction and past-year suicidal ideation, cross-sectionally. Although these hypotheses were not based on any particular theory, these findings pave the way

toward beginning to test interpersonal mechanisms, which prevailing theories of suicide suggest may contribute to suicide risk.

The Interpersonal Theory of Suicide (Van Orden et al., 2010) proposes that what leads to the development of suicidal desire is the presence of two psychological states: thwarted belongingness (i.e., unmet belonging needs) and perceived burdensomeness (i.e., perception of being a liability on others). Aspects of social media and smartphone use may enhance or alleviate these interpersonally related psychological states, which may influence STBs. Indeed, interpersonal themes were present throughout studies included in this review. Suicide risk was associated with online relationship building (Harris et al., 2014) and perceptions of social support from forums (Mok et al., 2016), but also with perceptions of negative interpersonal experiences online (Katsumata et al., 2008; Nesi et al., 2019). When perceptions of negative interactions outweigh perceptions of positive interactions online, thwarted belongingness may be reinforced, contributing to STBs. Some research suggests that thwarted belongingness is associated with greater perceptions of negative interactions on social media (Macrynika & Miranda, 2019; Moberg & Anestis, 2015). Online experiences may also impact perceived burdensomeness. For example, in youth, the negative interpersonal consequences of sexting (e.g., when sexts are seen and used by those they were not intended for) may lead to experiences of shame and perceptions that one is a burden on one's partner or family. There is great potential for significant negative interpersonal consequences on social media and smartphones, which may be amplified by the asynchronicity and lack of nonverbal cues online. The mediating influence of such interpersonal variables should be explored in future studies to elucidate how patterns of digital use may confer suicide risk through interpersonal pathways. However, there is also potential for positive interpersonal consequences, as Choi and Noh (2019) demonstrated, which should also be explored in future studies.

#### 4.6.3. Intrapersonal mechanisms

The fourth mechanism examined in these studies was positive mental health, found to fully mediate the relationship between Facebook addiction and STBs in a longitudinal study (Brailovskaia et al., 2020). Positive mental health, a resilience factor defined as a "high level of emotional, cognitive, and psychological well-being" (Brailovskaia et al., 2020) predicts remission of suicidal thoughts over time (Teismann, Forkmann, Glaesmer, Eger, & Margraf, 2016) and moderates the impact of depression on suicidal ideation (Siegmann et al., 2018). Brailovskaia et al. (2020) found that higher levels of Facebook addiction predicted lower levels of positive mental health, which, in turn, predicted higher levels of STBs one year later.

Although positive mental health is a broad factor that encompasses different aspects of well-being, it points to the importance of examining intrapersonal factors as potential mechanisms in the relationship between digital use and STBs. Such factors play a central role in the Integrated Motivational-Volitional (IMV) model of suicidal behavior (O'Connor & Kirtley, 2018), an empirically supported theoretical framework that explains the development of suicidal ideation and the progression to suicidal behavior. Specifically, the IMV emphasizes the role of defeat and entrapment, proposing that suicidal ideation develops when, in the context of adversity, the experience of defeat (failed struggle) turns into entrapment (failed escape), leading to the perception of suicide as the only solution (O'Connor & Kirtley, 2018). Defeat and entrapment have yet to be examined in the social media context; if aspects of social media use, however, confer suicide risk, defeat and entrapment may explain why. For vulnerable individuals, it is possible that negative online interactions or experiences fuel perceptions of defeat. Moreover, if failed interpersonal interactions mirror offline interpersonal problems, the double dose may lead to an experience of defeat for vulnerable individuals. Future studies should examine the conditions under which such experiences may arise.

Additionally, future studies should examine when experiences of defeat in the social media context might turn into entrapment. Although

positive mental health was tested as a mediator in the study by Brailovskaia et al. (2020), the authors proposed that a factor like positive mental health may be a target for intervention that may moderate the impact of Facebook addiction on psychological harm. Such modifiable moderators that can change the course of suicide risk progression play a key role in the IMV model of suicidal behavior. The IMV suggests that three sets of moderators increase or decrease the likelihood that an individual will transition from one stage to the next – that is, that one's experience of defeat will turn into entrapment, entrapment into ideation, and ideation into attempt (via the aid of threat-to-self, motivational, and volitional moderators, respectively). Factors related to social media and smartphone use that may aid or hamper one's progression through these stages should be examined. Identifying not just mechanisms of harm but also factors that can confer resilience is key for the prevention of suicide (O'Connor & Nock, 2014), including in digital spaces of interaction, which are now prevalent across the life span (Auxier & Anderson, 2021).

#### 4.7. Calls to action for future research

To complement the future directions for research discussed thus far, we now turn to several calls to action to help move the field forward.

First, more prospective studies need to be conducted. Findings from this review suggest there are associations between various patterns of digital use and STBs, yet whether such patterns actually confer suicide risk remains inconclusive. Although most cross-sectional studies on the topic conceptualize digital patterns as the predictor and STBs as the outcome, it is equally plausible that STBs simply motivate increased patterns of digital use, and this use has little to no negative impact on mental health. Prospective longitudinal studies will help shed light on the directionality of associations, leading to informed measures to encourage or limit social media and smartphone use among vulnerable individuals.

Second, future studies should move away from examining direct associations between broad conceptualizations of social media use, such as overall use/frequency and STBs. Findings from this review showed that such conceptualizations are not as informative, leading to small (in magnitude) or no associations. Examining indirect associations between frequency and STBs as well as more specific aspects of social media use (e.g., types of use, valence of interactions, motivations for use) may be more informative, as indicated by findings in this review and from the literature on depression and social media use.

Third, more research needs to investigate mechanisms explaining the associations found in this review. To date, potential mechanisms have been much more often proposed (see Table 3) than tested; testing these mechanisms, in the context of empirically supported theories of suicidal behavior, will do much to improve our understanding of why certain aspects or patterns of social media and smartphone use may influence STBs.

Fourth, better measurement of key variables needs to be pursued. Despite the existence of validated, multi-item measures of STBs, few studies included in this review used them. Additionally, there is a dearth of validated measures assessing different aspects of social media and smartphone use. Creating and validating such measures for various aspects of digital use (e.g., interaction, social comparison, motivations) will be a significant contribution to the field, improving the precision and consistency of assessment of digital constructs.

Fifth, much more research needs to be done with adult samples. As this review indicates, studies have focused mostly on adolescents and young adults. Yet, social media use is now relatively evenly distributed across age groups, with roughly three-fourths of adults ages 50–64 and nearly half of adults ages 65 and older reporting using Facebook (Auxier & Anderson, 2021). As individuals in middle and older adulthood have been vastly underrepresented in this research, however, it remains unclear whether associations found in this review extend to age groups beyond young adulthood. The precise impact of social media on STBs in older populations needs more empirical attention. It may be that social media use is more protective in older adults than in youth, as some

findings in this review suggested (Choi & Noh, 2019). Loneliness in older adulthood is a predictor of functional decline and death (Perissinotto, Cenzer, & Covinsky, 2012), and social media may present an opportunity for the development of accessible interventions to decrease loneliness and improve physical and mental health outcomes in this population.

Finally, more consideration should be given to other kinds of diversity beyond age. Males were underrepresented in much of the research included in this review, yet clear gender differences emerged in some studies. It is important for future studies to pay special attention to gender differences, as empirical findings from both social media and suicide research have shown that gender influences patterns of behavior and their outcomes (e.g., Nesi & Prinstein, 2015; Zhang et al., 2019). Race and ethnicity also tended to be underreported. Several studies only reported the percentage of the sample that was White, neglecting to present the rest of the demographics of the sample. Such underreporting further entrenches the injustice of underrepresentation of minoritized groups in empirical research conducted in countries with White majorities and limits an understanding of the extent to which extant findings may differ in non-White populations. There were also no comparisons by ethnic or cultural background, yet data suggest that social media preferences vary by ethnicity (Krogstad, 2015). Additionally, only two studies assessed sexual orientation, even though sexual minorities tend to report significantly higher rates of suicidal thoughts and behavior (see Marshal et al., 2011). It was also noteworthy that most studies assessed social media platform use either in broad terms or focused only on leading platforms (e.g., Facebook). One method of diversifying samples is to recruit from specific social media platforms or niche online communities where individuals that exemplify the aforementioned aspects of diversity may be more adequately represented. Taking such aspects of diversity into account will help improve our understanding of whether and how different risk and protective factors in the social media context apply to different populations.

#### 4.8. Strengths & limitations

A strength of this review is the well-defined (and well-accepted) definition of social media used to guide study selection. This approach limited inclusion to only studies that focused on social media or smartphone use, rather than more general online activities. We chose this definition in an attempt to identify what we know about social media use, specifically, rather than Internet use or screen time, more generally. A second strength is that we set no age restrictions, so as to better understand the scope of existing research across the lifespan. Additionally, we undertook a systematic approach to conducting this review.

Several limitations of this review should also be considered when interpreting findings. First, key themes presented in this review are not fully comprehensive of aspects of social media use. For example, we excluded two large bodies of research: one on cyberbullying and one on Internet use. These decisions were made to maintain a focused discussion on the literature on newer patterns of digital use and digital behaviors that had not been examined in previous meta-analyses. Still, doing so may have limited the scope of known influences of social media and smartphones on self-injurious behavior. Second, we did not exclude papers of the lowest quality from our review (i.e., those rated poor and poor/fair). This decision was made to allow consideration of as much existing research as possible in order to highlight various aspects of (and findings on) digital patterns of use to stimulate future research. Some of the findings presented should thus be interpreted with caution. Third, although we took several steps to identify relevant studies that may not have appeared in our search (e.g., examining reference lists), we may still have left out relevant studies. For example, we did not contact experts in the field to request unpublished data, which may have introduced some bias. We also did not include “YouTube” and other video-based social media related terms in our search. Still, we believe that enough studies were included in this review to impart a holistic picture of what is currently known about the link between patterns of digital use and STBs,

and to make informed recommendations on future directions that will improve our understanding of these associations.

## 5. Conclusion

Findings of this review suggest that there is a positive association between various patterns of digital use – i.e., frequency of social media use, smartphone addiction, suicide-related social media use, sexting – and STBs, in adolescents and young adults. However, whether such patterns confer suicide risk remains inconclusive. Given the consistency with which these associations were found across studies, however, as well as the ubiquity of social media and smartphones across the life span, it is imperative to continue examining whether and how such media may impact the mental health of the most vulnerable individuals.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chbr.2021.100094>.

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