Social media use, social anxiety, and loneliness: A systematic review

Emily B. O'Day, Richard G. Heimberg [*]

Department of Psychology, Temple University, Philadelphia, PA, 19122, USA

A B S T R A C T

Background: Social media use (SMU) has become highly prevalent in modern society, especially among young adults. Research has examined how SMU affects well-being, with some findings suggesting that SMU is related to social anxiety and loneliness. Socially anxious and lonely individuals appear to prefer and seek out online social interactions on social media.
Objective: This systematic review examines social anxiety (SA) and loneliness (LO) in the context of SMU.
Methods: A multi-database search was performed. Papers published prior to May 2020 relevant to SMU and SA and/or LO were reviewed.
Results: Both socially anxious and lonely individuals engage online more problematically and seek out social support on social media, potentially to compensate for lack of in-person support. SA and LO are associated with problematic SMU; LO appears to be a risk factor for engaging problematically online.
Conclusions: LO is a risk factor for problematic SMU. More research on the relationship between SA and SMU is needed. To date, problematic SMU has been defined in terms of frequency rather than pattern of use. Most research has relied on self-report cross-sectional examinations of these constructs. More experimental and longitudinal designs are needed to elucidate potential bidirectional relationships between SA, LO, and SMU.

1. Introduction

1.1. Social media use today

Social media is ever-present in modern society and has changed the way people communicate with those around them. Over the last two decades, social media has expanded exponentially, now comprising a variety of websites and applications used by people of all ages around the world. Social media has been defined as web-based communication platforms with three distinct features, in which the platform 1) allows users to create unique profiles and content to share with other users, 2) creates a visible network connection between users that can be navigated by other users, and 3) provides users with a space to broadcast content, consume information, and interact with others in a continuous stream of information (Ellison & Boyd, 2013). Several applications (e.g., Facebook, Instagram, Snapchat) satisfy these criteria.

Social media is used frequently by individuals of all ages; as of March 2018, 68% of adults in the United States had a Facebook account, 75% of whom reported using Facebook daily (Smith & Anderson, 2018). As one of the original social media sites, Facebook has received the most attention in the research literature and continues to be the most widely used social media platform internationally (Smith & Anderson, 2018); however, other social media sites, such as Instagram and Snapchat, have become increasingly popular, especially among younger generations. Seventy-eight percent of young adults (ages 18–24) report using Snapchat and 71% report using Instagram, most of whom use the sites daily or several times per day (Smith & Anderson, 2018). Social media can be used for a variety of reasons, including to keep in touch with friends, to connect with others with shared hobbies or interests, to follow celebrities, to find romantic partners, to seek out new information, to express one's thoughts, feelings, and identity, and to share good and bad news (Boyd & Ellison, 2007; Ellison & Boyd, 2013; Smith, 2011).

Young adults are the generation that most frequently uses social media; 88% of 18-to-29-year-olds indicate that they use social media in some capacity (Smith, 2015; Smith & Anderson, 2018). Younger generations use multiple social media platforms several times a day, spending a large portion of their time online. Thus, it is critical to explore *how* and *why* people use social media, especially young adults who use the sites most frequently. An important question is whether this shift to communication through social media has negatively affected the subjective well-being of younger generations (Verduyn, Ybarra, Resibois, Jonides, & Kross, 2017).

1.2. Defining & conceptualizing social media use

To understand how social media use (SMU) affects psychological well-being, researchers have tried to differentiate between normative and more "addictive," "pathological," or "problematic" use of social media. To date, problematic SMU has been defined in many different ways, using a variety of terms, which has made it difficult for researchers to succinctly define what it means to use social media "problematically." In order to understand and define problematic SMU today, it is important to examine earlier research on problematic Internet use, as Internet use was the natural predecessor to SMU. "Internet addiction" was an early term used to describe dependency on or inability to limit Internet use (Young, 1999). However, because addiction refers more correctly to a physiological dependence on a substance, Davis (2001) proposed the alternative term "pathological Internet use" to refer to the general, multidimensional overuse of the Internet. Interestingly, even before the advent of social media, "pathological" or "addictive" Internet use was most often described in relation to social applications of the Internet, such that individuals' tendency to use the Internet "pathologically" or "addictively" was most associated with their attempts to use it to socially connect with others (Davis, 2001). With the birth of social media, research naturally transitioned from a focus on more general Internet use to closer look at social uses of the Internet via social media, since social media platforms were inherently created and are used for social connection. Despite the various terms related to Internet and SMU still used in the literature today, we will use the term "problematic social media use" to refer to this concept in this review.

Davis's early model of pathological Internet use (2001, 2005) can also be used to conceptualize problematic SMU. From a cognitive-behavioral framework, individuals with psychosocial problems (e.g., loneliness, social anxiety, depression) are predisposed to engage in maladaptive cognitions and/or behaviors that lead to problematic SMU, which then leads to negative outcomes (e.g., poorer performance in work or school, missed social engagements) (Davis, 2001; Davis, Flett, & Besser, 2002; Caplan, 2002, 2003). This model highlights that maladaptive cognitions play a central role in individuals' tendency to engage in problematic SMU and may precede the behaviors of problematic SMU (e.g., compulsive or excessive time spent online, decreased time spent with friends or doing other pleasurable activities, social isolation). Caplan (2005) updated this model to additionally include deficits in social skills and self-presentation, in addition to other psychosocial problems, as antecedents to the onset and maintenance of problematic SMU. Caplan (2005) argued that individuals who may lack social or self-presentational skills (e.g., some socially anxious individuals) may be particularly likely to prefer online social interaction to in-person communication and that this preference for online interaction makes them vulnerable to engaging problematically online, leading to negative outcomes. However, it is important to note that not all socially anxious individuals have social skills deficits. Therefore, we can understand Caplan's (2005) updated model to be more comprehensive, such that individuals with psychosocial problems, social skills deficits, and/or self-presentation challenges may all be at risk of preferring and engaging more problematically online. Social compensation theory (Tice, 1993) and social augmentation theory (Bessiere, Kiesler, Kraut, & Boneva, 2008; Valkenburg & Peter, 2009) of problematic Internet use similarly echo Caplan's updated model, positing that social media is a social environment in which socially disadvantaged or inhibited individuals (e.g., socially anxious individuals) may attempt to compensate for their shortcomings online and may seek out social opportunities online to augment their limited social world. Taken together, these theoretical frameworks help us to understand that individuals with more psychosocial problems (e.g., loneliness, social anxiety, depression), social deficits, and/or social inhibitions may prefer online interactions and use social media frequently in order to seek out social connection they may otherwise be lacking. Additionally, these frameworks suggest that this preference and frequency of using social media may not lead to the desired social outcomes.

1.3. Social media use & psychological well-being

Research to date on SMU and psychological well-being has been mostly cross-sectional in nature and findings have been somewhat mixed. Although some studies have suggested that SMU promotes psychological well-being (e.g., Pittman & Reich, 2016; Valenzuela, Park, & Kee, 2009), more research has indicated that it negatively affects one's mental and physical health (Verduyn, Ybarra, Résibois, Jonides, & Kross, 2017) and is associated with lower self-esteem (Kalpidou, Costin, & Morris, 2011), greater depression (Donnelly & Kuss, 2016; Lup, Trub, & Rosenthal, 2015; Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Shensa et al., 2017; Steers, Wickman, & Acitelli, 2014; Tandoc, Ferrucci, & Duffy, 2015; Wright et al., 2012), greater negative social comparison (Chou & Edge, 2012; Tandoc et al., 2015) and greater loneliness (Song et al., 2014; Verduyn et al., 2017). A few studies have found no significant relationship between one's SMU and psychological well-being (e.g., Berryman, Ferguson, & Negy, 2018; Coyne, Rogers, Zurcher, Stockdale, & Booth, 2020; Heffner, Good, Daly, MacDonell, & Willoughby, 2019). Even when studies have found associations between psychological well-being and SMU, they often have shown small effects. Many of the studies also have methodological limitations (i.e., cross-sectional designs, over-reliance on self-report data, inconsistent measurement of SMU), which further limit our ability to make firm conclusions. There is a pressing need to delve deeper into how and under what circumstances SMU is related to psychological well-being, so that we can gain more clarity on the nature of this relationship.

In a recent systematic review, Seabrook, Kern, and Rickard (2016) explored the relations between anxiety, depression, and SMU and concluded that more positive interactions, social support, and feelings of social connectedness on social media were associated with lower levels of anxiety and depression, whereas more negative interactions and social comparisons were associated with higher levels of anxiety and depression. Seabrook et al. (2016) also concluded that SMU was related to lesser loneliness and greater self-esteem and life satisfaction, but they suggested that this pattern of results may be related to *how* individuals engage with social media, which was not explored in depth in the original studies in their review.

Recent research has tried to differentiate two broad categories of how people use social media: active use and passive use. Active use includes any activity on social media sites that facilitates direct exchange with others, such as direct communication, posting, sharing private links, or direct messaging, whereas passive use includes monitoring other people's lives without direct engagement, such as scrolling through profiles, pictures, videos, or updates (Burke, Kraut, & Marlow, 2011; Verduyn et al., 2017). Although based mostly on cross-sectional studies, findings from a recent review by Verduyn et al. (2017) indicated that active use is associated with greater psychological well-being and passive use is associated with poorer psychological well-being. It is likely that individuals who engage more actively on social media feel more positively, more supported, and more socially connected, which may protect them from greater anxiety and depression. In contrast, considering that passive use consists primarily of scrolling and browsing of other people's lives, it may provide a platform for social comparisons and envy, which consequently may put individuals at elevated risk for anxiety and depression (Seabrook et al., 2016).

1.4. Social media use & social anxiety

Socially anxious individuals seem to be at particularly elevated risk of engaging more frequently and more passively on social media. Individuals with social anxiety experience fear and anxiety in social situations in which they will be negatively evaluated or judged by others and may limit their opportunities to have meaningful social relationships (Alden & Taylor, 2004; Clark & Wells, 1995; Hoffman, 2007; Rapee & Heimberg, 1997). Additionally, as a potential result of their maladaptive social beliefs, socially anxious individuals may show a preference for

online interaction over face-to-face interactions, increasing the likelihood that they will engage more frequently online (Caplan, 2005; Davis, 2001; Erwin, Turk, Heimberg, Fresco, & Hantula, 2004; Weidman et al., 2012). Furthermore, they frequently engage in negative upward social comparisons, in which they view themselves more negatively in comparison to other people (Antony, Rowa, Liss, Swallow, & Swinson, 2005); as a result, it is likely that the elevated likelihood of negatively comparing oneself to others places individuals with social anxiety at increased risk of engaging more passively online and feeling more socially isolated and alone as a result.

It has also been posited that socially anxious individuals use the Internet to regulate and compensate for their social fears (Shepherd & Edelmann, 2005). Research indicates that socially anxious individuals may perceive the Internet broadly as a more comfortable platform for socializing, which affects their preference and choice to engage online rather than face-to-face (Erwin et al., 2004). Further, socially anxious individuals may seek out online interaction to compensate for their lack of social support experienced in the real world (Weidman et al., 2012). However, it remains unclear whether this preference and tendency to engage online actually leads socially anxious individuals to receive the social support they seek, or if their social fears follow them online. A recent meta-analysis by Cheng, Wang, Sigerson, and Chau (2019) examined the perceived versus actual benefits of one's SMU and found that, whereas extraverted individuals reported that they used social media to enhance their opportunities for social interactions and did acquire more online social resources, more socially anxious individuals reported using social media to compensate for their social deficits but did not ultimately accumulate online social resources. Thus, it may be that despite seeking out social support, socially anxious individuals have negative social experiences online.

1.5. Social media use & loneliness

Recently, there has been increased attention to the rising rates of loneliness in modern society. A recent national report found that nearly half of Americans report sometimes or always feeling lonely, and interestingly, that young adults (ages 18–22) are at the highest risk for loneliness (Chatterjee, 2018). Loneliness is defined as the aversive state of feeling that there is a discrepancy between one's actual and desired social relationships (Peplau & Perlman, 1982). Individuals may feel lonely even when surrounded by friends or family, as loneliness relates to the perceived quality of one's relationships, rather than the quantity of one's relationships or time spent with others (Hawkley, Burleson, Berntson, & Cacioppo, 2003; Masi, Chen, Hawkley, & Cacioppo, 2011; Peplau & Perlman, 1982). Some researchers postulate that this increase in loneliness among younger adults is potentially related to their screen time and social media use, although this relationship has yet to be fully understood (Chaterjee, 2018; Twenge, Joiner, Rogers, & Martin, 2018). A meta-analysis by Song et al. (2014) found a positive relationship between Facebook use and loneliness; they also explored potential causal pathways between loneliness and Facebook use and found that shyness and a lack of social support predicted loneliness and loneliness predicted Facebook use. The results from Song et al.'s (2014) meta-analysis are in line with current theories on the etiology of loneliness, which suggest that lonely individuals exhibit maladaptive social cognitions and negative interpersonal appraisals that lead them to avoid opportunities for social connection and make them feel lonely as a result (Käll et al., 2020; Masi et al., 2011). From this perspective, it is likely that lonely individuals seek out social support on social media, as indicated in Song et al.'s (2014) review.

Despite finding only that loneliness predicts more frequent Facebook use, Song et al. (2014) note that there is continued debate in the literature about the causal direction of this relationship and more research is needed to determine whether problematic SMU also predicts loneliness. Although it appears that lonely individuals may engage more frequently online, whether they find what they are looking for online remains unclear. Further, it is not yet understood whether certain types of SMU (e.g., passive scrolling, active broadcasting of information without engaging others) may exacerbate loneliness, which we explore in this review. Although social media may increase opportunities for social connectedness, it may also create an environment brimming with social comparisons that may exacerbate experiences of social isolation and loneliness among the younger generations who use it most.

1.6. Social media use, loneliness, & social anxiety

Due to experiences of social isolation and rejection, socially anxious individuals are at risk for feeling particularly lonely (Cacioppo, Grippo, London, Goossens, & Cacioppo, 2015; Fung, Patterson, & Alden, 2017; Teo, Lerrigo, & Rogers, 2013). Lim, Rodebaugh, Zyphur, and Gleeson (2016) found that, other than prior loneliness, prior social anxiety was the only predictor of future loneliness in a community-based sample, indicating that social anxiety plays an important role in the persistence of loneliness. Because they limit opportunities to create meaningful social connections through negative beliefs about the self and others as well as avoidance of social situations, more socially anxious and lonely individuals may be highly susceptible to social isolation, which puts them at increased risk of future loneliness (Cacioppo et al., 2015; Teo et al., 2013).

Taken together, we are interested in understanding how experiences of social anxiety and loneliness are related to one's SMU. As outlined in the cognitive behavioral model and social skills account of pathological Internet use that we can use to understand problematic SMU today, more socially anxious and lonely individuals may be predisposed to engage problematically on social media and also experience negative consequences of their online behavior (Caplan, 2005; Davis, 2001). It also appears that more socially anxious and lonely individuals may attempt to compensate for or augment their limited in-person social relationships online (Bessiere et al., 2008; Käll et al., 2020; Masi et al., 2011; Shepherd & Edelmann, 2005; Weidman et al., 2012). Caplan (2006) further proposed that social anxiety may help to explain the relationship between loneliness and problematic SMU. As part of his early research on pathological Internet use, Caplan (2006) found that social anxiety accounted for a significant proportion of the variance in the relationship between loneliness and preference for online interaction. Interestingly, more recent research on problematic SMU and loneliness has often not included social anxiety as either a predictor or outcome of this relationship. It appears that both social anxiety and loneliness may potentially predict problematic SMU and that preference for and problematic use of social media have the potential to predict experiences of social anxiety and loneliness.

1.7. Objective

The aim of this systematic review is to summarize research examining social anxiety and loneliness in the context of social media. We identified research not just on the frequency with which people use social media as related to these constructs, but also how people use social media, and whether different types of SMU are related to one's experiences of social anxiety and/or loneliness. This review focuses on SMU in young adults, as this is the generation that most frequently uses and interacts on social media. In addition, since young adults were recently found to be the loneliest generation (Chatterjee, 2018), we examine possible links between social media use and loneliness in this cohort.

2. Methods

2.1. Search strategy

Fig. 1 summarizes the search strategy and article selection. PsycINFO and PubMed databases were explored to identify studies in this literature review prior to May 2020. Additional articles that met our criteria were
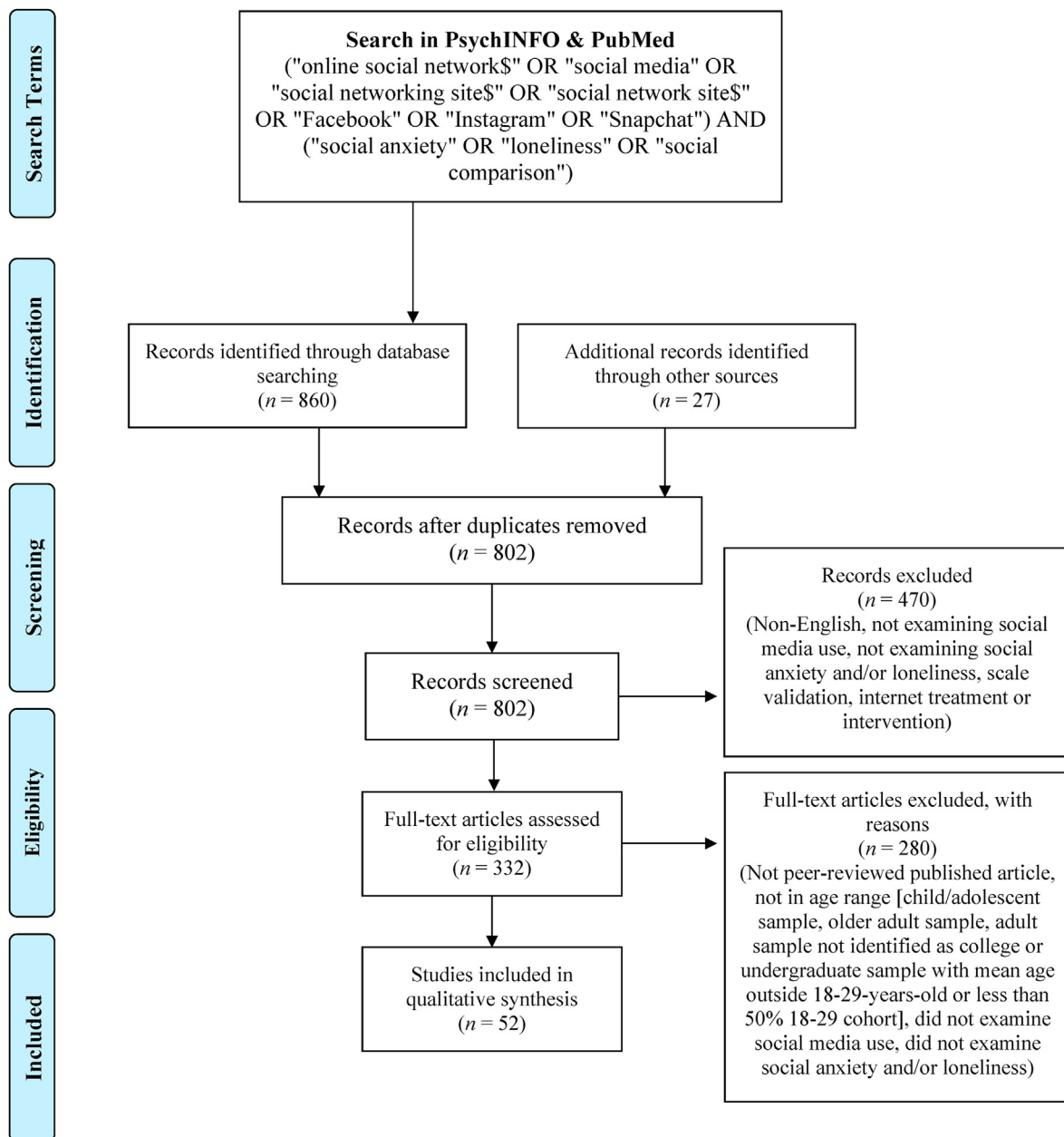
Fig. 1. PRISMA flow diagram for the systematic review detailing the database searches, the number of abstracts screened and the full texts retrieved.

identified by searching the reference lists of articles included in this review. Search terms were selected in order to comprehensively capture the various ways SMU, social anxiety, and loneliness have been defined and explored in the existing literature (see Fig. 1 for a full list of search terms and supplementary Table 1 for details of all studies included in this review).

2.2. Inclusion and exclusion criteria

Articles were restricted to English-language, peer-reviewed journals with quantitative or mixed methodologies. Meta-analyses, reviews, book chapters, dissertations, commentaries, and editorial articles were excluded. Studies were included if they had a primary focus on SMU as a behavior. Studies that referred to social media as solely a recruitment method or as a means of intervention delivery were excluded. Studies were included as part of this review if they examined SMU generally

across social networking sites or if they examined SMU on specific platforms, including Facebook, Instagram, and/or Snapchat. Studies that examined SMU on other platforms or SMU on platforms not used in the United States were excluded. Studies examining more general smartphone use, Internet use, or Internet addiction were excluded. Studies were included if they examined social anxiety and/or loneliness as related to SMU. Studies that examined SMU as related to other psychological constructs (e.g., general psychological well-being, general psychological distress, satisfaction with life, self-esteem, self-identity, self-worth, body-image or satisfaction, personality, general anxiety, or depression) that did not also include social anxiety or loneliness as specific variables of interest were excluded. Studies were included if they examined a sample of undergraduate students or a sample of adults that had a mean age between 18 and 29 years old or reported a proportion of 50% or more of participants in the 18-29-year-old cohort. Child and adolescent samples, older adult samples, and adult samples that did not

meet the "young adult" criterion specified above were excluded.

3. Results

3.1. Description of studies

Of the 332 articles reviewed, 52 studies met inclusion criteria. Facebook has been the most studied social media platform to date, with the majority of the studies included in our review examining Facebook use as related to social anxiety or loneliness ($n = 35$). The remainder of studies examined Instagram only ($n = 2$), social media use across a combination of platforms ($n = 4$), or general use of these social networking sites ($n = 11$). Seventeen studies examined SMU and social anxiety. Twenty-seven studies examined SMU and loneliness. Only eight studies examined both loneliness and social anxiety ($n = 4$) or the similar construct of shyness ($n = 4$) in the context of SMU. Interestingly, despite the important role of negative social comparison in the conceptualization of social anxiety and as a process that frequently occurs when using social media, only six studies examined social comparison or related constructs (e.g., envy, fear of missing out) as related to social anxiety or loneliness. The majority of studies to date have been cross-sectional in nature; only 15 studies in this review examined SMU with social anxiety and/or loneliness in an experimental ($n = 7$) or longitudinal ($n = 9$) design; one paper included two studies—one experimental and one longitudinal. Additionally, the majority of studies examined questions related to the frequency of one's social media use; only six studies examined differences in types of social media use (e.g., active vs. passive use).

3.2. Social media, social anxiety, & loneliness: summary of findings

3.2.1. Social media use & social anxiety

A number of studies have illustrated that socially anxious individuals prefer online to face-to-face social interactions and have a tendency to use social media more problematically. More socially anxious individuals appear to use social media with greater frequency (Casale & Fioravanti, 2015; Dempsey, O'Brien, Tiamiyu, & Elhai, 2019; Lee-Won, Herzog, & Park, 2015; Shaw, Timpano, Tran, & Joormann, 2015) and greater intensity (i.e., defined as emotional attachment and use of social media in daily life; Davidson & Farquhar, 2014) than less socially anxious peers. Research has also pointed to the association between social anxiety and the addictive qualities of SMU; Honnekori et al. (2017) found that greater social anxiety was associated with a perceived inability to reduce Facebook use, greater urges toward increasing use, spending more time thinking about Facebook, experiencing negative reactions to restricting use, and using it to forget one's problems. Additionally, socially anxious individuals' problematic SMU may be driven by their tendency to engage in maladaptive cognitive patterns and make negative social comparisons. In a recent study by Dempsey et al. (2019), fear of missing out and rumination accounted for a significant proportion of the variance in the relationship between social anxiety and problematic SMU. Furthermore, Shaw et al. (2015) found that greater social anxiety was associated with more passive SMU, in addition to greater frequency of SMU; in this study, brooding explained a significant portion of the variance in the relationship between social anxiety and passive SMU, highlighting that socially anxious individuals' tendency to ruminate may lead them to passively engage on social media, rather than interacting with others online. However, these studies utilized cross-sectional designs, so it is important to use caution when interpreting their findings, as casual relationships cannot be established.

Socially anxious individuals appear to seek out social support online to compensate for a lack of in-person support. Indian et al. (2014) explored the effect of perceived online social support on one's subjective well-being and found that among more socially anxious individuals, perceived online social support was associated with greater subjective well-being, with a medium effect size ($f^2 = 0.15$), whereas offline social support was not. It is likely that more socially anxious individuals may

prioritize and seek out social support online to improve their well-being compared to less socially anxious individuals, to receive the social acceptance that they do not necessarily expect to receive in person. However, this study did not control for the number or quality of one's in-person relationships, so it is difficult to make firm conclusions about what individuals may wish to compensate for with their time spent online. Further, Lee-Won et al. (2015) demonstrated that the need for social assurance appears to moderate the relationship between social anxiety and problematic SMU; specifically, higher need for social assurance strengthened the relationship between social anxiety and problematic SMU. Casale and Fioravanti (2015) also found that social anxiety was positively associated with the need to use social media for self-presentation purposes (i.e., to appear more competent and avoid displays of imperfection), the need for assertiveness (i.e., to be able to confidently express one's opinions), and the desire to belong and feel included by others. Interestingly, different patterns emerged between men's and women's motivation for their SMU; socially anxious men's more frequent and compulsive SMU was motivated by their desire to present themselves positively online and avoid displays of imperfections that may be more salient during in-person interactions. For socially anxious women, the desire to belong seemed to motivate their more frequent and more compulsive SMU (Casale & Fioravanti, 2015). Thus, it appears that for various reasons, socially anxious individuals may turn towards engaging more problematically online, viewing social media as place where they can present themselves more positively and/or feel more included than during in-person face-to-face interactions. However, it is possible that other factors inherent to the person (e.g., personality traits) or the social media platform (e.g., the ability to use filters to improve one's appearance online, the potential for anonymity by using pseudonyms or "fake" accounts) that were not explored or controlled for as part of this study design may be motivating socially anxious men and women's SMU.

No studies in our review indicated that socially anxious individuals actually receive their desired support online. Interestingly, however, Deters, Mehl, and Eid (2016) examined status updates and direct social feedback received by individuals using Facebook in studies in both the US and Germany and found that, in both studies, more socially anxious individuals did not post more or receive more direct social feedback (i.e., likes or comments on their posts). However, their positive status updates were more appreciated by friends and received more likes. The authors suggested that social media may provide socially anxious individuals with the opportunity to receive social support, if they choose to engage online with others.

Instead, social anxiety seems to carry over to socially anxious individuals' social media presence and hinder their ability to connect with others on social media. A few studies have highlighted the ways in which socially anxious individuals exhibit behavioral symptoms of their social anxiety on social media. In their explorations of Facebook profile attributes, Fernandez, Levinson, and Rodebaugh (2012) and Weidman and Levinson (2015) found that social anxiety was observable both in the objective ways that individuals presented information on their profiles, as well as in others' impressions of their profiles; individuals with higher social anxiety showed less social activity on their profile (e.g., fewer Facebook friends and photographs, fewer activities listed on profile), fewer romantic relationships (e.g., relationship status listed as "single"), and less self-disclosure (e.g., fewer status updates) than individuals with lower social anxiety, and these findings showed medium effects. Observers also rated the perceived level of individuals' social anxiety based on viewing their Facebook profiles and observed more social anxiety on more socially anxious individuals' profiles compared to less socially anxious individuals' profiles.

Socially anxious individuals' fears of negative evaluation also seem to follow them online. Despite preferring online interaction, socially anxious individuals maintain maladaptive beliefs that engaging with a virtual community is "dangerous" (i.e., makes them vulnerable to interpersonal threats or judgements) and fear sharing personal information

online (Hong, Hwang, Hsu, Tai, & Kuo, 2015), and results indicated large effects. Green, Wilhelmsen, Wilmots, Dodd, and Quinn (2016) examined socially anxious individuals' Facebook attitudes and behaviors and found that despite believing that there are benefits to engaging online (e.g., fewer visual and contextual cues such as eye contact or facial expressions, more controllability since they have more time to think about and edit responses), they still inhibit their public behavior online (e.g., status updates, wall posts, comments or likes on posts), but effect sizes were small (R^2 ranging from 0.04 to 0.12). A study by Chen et al. (2017) indicated that greater self-esteem and perceived collectivism were associated with positive self-disclosure online, whereas online privacy concerns were associated with lesser positive self-disclosure, which is somewhat in line with the findings above; however, this study did not find a relationship between social anxiety and self-disclosure, indicating that various factors may affect one's willingness to share information online. Research has also suggested that greater social anxiety is associated with lesser assertiveness and lesser engagement on social media, with effect sizes ranging from small to large ($\eta_p^2 = 0.04$ to 0.30), which mimics the more inhibited behavior seen among socially anxious individuals in in-person settings (Baker & Jeske, 2015). Thus, despite the desire for positive outcomes through their online interaction, socially anxious individuals' maladaptive social cognitions and inhibited behavior may prevent them from receiving the social benefits of their online presence. Because their social anxiety follows them online, socially anxious individuals may have difficulty eliciting the online support they may want, although more research is needed.

Only a few studies have examined the directional relationship between social anxiety and problematic SMU. Only one study included in this review examined whether social anxiety predicts problematic SMU; in a two time-point longitudinal study, Feinstein, Bhatia, Hershenberg, and Davila (2012) examined the relationship between social anxiety and problematic SMU but found that social anxiety did not predict increased frequency of SMU. However, another study indicated that social anxiety predicts negative self-perceptions on Facebook. In a 10-day longitudinal design, Burke and Ruppel (2015) examined individuals' motivation to present themselves positively on Facebook, fears of negative self-presentation, and social anxiety, and found that individuals reported greater negative self-presentation concerns the day following reporting higher social anxiety. Although social anxiety did not predict more problematic SMU behavior in this study, more negative self-presentation concerns following experiences of social anxiety may be associated with more problematic SMU.

In addition, only one experimental study has examined whether social anxiety is a consequence of problematic SMU. Rauch, Strobel, Bella, Odachowski, and Bloom (2014) examined whether exposure to someone in-person prior to interacting with them on Facebook or exposure to someone on Facebook prior to engaging with them in-person elicits greater arousal and experiences of social anxiety than engaging with someone only in-person or online, and found that a prior exposure to a person on Facebook elicited increased arousal during a pursuant face-to-face interaction, particularly among those with higher levels of social anxiety. Rauch et al. (2014) concluded that interactions through social media may prime self-presentation and social comparison concerns, which may make socially anxious individuals more aroused and anxious during in-person interactions. This study indicates that increased social anxiety may be a consequence of SMU, especially among those with high levels of baseline social anxiety.

Taken together, we see that socially anxious individuals prefer and seek out online versus face-to-face interactions and engage on social media more problematically, shown in terms of both greater frequency and more passive use. However, socially anxious individuals do bring their social anxiety online, which may affect whether they receive the online social support they seek. To date, there has been a larger body of literature examining the cross-sectional relationship between social anxiety and problematic SMU, but very few longitudinal or experimental studies that have examined whether social anxiety predicts or is a

consequence of problematic SMU. Another limitation we see with these studies is the limited use of objective measures of SMU, as most studies to date rely exclusively on self-report measures to assess one's SMU. Nevertheless, it does appear that feeling socially anxious may lead individuals to have more negative self-presentation concerns on social media, which may exacerbate problematic SMU. Further, it appears that exposure to online social interactions may elicit social fears and negative social comparisons among those who are more socially anxious, increasing their arousal and anxiety in later in-person social situations. Although there is support that social anxiety is associated with problematic SMU and may potentially be a predictor and consequence of problematic SMU, more research is needed.

3.2.2. Social media use & loneliness

As is the case for social anxiety, research has indicated that lonely individuals may turn to social media to seek out social support and compensate for their lack of in-person relationships. Clayton, Osborne, Miller, and Oberle (2013) examined undergraduates' emotional attachment and connectedness, communication behaviors, and reasons for using Facebook, and found that loneliness was associated with using Facebook to connect with others, although this effect was small (squared semi-partial correlation coefficient = 0.03). Research is also mixed as to whether lonely individuals receive support online. Although some studies indicate that lonely individuals may experience positive benefits of their SMU (Skues, Williams, & Wise, 2012; 2017), other studies suggest that they may not receive the social support they are looking for and experience negative consequences as a result of their SMU (Lo, 2019). In two undergraduate samples, Skues et al. (2012; 2017) found that lonelier individuals had a greater number of Facebook friends than less lonely individuals, postulating that lonely individuals may be able to use social media as a means of compensating for a lack of offline support. In contrast, other research has demonstrated that greater loneliness is associated with fewer Facebook friends (Phu & Gow, 2019), but effect sizes were small, so skepticism remains as to whether lonely individuals are able to create online friendships. Additionally, a study by Lo (2019) highlighted that although receiving support through social media in general may benefit users, reducing users' exhaustion ($R^2 = 0.01$) and increasing their satisfaction ($R^2 = 0.19$), more lonely users experience greater stress while using social media compared to less lonely users, thus limiting their ability to realize the potential benefits of their SMU.

Lonely individuals appear to use social media problematically, with a number of studies indicating that they use social media with greater intensity (e.g., defined as more frequent use, more persistence use, and/or with more emotional attachment to social media; Petrocchi, Asnaani, Martinez, Nadkarni, & Hofmann, 2015; Phu & Gow, 2019) and more addictively (Biolcati, Mancini, Pupi, & Mugheddu, 2018; Rajesh & Rangaiah, 2020; Shettar, Karkal, Kakunje, Mendonsa, & Chandran, 2017). However, a few studies did not find a relationship between problematic SMU and loneliness (Kircaburun et al., 2018; Wohn & LaRose, 2014) or found that greater intensity of Facebook use was associated with lower loneliness (Lou, Yan, Nickerson, & McMorris, 2012). Although the research on problematic SMU and loneliness to date seems to be somewhat mixed, these studies have been cross-sectional in nature, and used only self-report rather than objective measures of SMU, so caution is warranted when interpreting findings.

Research has explored whether individuals' engagement and activity across different social media platforms may be associated with different experiences of loneliness (Petrocchi et al., 2015; Pittman & Reich, 2016). Petrocchi et al. (2015) examined loneliness among individuals who only used Facebook versus individuals who used both Facebook and Twitter and found that loneliness was positively associated with more intense Facebook use only among those who used Facebook alone, whereas it was negatively associated with Facebook and Twitter use among those who used both platforms, although effect sizes were small. Because Petrocchi et al. (2015) found that more intense SMU was more frequently seen among users of only Facebook, they postulated that individuals who

use Facebook only may use social media to escape feelings of loneliness, whereas those who utilize more social media platforms may be more socially connected and engaged across platforms and experience lower levels of loneliness as a result. Pittman and Reich (2016) also examined individuals' regular use of several social media platforms and found that the use of image-based platforms (e.g., Instagram, Snapchat) was associated with lower levels of loneliness with a medium effect ($\eta^2 = 0.12$), whereas the use of text-based platforms (e.g., Twitter, YikYak) did not affect loneliness; they hypothesized that the image-based nature of some platforms may increase social connectedness and decrease loneliness. Together, these studies highlight that there may be differential relationships between individuals' SMU and their experiences of loneliness and underscore the importance of examining the nature of individuals' activities across social media platforms to better understand loneliness in this context.

Importantly, it appears that the tendency to engage in social comparison on social media may affect outcomes of one's SMU and how lonely individuals feel when interacting online. Mackson, Brochu, and Schneider (2019) found that compared to those without an Instagram account, individuals with Instagram reported lower levels of loneliness, but that having more anxiety about one's Instagram use and engaging in social comparisons on Instagram predicted more depression and anxiety; they indicated that although using social media may make individuals initially feel less lonely and more connected, the tendency to engage in social comparisons while using the platform may lead to negative outcomes, although effect sizes were small. Another study by Yang (2016) examined the relationships between loneliness and active and passive forms of SMU, looking at the frequency of engaging in various activities on social media, including passively browsing one's newsfeed, actively broadcasting content, and interactively engaging with others, and interestingly found that both actively interacting with others and passively browsing were associated with lower loneliness, whereas actively broadcasting content was associated with higher loneliness. Importantly, however, Yang (2016) found that an individual's tendency to engage in social comparison moderated the relationship between loneliness and SMU; Instagram interaction was only related to lower loneliness among individuals who engaged in lesser social comparison. Thus, it appears that certain types of both active and passive SMU have the potential to improve loneliness, but the tendency to engage in social comparison may moderate how SMU activities affect how lonely individuals feel when using social media.

A few studies have examined the directional relationship between loneliness and problematic SMU (Aalbers, McNally, Heeren, De Wit, & Fried, 2019; Kross et al., 2013; Reissmann, Hauser, Stollberg, Kaunzinger, & Lange, 2018; Zhang, Rost, Wang, & Reynolds, 2020), with findings to suggest that loneliness predicts problematic SMU, defined both in terms of frequency and types of SMU (i.e., active and passive use). Kross et al. (2013) were among the first to longitudinally examine the relationship between Facebook use and psychological well-being using ecological momentary assessment (EMA) during a two-week period and found that loneliness at one time-point predicted increases in Facebook use over time. Reissmann et al. (2018) replicated these findings similarly using an EMA design to explore this relationship and also found that loneliness predicted subsequent increases in one's Facebook use. The size of this effect varied between persons and psychosocial variables (R^2 situational level $= 0.07$, R^2 person level $= .51$). Two studies have extended our understanding of this relationship in terms of active and passive SMU. Aalbers et al. (2019) concluded from their EMA study that loneliness also predicted passive SMU, suggesting that feeling lonely may lead individuals to scroll through social media pages passively. Loneliness may also exacerbate active SMU, in addition to passive SMU; Zhang et al. (2020) recently found that loneliness at time 1 predicted active SMU, in addition to passive SMU, at time 2. Not all research has yielded the same significant results, however; in a two time-point study by Yang, Carter, Webb, and Holden (2019), loneliness at time 1 did not predict problematic SMU at time 2. Interestingly, they did indicate that the

relationship between loneliness and problematic SMU may be affected by one's tendency to ruminate and engage in social comparisons. The tendency to engage in social comparisons was associated with higher rumination at time 1, which predicted greater problematic SMU at time 2. Importantly, these studies provide some evidence that loneliness predicts more frequent as well as active and passive SMU, but more research is needed to examine the potential mediating or moderating factors in this relationship and how loneliness is related to different types of SMU.

Interestingly, these studies (Aalbers et al., 2019; Kross et al., 2013; Reissmann et al., 2018; Yang et al., 2019; Zhang et al., 2020) failed to find that problematic SMU predicts loneliness. However, there is evidence that problematic SMU predicts poorer psychological well-being and that envy mediates this relationship. An experimental study by Verduyn et al. (2015, study 1) found that a period of passive Facebook use predicted declines in affective well-being among college students, compared to a period of active use, and this finding showed a medium effect ($\eta p^2 = 0.06$). In a related longitudinal examination of passive Facebook use and well-being, envy mediated this relationship (Verduyn et al., 2015, study 2). Although Verduyn et al. (2015) did not find that passive SMU predicted loneliness as a secondary outcome, they were among the first to experimentally manipulate SMU and longitudinally examine psychological well-being and loneliness as outcomes of problematic SMU; this study also provides information that potential experiences of social comparison/envy may affect the relationship between SMU and well-being and that more research is needed with loneliness as a primary outcome.

A few studies have examined whether greater engagement on social media predicts reductions in loneliness (Deters & Mehl, 2013; Seo, Kim, & Yang, 2016; Sohn, Woo, Jo, & Yang, 2018). A retrospective study by Seo et al. (2016) indicated that interactions with Facebook friends and faster reactions to one's posts from friends predicted greater perceived social support (small to medium effect, R^2 for confidant support $= .05$ and R^2 for belonging support $= .13$) and lower loneliness (large effect, $R^2 = 0.26$); this effect was most significant among those who were more sensitive to other's behaviors and feelings, which may be relevant for those who may feel lonely. Deters and Mehl (2013) experimentally manipulated the frequency with which individuals post status updates on Facebook and found that, compared to those who posted as usual, individuals who posted more than usual experienced reductions in loneliness; further, feeling more connected to their friends on a daily basis mediated the relationship between posting more status updates and improvements in loneliness. Interestingly, the effect of posting status updates was independent of whether or not individuals received feedback on their posts, suggesting that the act of increasing one's engagement, regardless of the reaction from others, can help to improve feelings of loneliness. Sohn et al. (2018) longitudinally examined college students' sense of intimacy and connectedness on social media and feelings of loneliness across three time-points during a six-month period as they transitioned from college into the working world and found that intimacy on social media and feelings of connectedness (i.e., bonding capital) predicted declines in loneliness across time, highlighting that using social media to stay connected with friends can reduce loneliness. Taken together, it appears that social engagement online, such as posting or sharing, that promotes feelings of connectedness with others helps to alleviate loneliness, and that although direct social feedback from others is beneficial, it is not necessary in order to experience improvements in loneliness. However, this study did not examine the source of the direct feedback received (e.g., whether feedback came from a close friend versus an acquaintance) or whether a specific interaction online sparked increased feelings of connectedness, which could be considered in future studies to better understand the value of receiving direct feedback or what may drive enhanced feelings of connectedness.

A few studies have also examined whether limiting or abstaining from SMU alleviates loneliness. Hunt, Marx, Lipson, and Young (2018) experimentally manipulated undergraduates' use of Facebook,

Instagram, and Snapchat over a three-week period and found that compared to SMU as usual, individuals who limited their SMU to 10 min per platform per day experienced reductions in loneliness. Two studies (Hall, Xing, Ross, & Johnson, 2019; Vally & D'Souza, 2019) questioned whether abstaining from social media all together may improve individuals' well-being; Vally and D'Souza (2019) found that compared to SMU as usual, abstaining from SMU led to an increase in loneliness, and Hall et al., 2019 found that social media abstinence had no effect on loneliness. Although these studies have poor ecological validity, such that they do not replicate naturalistic SMU, they provide important information about the potential benefits and consequences of changing one's SMU. It appears that limiting one's SMU may alleviate loneliness, whereas completely abstaining from social media may exacerbate feeling of disconnectedness or may be unrelated to one's experiences of loneliness.

Taken together, like socially anxious individuals, lonely individuals seem to engage on social media in order to compensate for their offline relationships and feel connected to others, but they may not necessarily receive the social support they seek. Several studies have shown that lonely individuals use social media problematically, defined in terms of greater frequency, greater intensity, and more addictively, although findings are mixed and more research is needed to expand our understanding beyond cross-sectional associations and use of self-reported SMU. There is additional support to indicate that greater activity across social media platforms and greater social connectedness online are associated with lesser loneliness, highlighting that the nature of one's engagement online and across platforms is indicative of the relationship between one's SMU and experiences of loneliness. Additionally, social comparison appears to be an important factor that can affect the relationship between SMU and loneliness. The majority of research on the relationship between problematic SMU and loneliness has been cross-sectional in nature, and no studies to date have found directional support for the proposition that problematic SMU predicts loneliness. However, a few experimental and longitudinal studies to date have indicated that loneliness predicts problematic SMU and that engaging more positively on social media and limiting one's SMU, but not completely abstaining, alleviates loneliness. Thus, loneliness appears to be a risk factor for problematic SMU, but research has not shown that loneliness is a direct consequence of problematic SMU. It does appear that limiting individuals' SMU has the potential to improve experiences of loneliness, although future research should determine how individuals can optimize their SMU to potentially alleviate loneliness.

3.2.3. Social media use, social anxiety, & loneliness

To date, very few studies have explored the relationship between social anxiety, loneliness, and SMU together, and all have been cross-sectional in nature, which limits conclusions. Further, these studies have drawn similar conclusions to what has been described above, when SA and LO were examined independently; these studies generally suggest that more socially anxious and lonely individuals use social media to compensate for or augment their offline relationships and that they may not receive the social support they seek (e.g., L.R. Baker & Oswald, 2010). Additionally, these studies indicate that socially anxious or lonely individuals may have difficulty engaging on social media in the first place. In one study, Sheldon (2012) found that compared to Facebook users, non-Facebook users were more shy and more lonely, hypothesizing that more socially anxious and lonely individuals may be hesitant to join social worlds online, although effects were small. This study did not collect information about reasons participants may have been hesitant to join social media platforms, which may have been important information to gather, in order to draw firmer conclusions. Further, as previously discussed, it appears that when socially anxious or lonely individuals do use social media, they may be more inhibited, withdrawn, and disclose less (Sheldon, 2013). More research is needed examining these constructs together, to better understand how and why more socially anxious and lonely individuals use social media and whether this affects the support

they receive or friendships they create online.

When studied together, social anxiety and loneliness have again been shown to be positively associated with problematic SMU. Research has shown that both greater social anxiety and loneliness are related to greater frequency of SMU (Atroszko et al., 2018; Lemieux, Lajoie, & Trainor, 2013), fewer Facebook friends (Lemieux et al., 2013), and using social media for recognition, publicity, and interaction with others (Yildiz Durak & Seferoğlu, 2019). However, the magnitude of these effects was either unreported or small in the studies listed above. Facebook addiction was also found to be associated with loneliness and social anxiety (Atroszko et al., 2018) and shyness (Satici, 2019). In a recent study, although a cross-sectional design, Satici (2019) found that shyness and loneliness explained a significant proportion of the variance in the relationship between Facebook addiction and subjective well-being, highlighting the important role these variables play in the potential detrimental effects of problematic SMU, although causality cannot be implied. Also, when these constructs are examined together, it appears that social anxiety has a stronger relationship with problematic SMU (Yildiz Durak & Seferoğlu, 2019); it is possible that social anxiety may drive the relationship between loneliness and problematic SMU, although this relationship needs to be examined in longitudinal or experimental designs and other potentially related third variables should be controlled for and considered. Of note, one study included in this review did not find a relationship between the frequency or importance of SMU and negative outcomes (e.g., social anxiety or loneliness; Berryman et al., 2018), but the investigators postulated that how people use social media may be more important than the sheer number of hours they spent on a given platform, which was not assessed in their study. Nevertheless, the majority of the few studies to date indicate that social anxiety and loneliness are both related to problematic SMU. Clearly, to probe unanswered questions about the nature of individuals' social media use and the more directional relationships between risk factors and consequences of one's SMU, more research is needed.

4. Discussion

4.1. Principal findings

This review provides important information about the relationships between social anxiety, loneliness, and SMU among young adults. It appears that although more socially anxious and lonely individuals may wish for online social connection, they may exhibit inhibited behavior, engage in maladaptive cognitive patterns such as rumination, or negatively compare themselves to others while using social media, all of which may prevent them from experiencing the social benefits of using social media. Importantly, there is cross-sectional support for the relationship between social anxiety and self-reported problematic SMU, as well as the relationship between loneliness and self-reported problematic SMU, indicating that more socially anxious and lonely individuals use social media more frequently, more intensely, and more addictively, with mixed support for the notion that more socially anxious and lonely individuals use social media more passively.

To date, there has been limited research experimentally or longitudinally examining the potential bidirectional relationship between social anxiety and problematic SMU. Although there is cross-sectional support, no experimental or longitudinal studies included in this review provided direct evidence that social anxiety predicts problematic SMU or problematic SMU predicts social anxiety. However, in one longitudinal study (Burke & Ruppel, 2015), it was shown that feeling socially anxious leads individuals to have more negative self-presentation concerns on social media. Further, one experimental study (Rauch et al., 2014) suggested that social anxiety may be a potential consequence of interacting with others online, especially among individuals who have higher levels of baseline social anxiety, although further research is also needed to explore whether problematic SMU directly predicts social anxiety.

Research examining the relationship between loneliness and

problematic SMU is also in its beginning stages, with only a few studies experimentally or longitudinally examining the directional relationship between these constructs. Importantly, a few longitudinal studies have shown that loneliness predicts problematic SMU, defined both in terms of frequency of SMU and types of SMU (i.e., active and passive use); together, these studies indicate that loneliness is a risk factor for problematic SMU. No studies have found directional support that problematic SMU predicts loneliness, although there is research to suggest that problematic SMU predicts poorer psychological well-being, and future studies are needed. Additionally, a few experimental studies have shown that engaging more actively on social media and/or limiting one's SMU but not completely abstaining from use, alleviates loneliness (Deters & Mehl, 2013; Hunt et al., 2018; Vally & D'Souza, 2019), which is an important consideration when determining how to intervene to improve outcomes of one's SMU.

This review also explored how types of SMU (e.g., active and passive use) affect experiences of social anxiety and loneliness. However, it is important to note that very few studies in our review differentiated between types of SMU, and those who have examined active and passive use have examined self-reported versus objective use, which limits our ability to draw firm conclusions about how they affect psychological well-being. The limited research on the different effects of active versus passive use as related to social anxiety and loneliness has been mixed and almost entirely cross-sectional. There was cross-sectional evidence to suggest that passive, but not active SMU, is associated with greater social anxiety (Shaw et al., 2015) and longitudinal evidence that loneliness predicts passive SMU (Aalbers et al., 2019), congruent with findings in past reviews (Seabrook et al., 2016; Verduyn et al., 2017). Interestingly, however, and somewhat contrary to conclusions made in previous reviews (Seabrook et al., 2016; Verduyn et al., 2017), we see that the relationship between types of SMU and psychological well-being may be more complex than the notion that active use is solely "good" and passive use is solely "bad." In a recent longitudinal study, Zhang et al. (2020) found that loneliness predicted both active and passive SMU. Furthermore, in Yang (2016)'s study, both actively engaging with others and passively scrolling were associated with lesser loneliness, whereas the form of active use called "broadcasting," in which individuals post active content, was associated with greater loneliness. It appears that there may be nuances in the relationships between different types of SMU and experiences of social anxiety and loneliness that need to be further examined.

4.2. Strengths and implications

Our review provides support for the social compensation theory of problematic SMU and the cognitive behavioral model and social skills account of problematic SMU for more socially anxious and lonely individuals. This review solidifies our understanding of why more socially anxious and lonely individuals engage problematically online and illuminates that more socially anxious and lonely individuals do not necessarily receive benefits from their online interactions. From the cross-sectional studies to date, we see that social anxiety and loneliness are associated with problematic SMU. From the experimental and longitudinal studies to date, we can conclude that loneliness is a risk factor for problematic SMU. It is likely that social anxiety and loneliness may be potential risk factors and consequences of one's SMU, although the studies are limited and more directional research is needed to make more definitive conclusions. To date, there has been the most direct evidence that loneliness predicts problematic SMU, as well as support for the notion that fostering social connectedness and more engagement online or limiting one's SMU can alleviate loneliness.

Together, these findings have important clinical implications; it is possible that despite their efforts, more socially anxious and lonely individuals may be engaging in ways that limit their potential for experiencing social connectedness online. By understanding how and why individuals engage online, clinical interventions could be directed at improving the ways in which more socially anxious and lonely individuals are able to foster social connectedness and support through their SMU. Furthermore, it appears that limiting one's SMU may have potential to alleviate loneliness; it may be important for clinicians to better understand what behaviors on social media are most common among more socially anxious and lonely individuals and attempt to limit the SMU behaviors that exacerbate one's problems, such as engaging in social comparison or rumination when interacting online.

4.3. Limitations

The majority of the studies included in this review were cross-sectional in nature; although these cross-sectional studies show that there is a relationship between problematic SMU, social anxiety, and loneliness, more research is needed to understand the potential bidirectional nature and causal pathways involved in these relationships. Additionally, among the studies to date, problematic SMU has been defined most commonly in terms of frequency of use, with limited studies examining different types of use (i.e., active and passive use) or motivations for one's SMU. Future research should continue to define and explore SMU above and beyond frequency of use and parse apart the more specific ways in which individuals may be using social media actively and/or passively to better understand how SMU affects psychological well-being.

Furthermore, SMU has been defined and conceptualized differently across studies; although there is typically overlap between study measures in terms of examining frequency of one's SMU or engaging in certain behaviors online, researchers have typically generated their own measure for the purposes of their study or adapted measures not originally created for examining SMU. Future research would benefit from more psychometric examinations of the most common SMU measures used to date, to allow for more streamlined and consistent measurement of SMU. Further, as touched on throughout the review, most studies to date have used self-report measures of SMU, and there may be some discrepancies between individuals' reported and actual SMU that is not captured in the current research. For example, instead of asking participants to estimate how much time they spend actively and passively on a platform (which inevitably leads to human error) or manipulating one's SMU in the lab (which is not representative of a natural setting), researchers could objectively measure how much time participants spend engaging on social media by using software that tracks and shares this information through participants' personal devices. Not only would this provide information on specific types of SMU above and beyond frequency of one's use, but it would also allow for more accurate data to be gathered. Researchers will likely face challenges in attempting to collect participants' personal information through a private device, but whenever possible, it seems important for future studies to collect information about an individual's objective SMU, in addition to their self-reported SMU.

Additionally, several studies have also quantified the potential benefits of one's SMU in terms of the number of one's Facebook friends; however, it is unclear whether a greater number of Facebook friends is truly indicative of positive outcomes; research by Ellison, Steinfield, and Lampe (2007; 2011) has indicated that using Facebook can improve bridging social capital, in which individuals can strengthen "weaker" ties and feel more connected to those in their community. However, in their studies, number of Facebook friends was not associated with improvements in social capital. Additionally, a study by Lima, Marques, Muiños, and Camilo (2017) found that although there are positive health benefits of having in-person friendships, the same was not true for online friendships. It is also important to consider that the definition of a social media "friend" may be very different from that of an in-person "friend." For example, social media friends may comprise someone's actual friends (e.g., people the user knows well and sees in-person regularly), acquaintances (e.g., people the user might have met peripherally such as people who are friends of friends), and strangers, who might be people

who are several steps away in their social network, or people they have never met before, such as celebrities or influencers. Thus, given the uncertain positive benefits of having a greater number of social media friends, and the broad and shifting meaning of what it means to be social media "friends," we remain skeptical that the number of friends on social media should be used as a measurement of the benefits of one's SMU.

Several other methodological issues affect the strength of the interpretations and conclusions we can make in our review. Among correlational studies examining loneliness and/or social anxiety with SMU, few studies control for theoretically relevant third variables. For example, because social anxiety is highly comorbid with depression (Koyuncu, İnce, Ertekin, & Tükel, 2019), it may be important for future work to control for depression when examining these constructs to better understand their unique relationship. In addition, among studies examining whether more socially anxious and lonely individuals turn to social media to compensate for lack of in-person relationships, it may be important to examine the number and quality of one's in-person relationships as potential control variables, which has not been done in the literature to date. Furthermore, the experimental studies included in this review did not indicate that they used methods to hide the experimental manipulation from participants. In future experimental study designs, an important methodological consideration may be to incorporate distractor questions or tasks into the research design, to prevent participants from potentially guessing the reason for the experimental manipulation. For example, in studies that experimentally manipulate or limit one's SMU, it is possible that participants may guess the purpose of the study and report improvement in well-being in relationship to active or more limited SMU, which we cannot know based on the literature to date.

Finally, one interesting consideration that should be noted is that the experimental studies included in this review lack ecological validity, as the nature of manipulating one's SMU as part of an experimental design inevitably changes one's SMU away from natural SMU in daily life. Several studies manipulated one's active versus passive SMU (Verduyn et al., 2015), limited one's SMU per day (Hunt et al., 2018), or had participants totally abstain from using social media (Hall et al., 2019; Vally & D'Souza, 2019), none of which are representative of naturalistic SMU. However, it is interesting to consider that these studies may not have been striving for ecological validity, but instead had the goal of manipulating participants' SMU in order to better understand how changing SMU may affect psychological well-being, which also contributes to our understanding of social media today. In tandem with studies that manipulate or change one's SMU, future research should attempt to replicate real world, naturalistic SMU whenever possible.

4.4. Future directions

Overall, despite the extensive use of social media among young adults, research dedicated to understanding the problematic nature of the relationship between SMU, social anxiety, and loneliness has been limited. This review has highlighted that more socially anxious and lonely individuals seem to engage similarly online; because social anxiety and loneliness are highly correlated, it will be interesting for future research to both parse apart these constructs and examine them together as they relate to SMU.

Furthermore, more experimental and longitudinal research examining these relationships is needed. The field would greatly benefit from more longitudinal designs, which would allow us to make stronger conclusions about the temporal precedence and directional nature of the relationships between social anxiety, loneliness, and problematic SMU. Longitudinal designs would help us more definitively answer whether social anxiety and/or loneliness serve as antecedents to various forms of problematic SMU and whether problematic SMU exacerbates feelings of social anxiety and/or loneliness when measured across time. Additionally, longitudinal designs with more than two time points would allow us to test whether problematic SMU mediates the relationship between social anxiety and loneliness, which has yet to be explored in the research

to date, and has limited our ability to identify causal relationships between these constructs. Further, research that incorporates experimental designs would greatly deepen our understanding of these relationships and would allow us to determine causality. For example, future studies could randomly assign participants to controlled conditions in which they can only use social media in a certain way (e.g., actively or passively), to elucidate whether specific types of SMU elicit feelings of social anxiety and/or loneliness. Additionally, regardless of specific study design, future research studies would greatly benefit from preregistration. There has been a growing interest and call for open science, to make research data and findings more accessible within the scientific community. Preregistration allows for clarity among researchers about the strength and magnitude of findings, which would inevitably improve our understanding of the nature of the relationship between SMU and psychological well-being.

Importantly, this review has highlighted that research is only in the beginning stages of defining problematic SMU in terms of specific types of use, above and beyond frequency. As discussed, past reviews have suggested that active use is more commonly associated with better psychological well-being, whereas passive use is associated with poorer psychological outcomes in cross-sectional designs (Verduyn et al., 2017), or have implied that the ways in which people use social media likely affects one's psychological health (Seabrook et al., 2016), yet we see that very few studies have actually examined specific types of SMU in relation to specific psychological constructs, such as social anxiety and loneliness. Further, our review highlighted that the relationship between types of SMU and psychological well-being may be more complex and nuanced that the notion that all passive use is "bad" and all active use is "good." As noted previously, Yang (2016)'s study has important implications about the benefits of identifying the specific ways that individuals may be engaging on platforms, above and beyond broad active and passive use categories. Although it appears that passive SMU may exacerbate negative feelings and social comparisons, engaging in certain active social media behaviors, such as broadcasting, may also lead to negative consequences, if individuals do not receive desired reactions in response to their posts. It will be important for future research to underscore how and why people are using social media, to better understand whether or not they will receive the support they seek, and whether their usage, both active and passive, may put them potentially at risk of experiencing negative consequences.

Furthermore, the tendency to engage in negative social comparisons while using social media appears to be an important process that is yet to be fully understood. The limited research to date has shown that engaging in negative social comparisons or feeling envious of others is associated with problematic SMU (Verduyn et al., 2015; Yang et al., 2019) and also appears to moderate the relationship between problematic SMU and social anxiety (Dempsey et al., 2019) as well as loneliness (Yang, 2016). As noted previously, although we see some support for the notion that passive use is associated with social anxiety (Shaw et al., 2015), loneliness (Aalbers et al., 2019), and other negative outcomes (Verduyn et al., 2015, 2017), it is possible that the negative effects of passive use may be driven by the tendency to engage in negative social comparisons or feel envious of others while passively scrolling, rather than just passive use alone. As a result, future studies should continue to explore whether engaging in social comparisons plays a critical role in the relationship between social anxiety, loneliness, and problematic SMU. As discussed, it is possible that forms of both passive and active use, such as passive scrolling or active broadcasting, may elicit feelings of envy, fear of missing out, and negative social comparisons with others, and that these negative feelings and experiences while using social media may be more problematic than whether or not an individual is engaging actively or passively online.

Finally, several of the research studies included in this review were conducted internationally (i.e., Australia, China, Germany, India, Italy, Poland, South Korea, Taiwan, Turkey, United Kingdom); although conclusions did not differ in terms of the nationality of the sample, it may be

important to consider whether there may be cultural differences in the motivations for using social media. As part of this review, we only included studies that examined general SMU across platforms or emphasized the three social media platforms most used by young adults in the United States (i.e., Facebook, Instagram, Snapchat), but future research may want to expand the search criteria to explore different social media platforms used in other countries.

4.5. Conclusions

This review provides us with a better understanding of how more socially anxious and lonely individuals use social media. We see that loneliness is a risk factor for problematic SMU and that socially anxiety and loneliness both have the potential to put people at risk of engaging problematically or experiencing negative consequences as a result of their SMU. However, more research is needed to examine the causal pathways of these relationships. Very few studies to date have examined social anxiety, loneliness, and SMU together, and no experimental or longitudinal studies have examined all three constructs. There are important unanswered questions about how various types of active and passive SMU may exacerbate feelings of social anxiety and loneliness and whether engaging in negative social comparisons or feeling envious of others while using social media can lead to negative outcomes. Continued efforts should be made among researchers to understand the bidirectional relationships among these constructs and identify the best way capture and measure SMU.

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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chbr.2021.100070.

References

Aalbers, G., McNally, R. J., Heeren, A., De Wit, S., & Fried, E. I. (2019). Social media and depression symptoms: A network perspective. *Journal of Experimental Psychology: General, 148*, 1454–1462. https://doi.org/10.1037/xge0000528

Alden, L. E., & Taylor, C. T. (2004). Interpersonal processes in social phobia. *Clinical Psychology Review, 24*, 857–882. https://doi.org/10.1016/j.cpr.2004.07.006

Antony, M. M., Rowa, K., Liss, A., Swallow, S. R., & Swinson, R. P. (2005). Social comparison processes in social phobia. *Behavior Therapy, 36*, 65–75. https://doi.org/10.1016/s0005-7894(05)80055-3

Atroszko, P. A., Balcerowska, J. M., Bereznowski, P., Biernatowska, A., Pallesen, S., & Andreassen, C. S. (2018). Facebook addiction among Polish undergraduate students: Validity of measurement and relationship with personality and well-being. *Computers in Human Behavior, 85*, 329–338. https://doi.org/10.1016/j.chb.2018.04.001

Baker, A. E., & Jeske, D. (2015). Assertiveness and anxiety effects in traditional and online interactions. *International Journal of Cyber Behavior, Psychology and Learning, 5*, 30–46. https://doi.org/10.4018/ijcbpl.2015070103

Baker, L. R., & Oswald, D. L. (2010). Shyness and online social networking services. *Journal of Social and Personal Relationships, 27*, 873–889. https://doi.org/10.1177/0265407510375261

Berryman, C., Ferguson, C. J., & Negy, C. (2018). Social media use and mental health among young adults. *Psychiatric Quarterly, 89*, 307–314. https://doi.org/10.1007/s11126-017-9535-6

Bessiere, K., Kiesler, S., Kraut, R., & Boneva, B. S. (2008). Effects of Internet use and social resources on changes in depression. *Information, Community & Society, 11*, 47–70. https://doi.org/10.1080/13691180701858851

Biolcati, R., Mancini, G., Pupi, V., & Mugheddu, V. (2018). Facebook addiction: Onset predictors. *Journal of Clinical Medicine, 7*, 118. https://doi.org/10.3390/jcm7060118

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*, 210–230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Burke, M., Kraut, R., & Marlow, C. (2011). Social capital on Facebook: Differentiating uses and users. In *Proceedings of the 29th international conference on human factors in computing systems (CHI'11)* (pp. 571–580). https://doi.org/10.1145/1978942.1979023

Burke, T. J., & Ruppel, E. K. (2015). Facebook self-presentational motives: Daily effects on social anxiety and interaction success. *Communication Studies, 66*, 204–217. https://doi.org/10.1080/10510974.2014.884014

Cacioppo, S., Grippo, A. J., London, S., Goossens, L., & Cacioppo, J. T. (2015). Loneliness: Clinical import and interventions. *Perspectives on Psychological Science, 10*, 238–249. https://doi.org/10.1177/1745691615570616

Caplan, S. E. (2002). Problematic Internet use and psychosocial well-being: Development of a theory based cognitive-behavioral measurement instrument. *Computers in Human Behavior, 18*, 553–575. https://doi.org/10.1016/s0747-5632(02)00004-3

Caplan, S. E. (2003). Preference for online social interaction: A theory of problematic internet use and psychosocial well-being. *Communication Research, 30*, 625–648. https://doi.org/10.1177/0093650203257842

Caplan, S. E. (2005). A social skill account of problematic Internet use. *Journal of Communication, 55*, 721–736. https://doi.org/10.1093/joc/55.4.721

Caplan, S. E. (2006). Relations among loneliness, social anxiety, and problematic Internet use. *CyberPsychology and Behavior, 10*, 234–242. https://doi.org/10.1089/cpb.2006.9963

Casale, S., & Fioravanti, G. (2015). Satisfying needs through social networking sites: A pathway towards problematic internet use for socially anxious people? *Addictive Behaviors Reports, 1*, 34–39. https://doi.org/10.1016/j.abrep.2015.03.008

Chatterjee, R. (2018, May 1). *Americans are lonely a lot, and younger people bear the heaviest burden*. National Public Radio. Retrieved from https://www.npr.org/sections/health-shots/2018/05/01/606588504/americans-are-a-lonely-lot-and-young-people-bear-the-heaviest-burden.

Chen, H. (2017). Antecedents of positive self-disclosure online: An empirical study of US college students' Facebook usage. *Psychology Research and Behavior Management, 10*, 147–153. https://doi.org/10.2147/prbm.s136049

Cheng, C., Wang, H. Y., Sigerson, L., & Chau, C. L. (2019). Do the socially rich get richer? A nuanced perspective on social network site use and online social capital accrual. *Psychological Bulletin, 145*, 734–764. https://doi.org/10.1037/bul0000198

Chou, H. T. G., & Edge, N. (2012). "They are happier and having better lives than I am": The impact of using Facebook on perceptions of others' lives. *Cyberpsychology, Behavior, and Social Networking, 15*, 117–121. https://doi.org/10.1089/cyber.2011.0324

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY: Guilford Press.

Clayton, R. B., Osborne, R. E., Miller, B. K., & Oberle, C. D. (2013). Loneliness, anxiousness, and substance use as predictors of Facebook use. *Computers in Human Behavior, 29*, 687–693. https://doi.org/10.1016/j.chb.2012.12.002

Coyne, S. M., Rogers, A. A., Zurcher, J. D., Stockdale, L., & Booth, M. (2020). Does time spent using social media impact mental health? An eight year longitudinal study. *Computers in Human Behavior, 104*, 106160.

Davidson, T., & Farquhar, L. K. (2014). Correlates of social anxiety, religion, and Facebook. *Journal of Media and Religion, 13*, 208–225. https://doi.org/10.1080/15348423.2014.971566

Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior, 17*, 187–195. https://doi.org/10.1016/s0747-5632(00)00041-8

Davis, R. A., Flett, G. L., & Besser, A. (2002). Validation of a new scale for measuring problematic Internet use: Implications for pre-employment screening. *CyberPsychology and Behavior, 5*, 331–345. https://doi.org/10.1089/109493102760275581

Dempsey, A. E., O'Brien, K. D., Tiamiyu, M. F., & Elhai, J. D. (2019). Fear of missing out (FoMO) and rumination mediate relations between social anxiety and problematic Facebook use. *Addictive Behaviors Reports, 9*, 100150. https://doi.org/10.1016/j.abrep.2018.100150

Deters, F. G., & Mehl, M. R. (2013). Does posting Facebook status updates increase or decrease loneliness? An online social networking experiment. *Social Psychological and Personality Science, 4*, 579–586. https://doi.org/10.1177/1948550612469233

Deters, F. G., Mehl, M. R., & Eid, M. (2016). Social responses to Facebook status updates: The role of extraversion and social anxiety. *Computers in Human Behavior, 61*, 1–13. https://doi.org/10.1016/j.chb.2016.02.093

Donnelly, E., & Kuss, D. J. (2016). Depression among users of social networking sites (SNSs): The role of SNS addiction and increased usage. *Journal of Addiction and Preventative Medicine, 1*, 1–6. https://doi.org/10.19104/japm.2016.107

Ellison, N. B., & Boyd, D. (2013). Sociality through social network sites. In W. H. Dutton (Ed.), *The Oxford handbook of internet studies* (pp. 151–172). Oxford: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199589074.013.0008.

Ellison, N., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends:" Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication, 12*, 1143–1168. https://doi.org/10.1111/j.1083-6101.2007.00367

Ellison, N., Steinfield, C., & Lampe, C. (2011). *Connection strategies: Social capital implications of facebook-enabled communication practices* (Vol. 13, pp. 1–20). New Media & Society. https://doi.org/10.1177/1461444810385389

Erwin, B. A., Turk, C. L., Heimberg, R. G., Fresco, D. M., & Hantula, D. A. (2004). The Internet: Home to a severe population of individuals with social anxiety disorder? *Journal of Anxiety Disorders, 18*, 629–646. https://doi.org/10.1016/j.janxdis.2003.08.002

Feinstein, B. A., Bhatia, V., Hershenberg, R., & Davila, J. (2012). Another venue for problematic interpersonal behavior: The effects of depressive and anxious symptoms on social networking experiences. *Journal of Social and Clinical Psychology, 31*, 356–382. https://doi.org/10.1521/jscp.2012.31.4.356

Fernandez, K. C., Levinson, C. A., & Rodebaugh, T. L. (2012). Profiling: Predicting social anxiety from Facebook profiles. *Social Psychological and Personality Science, 3*, 706–713. https://doi.org/10.1177/1948550611434967

Fung, K., Paterson, D., & Alden, L. E. (2017). Are social anxiety and loneliness best conceptualized as a unitary trait? *Journal of Social and Clinical Psychology, 36*, 335–345. https://doi.org/10.1521/jscp.2017.36.4.335

Green, T., Wilhelmsen, T., Wilmots, E., Dodd, B., & Quinn, S. (2016). Social anxiety, attributes of online communication and self-disclosure across private and public Facebook communication. *Computers in Human Behavior, 58*, 206–213. https://doi.org/10.1016/j.chb.2015.12.066

Hall, J. A., Xing, C., Ross, E. M., & Johnson, R. M. (2019). Experimentally manipulating social media abstinence: Results of a four-week diary study. *Media Psychology*. https://doi.org/10.1080/15213269.2019.1688171

Hawkley, L. C., Burleson, M. H., Berntson, G. G., & Cacioppo, J. T. (2003). Loneliness in everyday life: Cardiovascular activity, psychosocial context, and health behaviors. *Journal of Personality and Social Psychology, 85*, 105–120. https://doi.org/10.1037/00223514.85.1.105

Heffner, T., Good, M., Daly, O., MacDonell, E., & Willoughby, T. (2019). The longitudinal association between social-media use and depressive symptoms among adolescents and young adults: An empirical reply to Twenge et al. *Clinical Psychological Science, 7*, 462–470. https://doi.org/10.1177/2167702618812727, 2018.

Hofmann, S. G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive Behaviour Therapy, 36*, 193–209. https://doi.org/10.1080/16506070701421313

Hong, J. C., Hwang, M. Y., Hsu, C. H., Tai, K. H., & Kuo, Y. C. (2015). Belief in dangerous virtual communities as a predictor of continuance intention mediated by general and online social anxiety: The Facebook perspective. *Computers in Human Behavior, 48*, 663–670. https://doi.org/10.1016/j.chb.2015.02.019

Honnekeri, B. S., Goel, A., Umate, M., Shah, N., & De Sousa, A. (2017). Social anxiety and Internet socialization in Indian undergraduate students: An exploratory study. *Asian Journal of Psychiatry, 27*, 115–120. https://doi.org/10.1016/j.ajp.2017.02.021

Hunt, M. G., Marx, R., Lipson, C., & Young, J. (2018). No more FOMO: Limiting social media decreases loneliness and depression. *Journal of Social and Clinical Psychology, 37*, 751–768. https://doi.org/10.1521/jscp.2018.37.10.751

Indian, M., & Grieve, R. (2014). When Facebook is easier than face-to-face: Social support derived from Facebook in socially anxious individuals. *Personality and Individual Differences, 59*, 102–106. https://doi.org/10.1016/j.paid.2013.11.016

Käll, A., Shafran, R., Lindegaard, T., Bennett, S., Cooper, Z., Coughtrey, A., et al. (2020). A common elements approach to the development of a modular cognitive behavioral theory for chronic loneliness. *Journal of Consulting and Clinical Psychology, 88*, 269–282. https://doi:10.1037/ccp0000454.

Kalpidou, M., Costin, D., & Morris, J. (2011). The relationship between Facebook and the well-being of undergraduate college students. *Cyberpsychology, Behavior, and Social Networking, 14*, 183–189. https://doi.org/10.1089/cyber.2010.006

Kircaburun, K., Griffiths, M. D., Şahin, F., Bahtiyar, M., Atmaca, T., & Tosuntaş, Ş. B. (2018). The mediating role of self/everyday creativity and depression on the relationship between creative personality traits and problematic social media use among emerging adults. *International Journal of Mental Health and Addiction*, 1–12. https://doi.org/10.1007/s11469-018-9938-0

Koyuncu, A., İnce, E., Ertekin, E., & Tükel, R. (2019). Comorbidity in social anxiety disorder: Diagnostic and therapeutic challenges. *Drugs in Context, 8*, 212573. https://doi.org/10.7573/dic.212573

Kross, E., Verduyn, P., Demiralp, E., Park, J., Lee, D. S., Lin, N., et al. (2013). Facebook use predicts declines in subjective well-being in young adults. *PloS One, 8*, Article e69841. https://doi.org/10.1371/journal.pone.0069841

Lee-Won, R. J., Herzog, L., & Park, S. G. (2015). Hooked on Facebook: The role of social anxiety and need for social assurance in problematic use of Facebook. *Cyberpsychology, Behavior, and Social Networking, 18*, 567–574. https://doi.org/10.1089/cyber.2015.0002

Lemieux, R., Lajoie, S., & Trainor, N. E. (2013). Affinity-seeking, social loneliness, and social avoidance among Facebook users. *Psychological Reports, 112*, 545–552. https://doi.org/10.2466/07.pr0.112.2.545-552

Lima, M. L., Marques, S., Muiños, G., & Camilo, C. (2017). All you need is Facebook friends? Associations between online and face-to-face friendships and health. *Frontiers in Psychology, 8*, 68. https://doi.org/10.3389/fpsyg.2017.00068

Lim, M. H., Rodebaugh, T. L., Zyphur, M. J., & Gleeson, J. F. (2016). Loneliness over time: The crucial role of social anxiety. *Journal of Abnormal Psychology, 125*, 620–630. https://doi.org/10.1037/abn0000162

Lo, J. (2019). Exploring the buffer effect of receiving social support on lonely and emotionally unstable social networking users. *Computers in Human Behavior, 90*, 103–116. https://doi.org/10.1016/j.chb.2018.08.052

Lou, L. L., Yan, Z., Nickerson, A., & McMorris, R. (2012). An examination of the reciprocal relationship of loneliness and Facebook use among first-year college students. *Journal of Educational Computing Research, 46*, 105–117. https://doi.org/10.2190/ec.46.1.e

Lup, K., Trub, L., & Rosenthal, L. (2015). Instagram #instasad? Exploring associations among Instagram use, depressive symptoms, negative social comparison, and strangers followed. *Cyberpsychology, Behavior, and Social Networking, 18*, 247–252. https://doi.org/10.1089/cyber.2014.0560

Mackson, S. B., Brochu, P. M., & Schneider, B. A. (2019). *Instagram: Friend or foe? The application's association with psychological well-being. 21* pp. 2160–2182). New Media & Society. https://doi.org/10.1177/1461444819840021

Masi, C. M., Chen, H., Hawkley, L. C., & Cacioppo, J. T. (2011). A meta-analysis of interventions to reduce loneliness. *Personality and Social Psychology Review, 15*, 219–266. https://doi.org/10.1177/1088868310377394

Peplau, L. A., & Perlman, D. (1982). Perspectives on loneliness. In L. A. Peplau, & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research and therapy* (pp. 1–20). New York: Wiley.

Petrocchi, N., Asnaani, A., Martinez, A. P., Nadkarni, A., & Hofmann, S. G. (2015). Differences between people who use only Facebook and those who use Facebook plus Twitter. *International Journal of Human-Computer Interaction, 31*, 157–165. https://doi.org/10.1080/10447318.2014.986640

Phu, B., & Gow, A. J. (2019). Facebook use and its association with subjective happiness and loneliness. *Computers in Human Behavior, 92*, 151–159. https://doi.org/10.1016/j.chb.2018.11.020

Pittman, M., & Reich, B. (2016). Social media and loneliness: Why an Instagram picture may be worth more than a thousand Twitter words. *Computers in Human Behavior, 62*, 155–167. https://doi.org/10.1016/j.chb.2016.03.084

Rajesh, T., & Rangaiah, B. (2020). Facebook addiction and personality. *Heliyon, 6*, Article e03184. https://doi.org/10.1016/j.heliyon.2020.e03184

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35*, 741–756. https://doi.org/10.1016/S0005-7967(97)00022-3

Rauch, S. M., Strobel, C., Bella, M., Odachowski, Z., & Bloom, C. (2014). Face to face versus Facebook: Does exposure to social networking web sites augment or attenuate physiological arousal among the socially anxious? *Cyberpsychology, Behavior, and Social Networking, 17*, 187–190. https://doi.org/10.1089/cyber.2012.0498

Reissmann, A., Hauser, J., Stollberg, E., Kaunzinger, I., & Lange, K. W. (2018). The role of loneliness in emerging adults' everyday use of Facebook: An experience sampling approach. *Computers in Human Behavior, 88*, 47–60. https://doi.org/10.1016/j.chb.2018.06.011

Rosen, L. D., Whaling, K., Rab, S., Carrier, L. M., & Cheever, N. A. (2013). Is Facebook creating "iDisorders"? The link between clinical symptoms of psychiatric disorders and technology use, attitudes and anxiety. *Computers in Human Behavior, 29*, 1243–1254. https://doi.org/10.1016/j.chb.2012.11.012

Satici, S. A. (2019). Facebook addiction and subjective well-being: A study of the mediating role of shyness and loneliness. *International Journal of Mental Health and Addiction, 17*, 41–55. https://doi.org/10.1007/s11469-017-9862-8

Seabrook, E. M., Kern, M. L., & Rickard, N. S. (2016). Social networking sites, depression, and anxiety: A systematic review. *JMIR Mental Health, 3*, e50. https://doi.org/10.2196/mental.5842

Seo, M., Kim, J., & Yang, H. (2016). Frequent interaction and fast feedback predict perceived social support: Using crawled and self-reported data of Facebook users. *Journal of Computer-Mediated Communication, 21*, 282–297. https://doi.org/10.1111/jcc4.12160

Shaw, A. M., Timpano, K. R., Tran, T. B., & Joormann, J. (2015). Correlates of Facebook usage patterns: The relationship between passive Facebook use, social anxiety symptoms, and brooding. *Computers in Human Behavior, 48*, 575–580. https://doi.org/10.1016/j.chb.2015.02.003

Sheldon, P. (2012). Profiling the non-users: Examination of life-position indicators, sensation seeking, shyness, and loneliness among users and non-users of social network sites. *Computers in Human Behavior, 28*, 1960–1965. https://doi.org/10.1016/j.chb.2012.05.016

Sheldon, P. (2013). Voices that cannot be heard: Can shyness explain how we communicate on Facebook versus face-to-face? *Computers in Human Behavior, 29*, 1402–1407. https://doi.org/10.1016/j.chb.2013.01.016

Shensa, A., Escobar-Viera, C. G., Sidani, J. E., Bowman, N. D., Marshal, M. P., & Primack, B. A. (2017). Problematic social media use and depressive symptoms among U.S. Young adults: A nationally-representative study. *Social Science & Medicine, 182*, 150–157. https://doi.org/10.1016/j.socscimed.2017.03.061

Shepherd, R. M., & Edelmann, R. J. (2005). Reasons for internet use and social anxiety. *Personality and Individual Differences, 39*, 949–958. https://doi.org/10.1016/j.paid.2005.04.001

Shettar, M., Karkal, R., Kakunje, A., Mendonsa, R. D., & Chandran, V. M. (2017). Facebook addiction and loneliness in the post-graduate students of a university in southern India. *International Journal of Social Psychiatry, 63*, 325–329. https://doi.org/10.1177/0020764017705895

Skues, J. L., Williams, B., & Wise, L. (2012). The effects of personality traits, self-esteem, loneliness, and narcissism on Facebook use among university students. *Computers in Human Behavior, 28*, 2414–2419. https://doi.org/10.1016/j.chb.2012.07.012

Skues, J., Williams, B. J., & Wise, L. (2017). Personality traits, boredom, and loneliness as predictors of Facebook use in on-campus and online university students. *International Journal of Cyber Behavior, Psychology and Learning, 7*, 36–48. https://doi.org/10.4018/ijcbpl.2017040104

Smith, A. (2011). Why Americans use social media friends. http://www.pewinternet.org/2011/11/15/why-americans-use-social-media/. (Accessed 12 October 2016).

Smith, A. (2015). U.S. Smartphone use in 2015. Pew research center. http://www.pewinternet.org/files/2015/03/PI_Smartphones_0401151.pdf.

Smith, A., & Anderson, M. (2018). Social media use in 2018. Pew research center. http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/.

Sohn, Y., Woo, S., Jo, D., & Yang, E. (2019). The role of the quality of college-based relationship on social media in college-to-work transition of Korean college students: The longitudinal examination of intimacy on social media, social capital, and loneliness. *Japanese Psychological Research, 61*, 236–248. https://doi.org/10.1111/jpr.12234

Song, H., Zmyslinski-Seelig, A., Kim, J., Drent, A., Victor, A., Omori, K., et al. (2014). Does Facebook make you lonely? A meta-analysis. *Computers in Human Behavior, 36*, 446–452. https://doi.org/10.1016/j.chb.2014.04.011

Steers, M. L. N., Wickham, R. E., & Acitelli, L. K. (2014). Seeing everyone else's highlight reels: How Facebook usage is linked to depressive symptoms. *Journal of Social and Clinical Psychology, 33*, 701–731. https://doi.org/10.1521/jscp.2014.33.8.701

Tandoc, E. C., Jr., Ferrucci, P., & Duffy, M. (2015). Facebook use, envy, and depression among college students: Is Facebooking depressing? *Computers in Human Behavior, 43*, 139–146. https://doi.org/10.1016/j.chb.2014.10.053

Teo, A. R., Lerrigo, R., & Rogers, M. A. (2013). The role of social isolation in social anxiety disorder: A systematic review and meta-analysis. *Journal of Anxiety Disorders, 27*, 353–364. https://doi.org/10.1016/j.janxdis.2013.03.010

Tice, D. M. (1993). The social motivations of people with low self-esteem. In R. F. Baumeister (Ed.), *Self-esteem: The puzzle of low self-regard* (pp. 37–54). New York: Plenum Press. https://doi.org/10.1007/978-1-4684-8956-9_3.

Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2018). Increases in depressive symptoms, suicide-related outcomes, and suicide rates among US adolescents after 2010 and links to increased new media screen time. *Clinical Psychological Science, 6*, 3–17. https://doi.org/10.1177/2167702617723376

Valkenburg, P. M., & Peter, J. (2009). Social consequences of the internet for adolescents: A decade of research. *Current Directions in Psychological Science, 18*, 1–5. https://doi.org/10.1111/j.1467-8721.2009.01595.x

Vally, Z., & D'Souza, C. G. (2019). Abstinence from social media use, subjective well-being, stress, and loneliness. *Perspectives in Psychiatric Care, 55*, 752–759. https://doi.org/10.1111/ppc.12431

Verduyn, P., Lee, D. S., Park, J., Shablack, H., Orvell, A., Bayer, J., et al. (2015). Passive Facebook usage undermines affective well-being: Experimental and longitudinal evidence. *Journal of Experimental Psychology: General, 144*, 480–488. https://doi.org/10.1037/xge0000057

Verduyn, P., Ybarra, O., Résibois, M., Jonides, J., & Kross, E. (2017). Do social network sites enhance or undermine subjective well-being? A critical review. *Social Issues and Policy Review, 11*, 274–302. https://doi.org/10.1111/sipr.12033

Weidman, A. C., Fernandez, K. C., Levinson, C. A., Augustine, A. A., Larsen, R. J., & Rodebaugh, T. L. (2012). Compensatory internet use among individuals higher in social anxiety and its implications for well-being. *Personality and Individual Differences, 53*, 191–195. https://doi.org/10.1016/j.paid.2012.03.003

Weidman, A. C., & Levinson, C. A. (2015). I'm still socially anxious online: Offline relationship impairment characterizing social anxiety manifests and is accurately

perceived in online social networking profiles. *Computers in Human Behavior, 49*, 12–19. https://doi.org/10.1016/j.chb.2014.12.045

Wohn, D. Y., & LaRose, R. (2014). Effects of loneliness and differential usage of Facebook on college adjustment of first-year students. *Computers & Education, 76*, 158–167. https://doi.org/10.1016/j.compedu.2014.03.01

Wright, K. B., Rosenberg, J., Egbert, N., Ploeger, N. A., Bernard, D. R., & King, S. (2012). Communication competence, social support, and depression among college students: A model of Facebook and face-to-face support network influence. *Journal of Health Communication, 18*, 41–57. https://doi.org/10.1080/10810730.2012.688250

Yang, C. C. (2016). Instagram use, loneliness, and social comparison orientation: Interact and browse on social media, but don't compare. *Cyberpsychology, Behavior, and Social Networking, 19*, 703–708. https://doi.org/10.1089/cyber.2016.0201

Yang, C. C., Carter, M. D., Webb, J. J., & Holden, S. M. (2019). Developmentally salient psychosocial characteristics, rumination, and compulsive social media use during the transition to college. *Addiction Research and Theory, 38*, 433–442. https://doi.org/10.1080/16066359.2019.1682137

Yildiz Durak, H., & Seferoğlu, S. S. (2019). Modeling of variables related to problematic social media usage: Social desirability tendency example. *Scandinavian Journal of Psychology, 60*, 277–288. https://doi.org/10.1111/sjop.12530

Young, K. S. (1999). Internet addiction: Symptoms, evaluation and treatment. In L. Vande Creek, & T. L. Jackson (Eds.), *Innovations in clinical practice: A source book* (Vol. 17, pp. 351–352). Sarasota, FL: Professional Resource Press.

Zhang, X. X., Rost, D. H., Wang, J. L., & Reynolds, K. J. (2020). Active and passive social networking sites usage and negative emotions: A reciprocal relationship? *Journal of Social and Clinical Psychology, 39*, 195–213. https://doi.org/10.1521/jscp.2020.39.3.195

Valenzuela, S., Park, N., & Kee, K. F. (2009). Is there social capital in a social network site?: Facebook use and college students' life satisfaction, trust, and participation. *Journal of Computer-Mediated Communication, 14*, 875–901. https://doi.org/10.1111/j.1083-6101.2009.01474.x