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Is Social Media Use Related to Social Anxiety? A Meta-Analysis

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ABSTRACT

During face-to-face interactions, social anxiety involves an intense fear which precipitates impaired communication and avoidance. Social media provides an alternate, potentially less anxiety-provoking communication venue. The relationship between social anxiety and social media is unclear. Prior reviews focused on the relationship between one of these terms (i.e. social anxiety or social media use) and a broader category (i.e. psychological well-being, computer-mediated communication). These earlier reviews found inconclusive results perhaps due to the paucity of studies available that *examined the specific relationship between social anxiety and social media use.* Given an uptick in research on this specific relationship in the past five years, the current study synthesized and analyzed 27 independent study samples that met inclusion criteria (Total $N = 38,163$). Using a random-effects model, we found a significant positive relationship between social media use and social anxiety ($r = .14$). Moderation analyses indicated smaller positive effect sizes for studies with adolescent-only samples, White-majority samples, North American samples, and less reliable measures of social media use. Since social media may provide affordances and risks that depend on each mental health challenge, we need more social media usage studies and reviews with results specified by challenge.

Most people experience anxiety in various social situations from time to time (Buss, 1980; Zimbardo, 1977), especially those in which people are or might become the focus of others' attention, such as during a conversation or a speech (Schlenker & Leary, 1982). Social anxiety appears to arise from people's concerns about others' judgments of them and, when sufficiently elevated, can adversely affect individuals' communication patterns (Schlenker & Leary, 1985). Although the occasional occurrence of social anxiety is common across children and adults, it becomes pathological for 12% of adults, typically before 20 years of age (Social Anxiety Disorder, 2017, November). At that point, it can chronically affect the quality and quantity of their social interactions and relationships and is a major risk factor for subsequent depressive illness and substance abuse (Stein & Stein, 2008).

The influence of social anxiety on one's communication patterns and social relationships has been extensively investigated. Prior studies have suggested that socially anxious individuals tend to have fewer social connections (Falk Dahl & Dahl, 2010) and have a preference for online communication over face-to-face communication (Akhter et al., 2022). Therefore, socially anxious individuals' social media use may be more frequent, intense, passive, and addictive, but they do not necessarily receive the support they seek (O'Day & Heimberg, 2021). Unfortunately, the relationship between social media use and social anxiety varies both in its direction and its magnitude. Some researchers reported positive correlations, that is, greater social media use is related to higher levels of social anxiety (e.g., Hawes et al., 2020; Vancu & Egerău, 2022), but others documented negative correlations (e.g., Lake Yimer, 2021; Wang et al., 2011), or null results (e.g., Charmaraman et al., 2022; Resnik & Bellmore, 2021). To address the extent and potential meaning of this variability, the current study employed a meta-analytic approach to determine the overall relationship between social media use and social anxiety and relevant moderators that may disentangle previous inconsistencies.

Social compensation model

McKenna and Bargh (1999), in their conceptual framework, proposed that social anxiety is one of the motivators for social interaction on the Internet. The authors argued that it is human nature to build connections and fulfill the need to belong, but socially anxious individuals usually find it hard to satisfy these goals. Therefore, they are more likely to turn to the Internet for close relationships. Later on, Kraut et al. (2002) further developed this idea into the social compensation model. As an alternative to the "rich get richer" model, the social compensation model predicts that those who are introverted or lack social support would profit most from using the

Internet. Reviewing empirical studies with respect to social media use and social anxiety, O'Day and Heimberg (2021) demonstrated that online communication can compensate for insufficient social interaction and connection in offline environments. Hence, socially anxious individuals will use the Internet more due to the difficulty of developing friendships in their real-life environment (Valkenburg et al., 2005; Zywica & Danowski, 2008).

A considerable literature supported the logic chain behind the social compensation model. Face-to-face communication may afford a particularly threatening environment for individuals prone to social anxiety (Pierce, 2009). The fear of being judged negatively, with the potential for humiliation and embarrassment, has historically been most marked in this type of social interaction. One has to respond appropriately to others quickly in social interaction: it's too easy not to find the right thing to say, to say the wrong thing, or to "freeze," making one's social deficits apparent to all. One possible reason is that those with social anxiety may process nonverbal cues differently from others, leading to pressure when a quick response is required. In line with that possibility, social anxiety was significantly related to response times to identify facial expressions, though the relationships varied under different conditions (Mullins & Duke, 2004).

Computer-mediated communication (CMC) provides socially anxious individuals with more possibilities to reduce their discomfort compared to face-to-face interactions. CMC refers to multimodal human-to-human social interaction mediated by information and communication technologies (Meier & Reinecke, 2021). One advantage of CMC is the flexible response time, where individuals are given the freedom to decide whether to respond to a message and how long it takes them to craft a reply. In a study about Facebook use among college students, Campisi et al. (2012) found that nearly half of the participants reported delaying responses to friend requests due to anxiety. Additionally, other scholars have stated that individuals prefer CMC to face-to-face communication because they perceive a decreased risk of negative evaluation (Caplan, 2007; Lee & Stapinski, 2012). In addition, the increased anonymity and deindividuation (McKenna & Bargh, 2000) allow more control of personal information and less opportunity for scrutiny, rendering more comfortable experiences in CMC versus face-to-face interactions (Shalom et al., 2015). On the other hand, socially anxious individuals might benefit from the reduced cues because they do not expend resources attempting to mask nonverbal signs of anxiety, thus they could expend more resources on strategic message development, thereby increasing the likelihood of positive self-presentation (High & Caplan, 2009). After all, aspects of social situations that socially anxious individuals fear (e.g., blushing, stammering, others' reactions to perceived physical or social shortcomings) could be avoided when they go online (Erwin et al., 2004).

Social media use

CMC is an inclusive umbrella term. CMC studies investigate communication processes that are mediated by various information and communication technologies such as the Internet, computer, smartphone, and social media. Each type of CMC provides a mediated channel for interactions that may attract socially anxious individuals. The current study narrows the scope to social media, per se, because this is a space where social functions are intentionally built and promoted, and social interactions are systematically encouraged. Unlike other CMC activities, when using social media individuals would have more common and consistent expectations regarding social interaction. Hence, since we are primarily interested in interpersonal CMC, social media is the most appropriate focus for the present meta-analytic review.

Social media is a form of online communication characterized by its persistence and ability to connect users in ways that enable them to interact with one another. Through social media, individuals can engage with others on a mass scale, allowing for the creation and maintenance of social networks that span geographic, cultural, and ideological boundaries. Social media allow users to interact opportunistically and present themselves selectively, either in real-time or asynchronously, with broad and narrow audiences (Carr & Hayes, 2015). The very similar term social network sites (SNSs) was defined as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (Boyd & Ellison, 2007). Considering the commonalities they share, when we use "social media" here, we are including research using SNSs.

According to Statista (2022, June 15), the number of social media users worldwide has increased in recent years, reaching 4.59 billion in 2022. The report showed that internet users spend 144 minutes per day on social media and messaging apps on average. As the prevalence of social media increases, the influence of social media on mental health merits increasing attention.

The current body of research often uses three types of measurements to assess social media use: frequency, time, and intensity. In most cases, the frequency and time were measured by asking participants to give their best estimates on how many times they access or how much time they spend on social media daily or weekly on average. The intensity was usually measured using a scale to estimate the integration of social media use in daily life (e.g., Facebook Intensity Scale by Ellison et al. (2007)).

Social media use and social anxiety

Previous literature has not determined a consistent relationship between social media use and social anxiety. Some studies demonstrated a significant positive relationship, and the magnitude of the reported effects ranged from small to moderate, indicating more social media use is associated with a higher level of social anxiety symptoms, no matter whether social media use is subjectively (Hawes et al., 2020; She et al., 2023; Thorisdottir et al., 2020) or objectively (Vancu & Egerău, 2022) measured. Besides an approach in a given study of generally analyzing social media (e.g., over multiple platforms), some researchers instead specifically tested social anxiety involving just a single social media platform. A higher level of social anxiety symptoms was evidenced to be associated with more Facebook use (Akhter et al., 2022; Hoffman et al., 2021; Jarrar et al., 2022; Shaw et al., 2015) and more Instagram use (Toh et al., 2022). On the contrary, however, some studies suggested a significant negative relationship between social anxiety and Facebook use (Lake Yimer, 2021) and online communication (Wang et al., 2011).

Meanwhile, many studies have found insignificant effects. For example, social anxiety was positively, but not significantly, related to the use of social media (Resnik & Bellmore, 2021; Yıldız Durak, 2020), Facebook (Davidson & Farquhar, 2014; Hu et al., 2017; McCord et al., 2014; Weiss, 2013), Instagram (Kaloeti et al., 2021), YouTube (Fardouly et al., 2020), WhatsApp (Lake Yimer, 2021), and Renren (a Facebook Chinese equivalent) (Zheng & Leung, 2016). In contrast, negative effects, albeit nonsignificant, have been found for the relationship between social anxiety and social media use (Berryman et al., 2018; Charmaraman et al., 2022; Kaloeti et al., 2021), Facebook (Burke & Ruppel, 2015; Creasy, 2012), Instagram (Fardouly et al., 2020), YouTube (Kaloeti et al., 2021), Snapchat (Fardouly et al., 2020), and Telegram (Lake Yimer, 2021).

Prior reviews miss the mark and are inconclusive

The inconsistent results, both in terms of the significance and directionality of effects, call for a systematic synthesis tackling the potential correlational effect between social media use and social anxiety. However, previous systematic reviews and meta-analyses broadly focused on either the relationship between social media and psychological well-being or social anxiety and CMC.

Social media and mental health reviews
Prior systematic reviews concluded that social media could be both detrimental and beneficial to mental health (Karim et al., 2020;

Naslund et al., 2020; Sadagheyani & Tatari, 2021; Seabrook et al., 2016). The use of social media can be associated with mental problems such as loneliness, anxiety, depression, and poor sleep, and limiting individuals' social media usage resulted in a direct and positive effect on subjective well-being over time (Sadagheyani & Tatari, 2021). On the other hand, social media can help users get health information and resources (Sadagheyani & Tatari, 2021), social support (Naslund et al., 2020), facilitate relationships (Naslund et al., 2020; Sadagheyani & Tatari, 2021), and promote engagement and retention in mental health services (Naslund et al., 2020).

In one prior meta-analysis, a small negative effect was found between time spent on social media and overall psychological well-being, where psychological well-being was assessed by combining studies investigating self-esteem, life satisfaction, loneliness, and depression (Huang, 2017). This meta-analysis found that more social media use is associated with both lower positive outcomes (i.e., self-esteem and life satisfaction) and lower negative outcomes (i.e., depression and loneliness). In short, the overall pattern is not clarified through this meta-analysis and across these reviews, leaving a confusing picture.

Social anxiety and CMC reviews

Reviews focused on social anxiety and CMC suggested inconclusive relationships as well. In a review by Frost and Rickwood (2017), Facebook use was found to be both positively and negatively associated with social anxiety. Dobrean and Păsărelu's (2016) review suggested no association between Facebook use and social anxiety. As for online communication, total time spent online or using e-mail or instant messaging was not correlated with social anxiety, but time spent on gaming was positively correlated with social anxiety (Prizant-Passal et al., 2016).

The current study

As the social compensation model proposed, socially anxious individuals should use social media more often to compensate for their lack of social interaction. Prior work has produced mixed findings (e.g., some consistent with and some inconsistent with this hypothesis). Quantitative synthesis examining the link between social media use and social anxiety would tell us what the average effect size is and the variability of these effects across studies. However, since there were previously few studies examining this relationship directly, a meta-analysis was not feasible. With the growing number of relevant publications, the current study aims to conduct a meta-analysis examining the relationship between social media use and social anxiety to provide a better understanding of the following question.

RQ1: What is the overall effect estimate for the relationship between social media use and social anxiety?

Given the conflicting pattern of findings often found in this literature, it is particularly important to identify potential moderators that might clarify these findings. Previous literature indicated a gender difference in terms of social media use (Twenge & Martin, 2020) and severity of social anxiety (Asher & Aderka, 2018; Caballo et al., 2008). Similarly, social media use was found to be not uniformly distributed across age groups (Chou et al., 2009). Furthermore, age moderated the relationship between social media use and mental well-being (Hardy & Castonguay, 2018). Race/ethnicity was another factor documented to account for the unbalanced distribution of the prevalence of social anxiety (Hofmann et al., 2010; Lesure-Lester & King, 2004) and social media use (Chou et al., 2009). Cross-country studies suggested that national culture had a moderating effect on the association between social media use and the prevalence of anxiety (Griffith et al., 2023), and different levels of prevalence of intense social media use across countries help explain the varied well-being outcomes (Boer et al., 2020). Besides, we applied an inductive meta-analytical approach (Matthes et al., 2019; Yang et al., 2014), and all available variations were perceived as potential moderators that might explain observed variability. Therefore, the following research question was proposed.

RQ2: Do the following variables moderate the relationship between social media use and social anxiety?

(1) Article characteristics: year of publication and publication type (journal article versus dissertation).
(2) Study characteristics: region of study, study design (cross-sectional versus longitudinal), and data collection before versus after the pandemic.
(3) Sample characteristics: sample size, average sample age, female percentage, student versus non-student, adolescent versus non-adolescent, and majority race/ethnicity of the sample.
(4) Measurement characteristics: multiple versus single social media platform(s), social media use measurement type (frequency, time, and intensity), reliability of social media use measure, and the social anxiety scale used.

Methods

Eligibility criteria

The first step in selecting studies to review for this meta-analysis was to clearly specify the criteria to be used and register those decisions. The study was pre-registered with PROSPERO (record ID: CRD42020153595). Publications were retained according to the following inclusion criteria: 1) being written in English, 2) including empirical studies that utilize a quantitative approach, 3) measuring both social media use and social anxiety, and 4) sufficient information to provide the statistical relationship between social media use and social anxiety. What constitutes "social media" varies across scholarly work (Aichner et al., 2021). For this review, if a study involved one or more social media platforms (e.g., Facebook, Twitter, Instagram, TikTok) or if an author specified that the study involved social media but didn't specify a platform (e.g., video games; instant messages), we included the study. To measure social media use, we accepted indicators that measure the magnitude of social media use (e.g., frequency, time, or intensity). In regard to social anxiety, we accepted measures that tapped into a range of related concepts, including social interaction anxiety, social phobia, and communication anxiety. We carefully examined the way these concepts were defined in the research and made sure measures were in line with this definition of social anxiety: *an intense and persistent fear of being watched and judged by others that adversely affects everyday life* (Stein & Stein, 2008). We excluded measures such as depression, anxiety, generalized anxiety, appearance anxiety, academic anxiety, and information anxiety because they are distinct concepts, although some of these states can be comorbid with social anxiety. According to DSM-5 (American Psychiatric Association & American Psychiatric Association DSM-5 Task Force, 2013), depression involves the presence of a sad, empty, or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function (p. 155). Anxiety involves excessive fear and anxiety and related behavioral disturbances and differs from one another in the types of objects or situations that induce fear, anxiety, or avoidance behavior (p. 189). Social anxiety, generalized anxiety, appearance anxiety, academic anxiety, and information anxiety all belong to the anxiety category but are different from each other. Generalized anxiety focuses more on the nature of ongoing relationships rather than on the fear of negative evaluation (p. 206). Appearance anxiety refers to anxiety about being negatively evaluated by others because of one's overall appearance, including body shape. Academic anxiety refers to anxiety related to academic tasks. Information anxiety refers to a condition of stress caused by the inability

to access, understand, or make use of necessary information (Bawden & Robinson, 2009).

Identification and selection of studies

Several approaches have been used to identify studies. First, we performed a comprehensive literature search in bibliographical databases: PubMed, MEDLINE(Ovid), IEEE Xplore, PsycINFO, Scopus, and ProQuest Dissertations & Theses Global for the following keywords on March 5, 2023: (social media OR social network site OR social networking site OR SNS OR Youtube OR Facebook OR Twitter OR Instagram OR Snapchat OR Reddit OR Tumblr OR LinkedIn OR WhatsApp OR Pinterest OR TikTok OR Discord OR Nextdoor OR WeChat OR QQ OR Line OR Kakao Talk) AND (social anxiety OR social phobia). Search terms were allowed to appear in the title, abstract, and keywords. We did not apply a time range filter, so studies published by the time of the search were all included. The literature search generated 5,474 records altogether. Duplicates were removed automatically by comparing the titles following an exact match rule, and 4,838 records remained.

With the inclusion criteria listed, we performed the first round of screening based on the titles and abstracts. Of the 4,838 identified records, 4,747 were excluded for various reasons: 1) they are duplicates by manually comparing titles, authors, publication years, and journals when applicable (records with the same title but slightly differed in terms of space, comma, a hyphen, etc. were identified, $k = 299$), 2) they are written in languages other than English[1] ($k = 177$), 3) they are review studies ($k = 414$), 4) they do not include a quantitative study ($k = 534$), 5) they do not analyze empirical data ($k = 12$), 6) they do not measure social media use ($k = 578$), 7) they do not measure social anxiety ($k = 228$), and 8) they do not measure both social media use and social anxiety ($k = 2505$).

We retrieved 91 full texts for the second-round eligibility assessment, and 65 were excluded. The reasons are 1) they do not include one or both the measures of interest ($k = 52$), 2) they do not provide sufficient information to extract effect size[2] ($k = 12$), and 3) one publication is a conference abstract ($k = 1$). We then searched the reference lists of the 26 included publications, and 31 unique citations were identified. We found eight

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[1]Languages include Spanish (38), French (38), German (27), Portuguese (12), Chinese (12), Turkish (12), Japanese (9), Italian (9), Russian (5), Slavic languages (4), Hungarian (3), Finnish (1), Slovak (1), Persian (1), Arabic (1), Dutch (1), Norwegian (1), Czech (1), and Greek (1).

[2]The first author reached out to the corresponding authors and requested the necessary information. One team of authors responded with the requested information so that their study was included in the review.

articles to be included in the initial literature search already, where three were included in the meta-analysis, three were screened out for not measuring the variables of interest, and two were screened out for insufficient information. We assessed the remaining 23 citations and excluded 22 because: 1) it was a review study ($k = 1$), 2) the full text was unavailable ($k = 1$), 3) there was insufficient information ($k = 1$), and 4) it was irrelevant to the scope of the analysis ($k = 19$). Therefore, 27 publications were included in the meta-analysis, comprising 27 distinct studies.

Detailed procedures for study inclusion and exclusion are provided in Figure 1. The Flow Diagram follows the recommendations of PRISMA2020 for the transparent reporting of systematic reviews and meta-analyses (Page et al., 2021).

Coding procedure and data extraction

In order to decide if a publication should proceed for full-text screening, authors one through five coded 4,838 records based on titles and abstracts. The first author developed a coding scheme by reading a random subset of 785 records carefully. Then, a small portion of 167 records was randomly selected for coder training, and disagreements on four records were resolved through discussion. Five coders worked independently afterward.

To decide whether a publication should be included in the analysis, the first, second, and third authors coded 91 full texts, from which 25 articles were randomly selected for an inter-coder reliability check. Three coders completely agreed on the inclusion decisions. Of the 25 reports, ten met the inclusion criteria and were used to test inter-coder reliability on effect size and moderator extraction. Full agreement was achieved. Three coders worked on the rest of the records independently. Once the assessment was completed, the first author examined the reference lists following the two-step coding procedure.

Effect size

The present meta-analysis aims to understand the relationship between social media use and social anxiety. Pearson's r was used as the effect size estimate. Therefore, we extracted Pearson's r and the corresponding significance between social media use and social anxiety when available. Otherwise, the following statistics were extracted and converted to Pearson's r: Spearman's ρ, standardized regression coefficient β, unstandardized regression coefficient b, and Chi-Square test $\chi2$. The conversion formulas are listed in Appendix B, Table B1. The correlation coefficients were keyed into the same direction, where a positive coefficient indicates that more social media use is associated with more severe social anxiety symptoms. A negative correlation per study entry indicates that more (less)
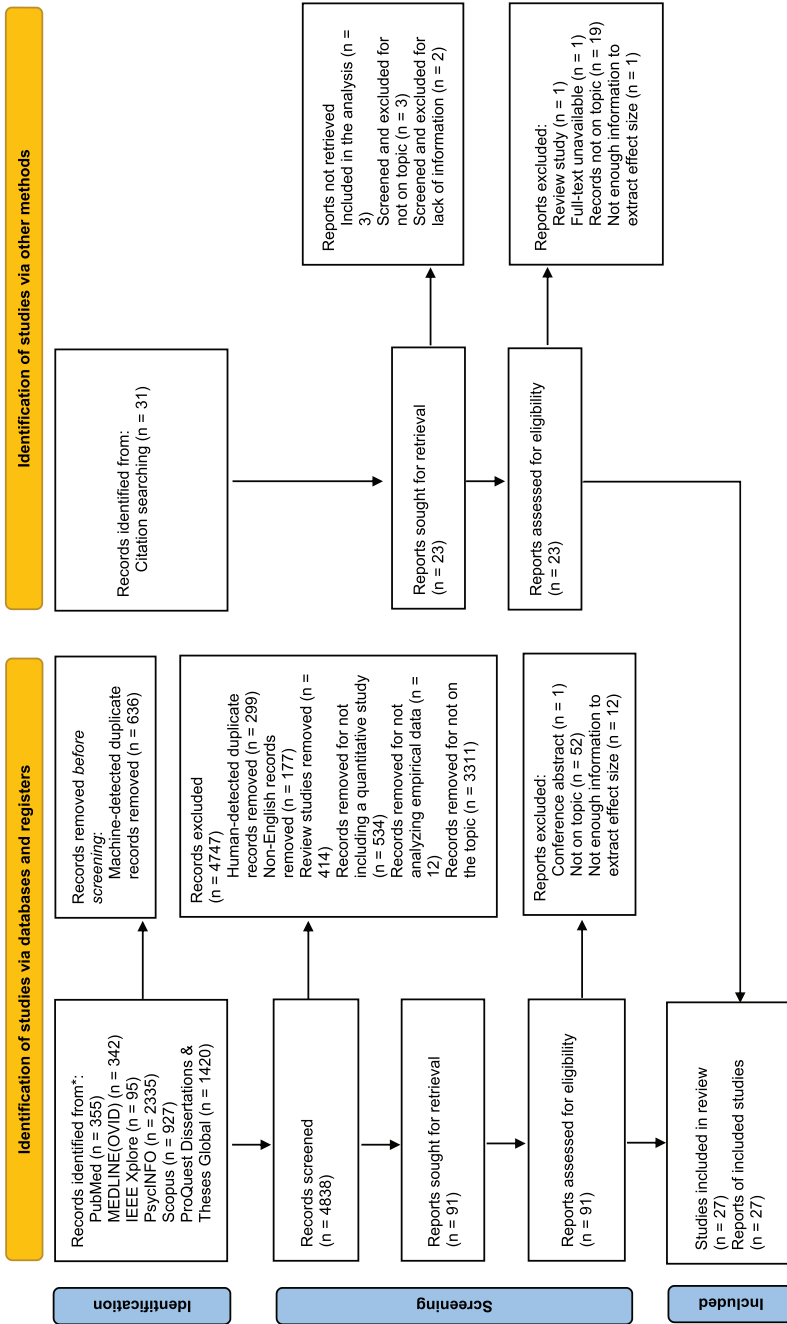
Figure 1. Flow diagram.

social media use is associated with less (more) severe social anxiety symptoms.

When the same study provided multiple effect sizes, we followed two straightforward approaches that Card (2012) recommended to resolve dependence. Coders were asked to select one that reflects the relationship of interest best. If multiple effect sizes were considered of the same importance (e.g., a study reported effect sizes on the correlation between social anxiety and time spent on Facebook, Instagram, and Snapchat, respectively), the mean effect size was calculated and used in the meta-analysis. Insignificant effect sizes were included as well because filtering out effect sizes based on significance can lead to overestimated effects (Bakdash et al., 2020).

Moderators

We obtained information regarding the following variables: 1) year of publication, 2) publication type (peer-reviewed journal article or dissertation), 3) study design (cross-sectional or longitudinal), 4) sample size, 5) sample average age, 6) whether the study used a student sample, 7) whether the study used an adult sample (adult, adolescent, mix), 8) predominant race or ethnicity, 9) proportion of female participants, 10) location where the study was conducted, 11) whether data collection happened before the pandemic, 12) social media operationalization (e.g., Facebook, Twitter, etc.), 13) social media use measure (frequency, time, intensity), 14) Cronbach's alpha of social media use measure if a scale is used, 15) social anxiety measure (e.g., Social Anxiety Scales for Adolescents, Brief Fear of Negative Evaluation Scale, etc.), 16) Cronbach's alpha of social anxiety measure if a scale is used, and 17) effect size direction (positive, negative).

We employed a flexible age rule when coding the variable *adult sample*. According to the World Health Organization, adolescence corresponds roughly to the period between the ages of 10 and 19 years, and sufficient flexibility in this age span was suggested to be allowed to encompass special situations (Sacks et al., 2003). Hence, we acknowledged the study used an adolescent sample as long as it claimed so, no matter what age span the study utilized. The study sample was considered an adult if it recruited participants of or above 18 years old or stated to use an adult sample. If a study reported an age range encompassing adults and adolescents, it was coded as a mixed sample. The adult, adolescent, and mixed samples were later recoded into dummy variables.

Locations where studies were conducted were coded into seven continents: Asia, Africa, North America, South America, Antarctica, Europe, and Australia. They were later recoded into dummy variables to take into account that some countries sit on the border of two continents (e.g., Turkey).

Since, in a given study, there might be multiple measures of social media use, to eliminate the influence of dependence, we averaged the effect size across social media use measures. And the social media use measure was coded into dummy variables to reflect the situation when a study measured more than one type of social media use. For example, Hawes et al. (2020) measured both time and intensity.

To code effect size direction, coders were asked to carefully read the direction of the social media use measure (if a higher score indicates more social media use) and the direction of the social anxiety measure (if a higher score indicates more severe social anxiety symptoms). Then, a judgment on the direction of a statistic could be made. That is, for example, if higher social media use (high numbers mean more use) was associated with more severe social anxiety (high numbers mean more social anxiety), then the relationship is positive and would be coded as such. On the contrary, if higher social media use was associated with less severe social anxiety, then this is an example of a negative relationship, and would be so coded.

Data analyses

Programming language R (version 4.3) was used for data processing and analysis. The R packages being used are tidyverse(1.3.0), fastDummies (1.6.3), esc (.5.1), meta (5.2–0), metafor (3.0–2), and dmetar (.0.9).

Main effect

The present study used the random effect model for the reason that it assumes that the included studies are drawn from "populations" of studies that differ from each other systematically (Borenstein et al., 2011). In other words, variability across studies is attributable to more than sampling error and instead can be due to systematic differences across studies, such as in the methods, participants, and measures used (Borenstein et al., 2014).

Imperfection in outcome measurement, such as low instrument reliability, could lead to attenuation. To treat the possibility that effect size estimates are biased due to measurement error, we followed the correction procedure proposed by Hunter and Schmidt (2004). The correction formula is provided in Appendix B Table B1. Twenty-four studies (88.89%) reported the reliability of social anxiety measures with a mean of .87 ($SD = .06$). Thus, corrected correlation coefficients were calculated and used in the meta-analysis.

Heterogeneity

Heterogeneity refers to the between-study variability in effect sizes across studies. First, we computed Cochran's Q. This statistic allows us to examine the observed variability in the distribution of correlation effects in the meta-

analysis. However, the Q test does not indicate the proportion of variability due to true heterogeneity across study effects (Borenstein et al., 2011; Lipsey & Wilson, 2001). And Q is subject to both the number of studies included and the sample size of studies.

Therefore, we calculated I^2 to indicate the proportion of heterogeneity in the observed effect sizes attributable to any true effect variations in the population. An I^2 value of 25%, 50%, and 75% suggests a low, moderate, and high proportion of dispersion in the observed correlations that would remain after removing sampling error, respectively (Borenstein et al., 2017). Being insensitive to the number of studies, I^2 value heavily depends on the precision of the included studies (Borenstein et al., 2017; Rücker et al., 2008).

As a remedy, we computed a prediction interval (PI) to evaluate the dispersion not simply of the observed effect sizes but also the true effect sizes. It offers a range into which effect sizes of future studies can be expected.

Moderator effect

To examine if any moderators contribute to the witnessed heterogeneity, we conducted subgroup analysis for categorical variables and meta-regression for continuous variables. Moderation analyses were only performed in case each category of the potential moderator was filled with at least three studies (Spruit et al., 2016). Meta-regression analyses were conducted according to the mixed-effects model. In this model, studies within subgroups are pooled with the random-effects model (assuming that studies within a subgroup are drawn from a universe of populations), and studies between subgroups use fixed effects (assuming that all subgroups share a common estimate of the between-study heterogeneity).

Results

Main effect analyses

The meta-analysis included 27 studies, with 27 independent samples, 27 effect sizes, and a total of 38,163 participants, with a mean sample size of 1413.44 and a median of 388. An overview of included studies is provided in Table 1. A random-effects meta-analysis revealed that the pooled association between social media use and social anxiety is $r = .14$ (95% CI [.06, .22]), and the effect is significant ($p = .001$). We first used Cohen's (1988) criteria for interpreting effect sizes: effect sizes around $r = .10$ were considered as small, effect sizes around $r = .30$ as medium, and effect sizes around $r = .50$ as large. The present analysis produced a significant positive small to medium effect, suggesting more social media use is related to a higher level of social anxiety symptoms. To better interpret the effect size in the context, we then referred to a review of

**Table 1.** Overview of studies included in meta-analysis.

Study	Year	N	Average age	Female %	Location	Social media	Social anxiety	SA reliability α
Akhter et al. (2022)	2022	544	22.56	44.10	Asia	Facebook	SIAS	.86
Berryman et al. (2018)	2018	467	19.66	71.73	North America	Social media	LSAS-SR	.90
Charmaraman et al. (2022)	2022	586	12.53	53.00	North America	Social media	SAS-A	.80
Creasy (2012)	2012	162	NA	37.04	NA	Facebook	SPAI	NA
Davidson and Farquhar (2014)	2014	336	NA	70.00	North America	Facebook	LSAS	.90
Dempsey et al. (2019)	2019	291	20.03	57.60	North America	Facebook	SIAS	.93
Erliksson et al. (2020)	2020	333	29.00	71.20	Europe	Social media	SAS-SMU, SPIN	.92
Fardouly et al. (2020)	2020	528	11.19	49.10	Australia	Social media	SCAS	.76
Hawes et al. (2020)	2020	763	17.70	59.00	Australia	Social media	SAS-A	.95
Hoffman et al. (2021)	2021	336	40.01	70.54	Asia	Facebook	LSAS	.94
Hu et al. (2017)	2017	342	19.80	71.00	North America	Facebook	SIAS	.93
Jarrar et al. (2022)	2022	432	21.30	52.00	Africa	Social media	LSAS	.87
Jiang and Ngien (2020)	2020	388	33.80	53.10	Asia	Instagram	SIAS	.82
Kaloeti et al. (2021)	2021	456	11.17	47.59	Asia	Social media	SCARED	.73
Lake Yimer (2021)	2021	204	NA	38.24	Africa	Social media	SAS-A	.91
McCord et al. (2014)	2014	216	32.20	85.65	North America	Facebook	SIAS-SPS-12	NA
Resnik and Bellmore (2021)	2021	307	15.91	66.00	North America	Twitter	SAS-A	.88
Shaw et al. (2015)	2015	75	19.20	55.20	NA	Facebook	SPS	.91
She et al. (2023)	2023	26612	NA	56.30	Asia	Social media	SASS-CS	.76
Thorisdottir et al. (2020)	2020	2211	12.00	49.90	Europe	Social media	MASC (Icelandic version)	.90
Toh et al. (2022)	2022	158	25.26	77.80	Australia	Instagram	BFNE	.90
Vancu and Egerău (2022)[a]	2022	78	19.72	47.44	NA	Social media	PDSQ	NA
Weiss (2013)	2013	171	21.00	NA	NA	Facebook	LSAS-SR	.91
Yildiz Durak and Seferoğlu (2019)	2019	580	NA	59.80	Asia, Europe	Social media	LSAS (Turkish version)	.92
Yıldız Durak (2020)	2020	451	NA	47.50	NA	Social media	SAS-A	.96
Zheng and Leung (2016)	2016	568	NA	44.00	Asia	Renren	CAI-Trait	.83
Zheng and Li (2016)	2016	568	NA	44.00	Asia	Renren	CAI	.81

[a]Objective measure of time spent on social media instead of self-reported measure.

112 meta-analyses in the communication field (Weber & Popova, 2012). The specified range of effect sizes within the lower third (small effect) is [.00, .10], the middle third (medium effect) is [.10, .23], and the upper third (larger effect) is [.23, .70]. Therefore, an effect size r of .14 was considered a medium effect.

The between-study heterogeneity variance was estimated at $Q_{(26)} = 493.85$ ($p < .0001$) and $\tau^2 = .038$ (95% CI [.02, .07]), with an I^2 value of 94.7% (95% CI [93.3%, 95.8%]). The prediction interval ranged from $-.26$ to .50, indicating that negative correlation coefficients cannot be ruled out for future studies. A forest plot is a visualization of meta-analysis, providing observed effects and confidence intervals (see Figure 2). The significant heterogeneity test and a large I^2 value indicated that observed correlation effects vary greatly, calling for moderator analyses to discover what explains the large variability (Higgins et al., 2003).

Source	COR (95% CI)
Lake Yimer (2021)	-0.17 [-0.30; -0.04]
Charmaraman et al. (2022)	-0.08 [-0.16; 0.00]
Berryman et al. (2018)	-0.07 [-0.16; 0.02]
Creasy (2012)	-0.01 [-0.16; 0.14]
McCord et al. (2014)	0.01 [-0.12; 0.14]
Resnik & Bellmore (2021)	0.01 [-0.10; 0.12]
Hu et al. (2017)	0.01 [-0.09; 0.12]
Fardouly et al. (2020)	0.01 [-0.07; 0.10]
Kaloeti et al. (2021)	0.02 [-0.07; 0.11]
She et al. (2023)	0.03 [0.02; 0.05]
Yıldız Durak (2020)	0.05 [-0.04; 0.14]
Davidson & Farquhar (2014)	0.06 [-0.05; 0.17]
Weiss (2013)	0.08 [-0.07; 0.23]
Yildiz Durak & Seferoğlu (2019)	0.10 [0.02; 0.18]
Zheng & Leung (2016)	0.11 [0.03; 0.19]
Thorisdottir et al. (2020)	0.15 [0.10; 0.19]
Zheng & Li (2016)	0.16 [0.08; 0.24]
Erliksson et al. (2020)	0.17 [0.06; 0.27]
Hawes et al. (2020)	0.18 [0.12; 0.25]
Dempsey et al. (2019)	0.21 [0.09; 0.31]
Toh et al. (2022)	0.21 [0.06; 0.36]
Hoffman et al. (2021)	0.30 [0.20; 0.39]
Jiang & Ngien (2020)	0.32 [0.23; 0.41]
Shaw et al. (2015)	0.35 [0.13; 0.53]
Vancu & Egerău (2022)	0.41 [0.21; 0.58]
Akhter et al. (2022)	0.47 [0.41; 0.54]
Jarrar et al. (2022)	0.64 [0.59; 0.70]
Total	0.14 [0.06; 0.22]
Prediction interval	[-0.26; 0.50]
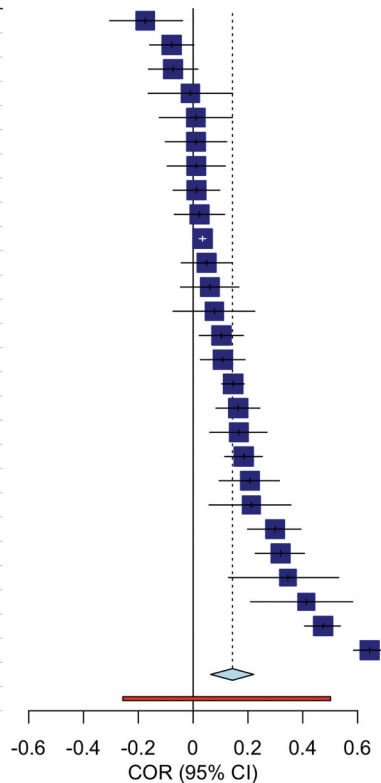
Heterogeneity: $\chi^2_{26} = 493.85$ ($P < .001$), $I^2 = 95\%$

Figure 2. Forest Plot (corrected effect sizes).

We also performed a meta-analysis using the uncorrected effect sizes. The mean effect size estimate was $r = .13$ (95% CI [.06, .21]), and the effect was significant ($p = .0009$) as well. The between-study heterogeneity variance was estimated at $Q_{(26)} = 422.5$ ($p < .0001$), $\tau^2 = .032$ (95% CI [.02, .06]), $I^2 = 93.8\%$ (95% CI [92.1%, 95.2%]), and PI [−.23, .47]. Although slightly different from the corrected main effect result, the interpretation of the uncorrected model led to similar conclusions.

Moderator effect analyses

Subgroup analyses

Subgroup analyses were performed to test if effect size varies across groups. Categorical moderators being tested were 1) sample characteristics, including student sample, adolescent sample, adult sample, mixed sample, majority race/ethnicity, Location - Asia, Location - Australia, Location - Europe, and Location - North America, and 2) measurement characteristics, including social media platform (multiple or single) and social media use measure (frequency, time, or intensity).

The subgroup analysis revealed that the adolescent sample exhibits a significant difference from other samples ($Q(1) = 8.04$, $p = .0046$) in terms of the relationship between their social media use and social anxiety. The adolescent sample tended to have a weaker effect ($r = .03$, 95% CI [−.04, .10], $k = 7$) than non-adolescent samples ($r = .19$, 95% CI [.09, .28], $k = 20$). That is to say, given the same amount of social media use, adolescents were likely to experience a lower level of social anxiety than others, while both groups were expected to see an increase in levels of social anxiety if they used social media more.

Using the majority race/ethnicity as a moderator, subgroup analysis suggested a significant difference between study samples where White individuals comprised the majority compared to those where other races or ethnicities predominated ($Q(1) = 4.66$, $p = .0309$). The White-majority sample tended to have a weaker effect ($r = .06$, 95% CI [−.01, .13], $k = 13$) than the others ($r = .21$, 95% CI [.08, .34], $k = 14$). In other words, given the same amount of social media use, White-majority populations had a higher chance of experiencing a lower level of social anxiety than others. However, higher social anxiety symptoms were expected when social media use was higher regardless of race/ethnicity.

When it comes to location, studies conducted in North America demonstrated a significant difference from the studies performed in other continents ($Q(1) = 8.07$, $p = .0045$). In particular, studies conducted in North America tended to have a weaker correlation ($r = .02$, 95% CI [−.07, .11], $k = 7$) than the other studies ($r = .19$, 95% CI [.09, .28], $k = 20$). Similar to the adolescent and non-adolescent comparison, social media

users in North America tended to experience a lower level of social anxiety than users from elsewhere, given the same amount of social media use. Still, both groups were expected to have higher levels of social anxiety if they used social media more. The detailed results of other variables can be found in Table 2.

Moderators not being used for analyses are those whose subgroups have less than three studies. As for publication type, we included 25 peer-reviewed journal articles and two dissertations. Similarly, 25 studies adopted a cross-sectional design, while the other two used longitudinal data and performed multilevel modeling to account for the time variable.

Table 2. The effects of correction on social anxiety measurement reliability by moderator.

Variable	r	K	Q	p	95% CI
Main effect	.14	27	493.85	**.001**	[.06; .22]
Student sample			.16	.6872	
Yes	.14	23			[.05; .22]
No	.18	4			[−.17; .49]
Adolescents sample			8.04	**.0046**	
Yes	.03	7			[−.04; .10]
No	.19	20			[.09; .28]
Adults sample			1.85	.1734	
Yes	.22	9			[.04; .39]
No	.1	18			[.02; .18]
Mixed sample			.03	.8660	
Yes	.15	7			[−.02; .32]
No	.14	20			[.04; .23]
Majority race/ethnicity			4.66	**.0309**	
White	.06	13			[−.01; .13]
Other	.21	14			[.08; .34]
Location – Asia			.94	.3334	
Yes	.19	8			[.05; .33]
No	.12	19			[.02; .22]
Location – Australia			.03	.8518	
Yes	.13	3			[−.14; .39]
No	.14	24			[.06; .23]
Location – Europe			.01	.9298	
Yes	.14	3			[.08; .20]
No	.14	24			[.05; .23]
Location – North America			8.07	**.0045**	
Yes	.02	7			[−.07; .11]
No	.19	20			[.09; .28]
Social media platform			.38	.5351	
Multiple	.12	13			[−.03; .26]
Single	.17	14			[.08; .26]
Frequency			.20	.6588	
Yes	.11	5			[−.09; .30]
No	.15	22			[.06; .24]
Time			2.11	.1459	
Yes	.09	15			[.01; .17]
No	.20	12			[.05; .34]
Intensity			1.96	.1620	
Yes	.21	10			[.04; .38]
No	.09	17			[.01; .17]

Most studies collected data before the pandemic ($k = 21$), whereas only one was conducted during the pandemic. The 27 independent studies used 14 distinct social anxiety scales, leading to small subgroup sizes and not being qualified for subgroup analysis.

Meta-regression analyses

Meta-regression models were fitted to examine continuous moderators. Continuous variables being tested were 1) year of publication, 2) sample size, 3) average sample age, 4) female participants proportion, and 5) social media measurement reliability.

Among the continuous moderators examined, social media use measurement reliability demonstrated a significant result ($b = 8.71$, $p = .043$, 95% CI [.37, 17.05], $\tau^2 = .04$, $QE(7) = 132.93$, $I^2 = 95.07\%$, $R^2 = 40.09\%$). In an extreme case where social media use measurement alpha reaches one, the estimated effect size is 1.37. Therefore, we can conclude that the effect sizes of studies increase as social media measurement reliability increases. A bubble plot visualizing the estimated regression slope and effect sizes is in Appendix B Figure B1. After the inclusion of the predictor, 40.09% of the difference in true effect sizes can be explained by the social media use measurement reliability, which is moderate. However, the Q test suggests that the heterogeneity not explained by the predictor is significant. More regression model results are reported in Table 3.

Publication bias

Publication bias refers to the extent of missing studies researchers conducted but didn't publish. It could bias our estimates of the overall effects and there are various approaches in meta-analysis to assess this. One approach is to inspect small-study effects through a funnel plot, which visualizes the observed effect size for every study sample against the standard error. The standard error is plotted on the y-axis and is usually inverted, meaning a higher position corresponds with a lower standard error. A contour-enhanced funnel plot can be found in Appendix B Figure B2. The funnel plot presented imputed studies (unfilled dot), clustering on the left side of the middle line. Significant studies (filled dots falling into the shaded regions) mostly demonstrated a positive effect size. The two studies with higher standard errors (they are considered small studies) both showed positive effects, but the magnitude of their effects did not exceed those provided by the studies with lower standard errors.

The trim and fill test (Duval & Tweedie, 2000) suggested seven studies need to be imputed to achieve a symmetric funnel plot. The imputed studies all had negative effect sizes, and some of them were even lower than $r = -.05$. The estimate of the corrected effect was $r = .05$ (95% CI [−.05,

Table 3. Mixed-effects meta-regression model results.

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Estimate	p	95% CI	Estimate	p	95% CI	Estimate	p	95% CI	Estimate	p	95% CI	Estimate	p	95% CI
Intercept	−34.9993	.1819	[−87.50, 17.50]	.1511	.0012	[.07, .24]	.002	.9890	[−.30, .31]	.2286	.2504	[−.17, .63]	−7.3427	.0474	[−14.58, −.11]
Year	.0174	.1802	[−.01, .04]												
Sample size				0	.5721	[0,0]									
Average age							.0088	.1868	[−.05, .02]						
Female%										−.0014	.6709	[−.008, .005]			
Social media α													8.7114	.0429	[.37, 17.05]
τ^2	.0361			.0387			.0433			.0403			.0395		
(SE)	(.0111)			(.1968)			(.0161)			(.0126)			(.0225)		
I^2	95.23%			94.32%			94.71%			96.87%			95.07%		
R^2	3.73%			.00%			5.63%			.00%			40.09%		
QE(df)	475.1393 (25)	<.0001		391.5037 (25)	<.0001		299.8036 (17)	<.0001		478.5068 (24)	<.0001		132.9307 (7)	<.0001	

.15]) and was not significant ($p = .295$). The between-study heterogeneity variance was estimated at $Q_{(33)} = 930.01$ ($p < .0001$), $\tau^2 = .072$ (95% CI [.05, .13]), $I^2 = 96.5\%$ (95% CI [95.7%, 97.1%]), and PI [−.46, .54]. Overall, the trim and fill method suggested that our predicted effect size was overestimated.

We also performed Egger's regression test (Egger et al., 1997) to test for asymmetry in the funnel plot. The bias was reported to be 2.33 ($SE = 1.05$), which was larger than zero and reached conventional levels of significance ($t = 2.22$, $p = .036$). Egger's regression test result suggested that the funnel plot was asymmetrical, indicating publication bias.

Sensitivity analysis

Sensitivity analysis was conducted by removing a particular study from the effect size estimation called the leave-one-out method. A forest plot showing recalculated pooled effect sizes with one study omitted each time is provided in Appendix B Figure B3. By excluding studies by Jarrar et al. (2022) and Akhter et al. (2022), the lowest I^2 and the effect sizes were reached. The Baujat Plot (see Appendix B Figure B4) also suggested the two studies overly contributed to the heterogeneity. In addition, a study by She et al. (2023) was perceived as influential, indicating that the standardized difference of effect sizes when this study is included versus removed is substantial.

Discussion

Over the last twenty years, there has been a dramatic increase worldwide in social media use (Pew Research Center, 2021 April 7). Not surprisingly, researchers have wondered how social media use is related to a diverse array of outcomes, including individuals' mental health. Social anxiety is one of the most common mental health challenges and impacts one's communication patterns. The link between social media use and social anxiety has been complex; the current meta-analysis seeks to fill this gap.

Our findings suggest that the relationship between social media use and social anxiety is significant and positive but that there is considerable heterogeneity in effect sizes across studies. We were able to identify four factors (three involving sample characteristics and one involving the reliability of social media use measures) that accounted for significant heterogeneity in these study results. Our findings contribute to the emerging literature by providing a synthesized mean correlation coefficient linking social media use and social anxiety – a finding that is consistent with the social compensation model (Kraut et al., 2002). Moreover, these findings deepen our understanding of the bigger picture of how social media use

relates to mental health. However, as we will discuss in future directions, what this relationship means about *causal links* still remains unclear.

Importance of unpacking the issue

As technologies change, they reshape the way we communicate and interact, raising concerns about their potential effects on psychological well-being. On the one hand, excessive use of social media might contribute to negative health outcomes, such as depression, anxiety, and loneliness. For example, Boer et al. (2020) found, across countries, that problematic social media use was correlated with adolescents' negative mental health outcomes. On the other hand, it is undeniable that social media provides easier access to information and support networks, likely being beneficial to one's health (Sadagheyani & Tatari, 2021). Meier and Reinecke (2021) suggested that different reported patterns of relationships between computer-mediated communication and mental health may result from different conceptualizations and operationalizations of each of these terms. We notice a similar correlational pattern for the relationship between social media and mental health. This conceptual diversity makes it difficult for researchers to draw a conclusion with respect to the relationship between social media use and mental health. Along the same lines, Huang (2017) found that social media exhibited different effects when using different mental health indicators. The influence of social media on mental health is not one-dimensional, and its complexity requires researchers to break down the measures and situate the discussion in a more specific context. To this end, the current study attempts to provide one more piece of information to help disentangle the inconsistent body of literature by investigating the overall relationship between social media use and social anxiety.

Social media use compensation

This study reveals a main effect that aligns with previous literature, which suggests total frequency or time spent on social media is positively associated with social anxiety (Frost & Rickwood, 2017; Seabrook et al., 2016). Collectively, the present study, along with prior evidence, is consistent with the social compensation model (Kraut et al., 2002), reinforcing the concern that more social media use and more severe social anxiety may go hand in hand. With the growing accessibility of mobile devices and the Internet, individuals are offered more opportunities and flexibility to devote themselves to social media whenever and wherever they want. Those who are socially anxious tend to use social media more as an alternative to face-to-face interactions. Individuals investing more in social media would have

less motivation, time, and energy committed to offline social interactions. Less practice and familiarity in face-to-face communication may also lead to anxiety when offline social situations are inevitable.

In accordance with the present results, most of the previous meta-analyses have demonstrated weak effects between social media use and psychological well-being. For instance, the mean correlation between time spent on social media and psychological well-being was small and negative (Huang, 2017). As for loneliness, social media use demonstrated a small positive correlational effect (Zhang et al., 2022) and a small-to-medium positive effect (Liu & Baumeister, 2016). Interestingly, Prizant-Passal et al. (2016) review showed that social anxiety is not significantly associated with total time spent online, e-mail, and instant messaging use, but is significantly positively correlated with online gaming. Meanwhile, it is noticeable that only online gaming demonstrated a correlational effect with social anxiety that is close to medium size effect, whereas the rest were relatively small. In this regard, it seems that the magnitude of our effect size is within the normal range of effect sizes when it comes to the association between social media and mental health and warrants research attention.

Unveiling influential moderators

Having discussed the main effects and observed patterns between social media use and social anxiety, the following session further looks into moderating factors that influence the strength of this relationship. With regard to the sample characteristics, we found that given the same amount of social media use, adolescents tend to experience lower levels of social anxiety than non-adolescents. This outcome is contrary to that of Valkenburg et al. (2005) who found early adolescents were more susceptible to social compensation effects than the older ones. Despite the argument that the fear of social rejection peaks in early adolescence (Valkenburg et al., 2005), it is essential to emphasize that adolescents today differ from adolescents in early 2000. Current adolescents grow up in a technology-saturated environment, thus being recognized as digital natives. According to the Pew Research Center (2022, August), 95% of teenagers have access to a smartphone, 97% use the Internet daily, and 46% say they use the Internet almost constantly. A 2022 survey study reported that 28% of adolescents spent more than four hours on social media daily, almost double the amount of time adults spent on social media (Statista, 2023 June 8). It is apparent that social media is more pervasive and heavily used among adolescents, which might be the underlying reason for the attenuated effect between social media use and social anxiety among adolescents. Additionally, there is a possibility that the attenuated effect is caused by a restricted range of sample age (Mendoza & Mumford, 1987).

In the current work, where White individuals comprised the majority of a study's sample, compared to where the sample majority was of another race/ethnicity, there is a weaker positive association between social media use and social anxiety. It is not clear why this would be the case. Nonetheless, prior work suggested that social anxiety was lower for the White population (Lesure-Lester & King, 2004), but how it relates to the weaker relationship between social media use and social anxiety is unclear. Additionally, previous survey results suggested that a higher percentage of White respondents than respondents from other race/ethnicity groups reported perceiving a negative impact of social media (Knight Foundation, 2022). Such survey items, however, failed to differentiate a range of negative impacts, including diverse mental health challenges, per race/ethnicity groups. We call for future studies focusing on the racial/ethnic differences in the links between social media use and specific mental health challenges.

On the issue of location differences, individuals from North America tend to experience lower levels of social anxiety than individuals from other continents given the same amount of social media use. A closer look at the location distribution shows that all the North American studies were conducted in the United States ($k = 7$), while the other studies were conducted in countries including Ethiopia ($k = 1$), Uganda ($k = 1$), Bangladesh ($k = 1$), China ($k = 3$), Indonesia ($k = 1$), Israel ($k = 1$), Turkey ($k = 1$), Australia ($k = 3$), Iceland ($k = 1$), and Sweden ($k = 1$). We call for future studies to be conducted in other regions to offer a more comprehensive understanding of the relationship between social media use and social anxiety across continents and provide more information to help us probe possible explanations for the observed differences.

Another interesting finding is that a larger effect size is expected to be detected as the reliability of social media use measurement increases. It is worth noting that only the intensity of social media was measured using scales, thus offering reliability scores, whereas frequency and time were usually measured by a single question. Scholars have argued that measurement reliability places an upper limit on the maximum detectable effect size (Zuo et al., 2019). That is to say, there is a chance that larger effect sizes were detected because the upper constraint was removed thanks to the improvement in social media use measurement.

Limitations and future directions

A couple of limitations are considered here. It would be ideal if all the research uses the same concept and measurement, but it is a limitation in many meta-analyses, including the current one. We acknowledge that plenty of other indicators have been used to examine social media use, and the measurement that the current study chose to review systematically is only a slice of the cake. It is possible that the relationship between social media use and social anxiety

changes when a different indicator for social media use is selected. Meier and Reinecke (2021) have laid a solid ground for future studies to review social media use and its potential effects on mental health. The authors identified six levels of social media indicators through the lens of channel- and communication-centered approaches. Future reviews are encouraged to refer to their work as a starting point and explore one or more types of social media use and the corresponding effect on mental health.

Regrettably, only one included study measured social media use objectively, while the rest employed a self-reported measure. It is not surprising as objective measures of social media use are relatively difficult to obtain. That said, researchers have suggested that there is only a modest association between self-reports and usage logs (Parry et al., 2021). They concluded that, overall, the correlation between self-reports and usage logs is positive, but mean self-reports of media use were either over- or under-reported relative to the logged measure. As the authors indicated, the (in)accuracy of self-reported media use measures might be systematic. With the increasing availability of screen usage time information on digital devices, we call for future studies to employ more objective measures of social media use.

We noticed a large proportion of studies recruited students-only samples (88.46%). Adolescents and young adults constituted the majority of samples used in research investigating social media and social anxiety. With the exception of one study, the samples included in our analysis have an average age ranging from 11.17 to 32.3 years old. Although using student-only samples or recruiting younger populations does not contribute to the large heterogeneity, samples with more diversity are desired in future studies. In addition, only one included study was conducted during the pandemic, leaving us no room to investigate the influence of the pandemic on the relationship between social media use and social anxiety. We encourage future reviews to consider the pandemic as a potential moderator.

There is evidence of publication bias in the current study, which can happen when non-significant findings are less likely to be published. Reviewers and editors are encouraged to accept well-done articles where the effects are not significant. Doing so could help to reduce publication bias across various research domains.

Lastly, there are currently a limited number of longitudinal or experimental studies that might help to unpack the dynamic causal links between social media use and social anxiety, especially for diagnosed socially anxious individuals. More longitudinal and experimental designs are needed to understand 1) the affordances of social media that particularly resonate with socially anxious individuals, 2) specific motivations of social media use that may contribute to the nature of the relationship, and 3) the reasons why some studies found a negative relationship between social media use and social anxiety.

Conclusion

This study sets out to assess the average correlation coefficient estimate for the association between social media use and social anxiety and evaluate the potential moderators. The meta-analysis results indicate a positive and significant relationship between social media use and social anxiety and identify four moderating factors that help to explain the heterogeneity of findings across studies. The findings are in line with predictions from the social compensation model that argue that socially anxious individuals tend to use social media more to compensate for lacking in-person interactions. However, since this is a correlational finding where the causal direction of effects can not be specified, it may further validate concerns pertaining to the negative influence of social media use on mental health.

The present study sheds new light on the rapidly expanding field of social media and mental health by synthesizing conflicting evidence, which all appear to come from rigorous and reliable studies, and providing an effect size estimate that future empirical studies can refer to. This review points out a research gap in that the affordances of social media provide socially anxious individuals enormous benefits being extensively discussed while the costs are less documented. Moreover, studies revealed that negative correlations between social media use and social anxiety received little attention, and no explanations were discussed.

Future empirical studies are recommended to adopt objective social media measurement, diversify the sample characteristics and locations, and employ longitudinal or experimental designs. Future reviews are recommended to position their work in a niche instead of treating social media and mental health as unitary concepts. For example, empirical studies have investigated the roles of social media use style (e.g., passive versus active, Akhter et al., 2022), specific behavior on social media (e.g., vaguebooking, Berryman et al., 2018), and problematic social media use (e.g., Boer et al., 2020) on mental health. Continued efforts are needed to dig deeper into the relationship between social media and mental health to provide more nuanced insights informing causal directions, intervention targets, and guidance on best practices.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

The following references of studies are cited in the body of the paper.
Aichner, T., Grünfelder, M., Maurer, O., & Jegeni, D. (2021). Twenty-five years of social media: A review of social media applications and definitions from 1994 to 2019. *Cyberpsychology, Behavior, and Social Networking*, *24*(4), 215–222. https://doi.org/10.1089/cyber.2020.0134

American Psychiatric Association & American Psychiatric Association DSM-5 Task Force. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.).

Asher, M., & Aderka, I. M. (2018). Gender differences in social anxiety disorder. *Journal of Clinical Psychology*, *74*(10), 1730–1741. https://doi.org/10.1002/jclp.22624

Bakdash, J. Z., Marusich, L. R., Kenworthy, J. B., Twedt, E., & Zaroukian, E. G. (2020). Statistical significance filtering overestimates effects and impedes falsification: A critique of endsley (2019). *Frontiers in Psychology*, *11*, 11. https://www.frontiersin.org/articles/10.3389/fpsyg.2020.609647

Bawden, D., & Robinson, L. (2009). The dark side of information: Overload, anxiety and other paradoxes and pathologies. *Journal of Information Science*, *35*(2), 180–191. https://doi.org/10.1177/0165551508095781

Boer, M., van den Eijnden, R. J. J. M., Boniel-Nissim, M., Wong, S.-L., Inchley, J. C., Badura, P., Craig, W. M., Gobina, I., Kleszczewska, D., Klanšček, H. J., & Stevens, G. W. J. M. (2020). Adolescents' intense and problematic social media use and their well-being in 29 countries. *Journal of Adolescent Health*, *66*(6, Supplement), S89–S99. https://doi.org/10.1016/j.jadohealth.2020.02.014

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2011). *Introduction to meta-analysis*. John Wiley & Sons.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2014). *Comprehensive meta-analysis version 3.3. 070*. Biostat, 104.

Borenstein, M., Higgins, J. P., Hedges, L. V., & Rothstein, H. R. (2017). Basics of meta-analysis: I2 is not an absolute measure of heterogeneity. *Research Synthesis Methods*, *8*(1), 5–18. https://doi.org/10.1002/jrsm.1230

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, *13*(1), 210–230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Burke, T. J., & Ruppel, E. K. (2015). Facebook self-presentational motives: Daily effects on social anxiety and interaction success. *Communication Studies*, *66*(2), 204–217. https://doi.org/10.1080/10510974.2014.884014

Buss, A. H. (1980). *Self-consciousness and social anxiety*. Freeman.

Caballo, V. E., Salazar, I. C., Irurtia, M. J., Arias, B., Hofmann, S. G., & CISO-A Research Team. (2008). Social anxiety in 18 nations: Sex and age differences. *Behavioral Psychology/Psicología Conductual*, *16*(2), 163–187.

Campisi, J., Bynog, P., McGehee, H., Oakland, J. C., Quirk, S., Taga, C., & Taylor, M. (2012). Facebook, stress, and incidence of upper respiratory infection in undergraduate college students. *Cyberpsychology, Behavior, and Social Networking*, *15*(12), 675–681. https://doi.org/10.1089/cyber.2012.0156

Caplan, S. E. (2007). Relations among loneliness, social anxiety, and problematic internet use. *CyberPsychology & Behavior*, *10*(2), 234–242. https://doi.org/10.1089/cpb.2006.9963

Card, N. (2012). *Applied meta-analysis for social science research*. Guilford Press.

Carr, C. T., & Hayes, R. A. (2015). Social media: Defining, developing, and divining. *Atlantic Journal of Communication*, *23*(1), 46–65. https://doi.org/10.1080/15456870.2015.972282

Chou, W.-Y. S., Hunt, Y. M., Beckjord, E. B., Moser, R. P., & Hesse, B. W. (2009). Social media use in the United States: Implications for health communication. *Journal of Medical Internet Research*, *11*(4), e1249. https://doi.org/10.2196/jmir.1249

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Dobrean, A., & Păsărelu, C.-R. (2016). Impact of social media on social anxiety: A systematic review. In F. Durbano & B. Marchesi (Eds.), *New developments in anxiety disorders*. IntechOpen. https://doi.org/10.5772/65188

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics Bulletin*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341X.2000.00455.x

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ: British Medical Journal*, *315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Ellison, N. B., 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*(4), 1143–1168. https://doi.org/10.1111/j.1083-6101.2007.00367.x

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*(5), 629–646. https://doi.org/10.1016/j.janxdis.2003.08.002

Falk Dahl, C. A., & Dahl, A. A. (2010). Lifestyle and social network in individuals with high level of social phobia/anxiety symptoms: A community-based study. *Social Psychiatry and Psychiatric Epidemiology*, *45*(3), 309–317. https://doi.org/10.1007/s00127-009-0069-6

Frost, R. L., & Rickwood, D. J. (2017). A systematic review of the mental health outcomes associated with Facebook use. *Computers in Human Behavior*, *76*, 576–600. https://doi.org/10.1016/j.chb.2017.08.001

Griffith, D. A., Lee, H. S., & Yalcinkaya, G. (2023). Understanding the relationship between the use of social media and the prevalence of anxiety at the country level: A multi-country examination. *International Business Review*, *32*(4), 102102. https://doi.org/10.1016/j.ibusrev.2023.102102

Hardy, B. W., & Castonguay, J. (2018). The moderating role of age in the relationship between social media use and mental well-being: An analysis of the 2016 general social survey. *Computers in Human Behavior*, *85*, 282–290. https://doi.org/10.1016/j.chb.2018.04.005

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ: British Medical Journal*, *327*(7414), 557–560. https://doi.org/10.1136/bmj.327.7414.557

High, A. C., & Caplan, S. E. (2009). Social anxiety and computer-mediated communication during initial interactions: Implications for the hyperpersonal perspective. *Computers in Human Behavior*, *25*(2), 475–482. https://doi.org/10.1016/j.chb.2008.10.011

Hofmann, S. G., Anu Asnaani, M., & Hinton, D. E. (2010). Cultural aspects in social anxiety and social anxiety disorder. *Depression and Anxiety*, *27*(12), 1117–1127. https://doi.org/10.1002/da.20759

Huang, C. (2017). Time spent on social network sites and psychological well-being: A meta-analysis. *Cyberpsychology, Behavior, and Social Networking*, *20*(6), 346–354. https://doi.org/10.1089/cyber.2016.0758

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings*. Sage.

Kaloeti, D. V. S., Manalu, R., Kristiana, I. F., & Bidzan, M. (2021). The role of social media use in peer bullying victimization and onset of anxiety among Indonesian elementary school children. *Frontiers in Psychology*, *12*, 635725. https://doi.org/10.3389/fpsyg.2021.635725

Karim, F., Oyewande, A. A., Abdalla, L. F., Ehsanullah, R. C., Khan, S., Karim, F., Oyewande, A. A., Abdalla, L. F., Ehsanullah, R. C., & Khan, S. (2020). Social media use and its connection to mental health: A systematic review. *Cureus*, *12*(6). https://doi.org/10.7759/cureus.8627

Knight Foundation. (2022). *Media and democracy: Unpacking America's complex views on the digital public square*.

Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., & Crawford, A. (2002). Internet paradox revisited. *Journal of Social Issues*, *58*(1), 49–74. https://doi.org/10.1111/1540-4560.00248

Lee, B. W., & Stapinski, L. A. (2012). Seeking safety on the internet: Relationship between social anxiety and problematic internet use. *Journal of Anxiety Disorders*, *26*(1), 197–205. https://doi.org/10.1016/j.janxdis.2011.11.001

Lesure-Lester, G. E., & King, N. (2004). Racial-ethnic differences in social anxiety among college students. *Journal of College Student Retention: Research, Theory & Practice*, *6*(3), 359–367. https://doi.org/10.2190/P5FR-CGAH-YHA4-1DYC

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Sage Publications, Inc.

Liu, D., & Baumeister, R. F. (2016). Social networking online and personality of self-worth: A meta-analysis. *Journal of Research in Personality*, *64*, 79–89. https://doi.org/10.1016/j.jrp.2016.06.024

Matthes, J., Knoll, J., Valenzuela, S., Hopmann, D. N., & Von Sikorski, C. (2019). A meta-analysis of the effects of cross-cutting exposure on political participation. *Political Communication*, *36*(4), 523–542. https://doi.org/10.1080/10584609.2019.1619638

McKenna, K. Y., & Bargh, J. A. (1999). Causes and consequences of social interaction on the internet: A conceptual framework. *Media Psychology*, *1*(3), 249–269. https://doi.org/10.1207/s1532785xmep0103_4

McKenna, K. Y., & Bargh, J. A. (2000). Plan 9 from cyberspace: The implications of the internet for personality and social psychology. *Personality and Social Psychology Review*, *4*(1), 57–75. https://doi.org/10.1207/S15327957PSPR0401_6

Meier, A., & Reinecke, L. (2021). Computer-mediated communication, social media, and mental health: A conceptual and empirical meta-review. *Communication Research*, *48*(8), 1182–1209. https://doi.org/10.1177/0093650220958224

Mendoza, J. L., & Mumford, M. (1987). Corrections for attenuation and range restriction on the predictor. *Journal of Educational Statistics*, *12*(3), 282–293. https://doi.org/10.3102/10769986012003282

Mullins, T. D., & Duke, M. P. (2004). Effects of social anxiety on nonverbal accuracy and response time I: Facial expressions. *Journal of Nonverbal Behavior*, *28*(1), 3–33. https://doi.org/10.1023/B:JONB.0000017865.24656.98

Naslund, J. A., Bondre, A., Torous, J., & Aschbrenner, K. A. (2020). Social media and mental health: Benefits, risks, and opportunities for research and practice. *The Journal of Technology in Behavioral Science*, *5*(3), 245–257. https://doi.org/10.1007/s41347-020-00134-x

O'Day, E. B., & Heimberg, R. G. (2021). Social media use, social anxiety, and loneliness: A systematic review. *Computers in Human Behavior Reports*, *3*, 100070. https://doi.org/10.1016/j.chbr.2021.100070

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic

reviews. *International Journal of Surgery*, *88*, 105906. https://doi.org/10.1016/j.ijsu.2021.105906

Parry, D. A., Davidson, B. I., Sewall, C. J., Fisher, J. T., Mieczkowski, H., & Quintana, D. S. (2021). A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour*, *5*(11), 1535–1547. https://doi.org/10.1038/s41562-021-01117-5

Pew Research Center. (2021, April 7). *Social media fact sheet*. Pew Research Center: Internet, Science & Tech. https://www.pewresearch.org/internet/fact-sheet/social-media/

Pew Research Center. (2022, August). *Teens, social media and technology 2022*. Retrieved July 16, 2023, from https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2022/08/PI_2022.08.10_Teens-and-Tech_FINAL.pdf

Pierce, T. (2009). Social anxiety and technology: Face-to-face communication versus technological communication among teens. *Computers in Human Behavior*, *25*(6), 1367–1372. https://doi.org/10.1016/j.chb.2009.06.003

Prizant-Passal, S., Shechner, T., & Aderka, I. M. (2016). Social anxiety and internet use–A meta-analysis: What do we know? What are we missing? *Computers in Human Behavior*, *62*, 221–229. https://doi.org/10.1016/j.chb.2016.04.003

Rücker, G., Schwarzer, G., Carpenter, J. R., & Schumacher, M. (2008). Undue reliance on I^2 in assessing heterogeneity may mislead. *BMC Medical Research Methodology*, *8*(1), 1–9. https://doi.org/10.1186/1471-2288-8-79

Sacks, D., Canadian Paediatric Society, & Adolescent Health Committee. (2003). Age limits and adolescents. *Paediatrics & Child Health*, *8*(9), 577–577.

Sadagheyani, H. E., & Tatari, F. (2021). Investigating the role of social media on mental health. *Mental Health and Social Inclusion*, *25*(1), 41–51. https://doi.org/10.1108/MHSI-06-2020-0039

Schlenker, B. R., & Leary, M. R. (1982). Social anxiety and self-presentation: A conceptualization model. *Psychological Bulletin*, *92*(3), 641. https://doi.org/10.1037/0033-2909.92.3.641

Schlenker, B. R., & Leary, M. R. (1985). Social anxiety and communication about the self. *Journal of Language and Social Psychology*, *4*(3–4), 171–192. https://doi.org/10.1177/0261927X8543002

Seabrook, E. M., Kern, M. L., & Rickard, N. S. (2016). Social networking sites, depression, and anxiety: A systematic review. *JMIR Mental Health*, *3*(4), e50. https://doi.org/10.2196/mental.5842

Shalom, J. G., Israeli, H., Markovitzky, O., & Lipsitz, J. D. (2015). Social anxiety and physiological arousal during computer mediated vs. Face to face communication. *Computers in Human Behavior*, *44*, 202–208. https://doi.org/10.1016/j.chb.2014.11.056

Social Anxiety Disorder. (2017, November). https://www.nimh.nih.gov/health/statistics/social-anxiety-disorder.shtml

Spruit, A., Assink, M., van Vugt, E. S., van der Put, C. E., & Stams, G. J. J. M. (2016). The effects of physical activity interventions on psychosocial outcomes in adolescents: A meta-analytic review. *Clinical Psychology Review*, *45*, 56–71. https://doi.org/10.1016/j.cpr.2016.03.006

Statista. (2022, June 15). *Number of social media users Worldwide from 2017 to 2027 (In Billions) [Graph]*. Retrieved April 6, 2023, from https://www-statista-com/statistics/278414/number-of-worldwide-social-network-users/

Statista. (2023, June 8). *Social media and generation Z in the United States*. Retrieved July 16, 2023, from https://www-statista-com/study/136194/social-media-and-generation-z-in-the-united-states/

Stein, M. B., & Stein, D. J. (2008). Social anxiety disorder. *The Lancet*, *371*(9618), 1115–1125. https://doi.org/10.1016/S0140-6736(08)60488-2

Twenge, J. M., & Martin, G. N. (2020). Gender differences in associations between digital media use and psychological well-being: Evidence from three large datasets. *Journal of Adolescence*, *79*(1), 91–102. https://doi.org/10.1016/j.adolescence.2019.12.018

Valkenburg, P. M., Schouten, A. P., & Peter, J. (2005). Adolescents' identity experiments on the internet. *New Media & Society*, *7*(3), 383–402. https://doi.org/10.1177/1461444805052282

Wang, J.-L., Jackson, L. A., & Zhang, D.-J. (2011). The mediator role of self-disclosure and moderator roles of gender and social anxiety in the relationship between Chinese adolescents' online communication and their real-world social relationships. *Computers in Human Behavior*, *27*(6), 2161–2168. https://doi.org/10.1016/j.chb.2011.06.010

Weber, R., & Popova, L. (2012). Testing equivalence in communication research: Theory and application. *Communication Methods and Measures*, *6*(3), 190–213. https://doi.org/10.1080/19312458.2012.703834

Yang, Z. J., Aloe, A. M., & Feeley, T. H. (2014). Risk information seeking and processing model: A meta-analysis. *Journal of Communication*, *64*(1), 20–41. https://doi.org/10.1111/jcom.12071

Zhang, L., Li, C., Zhou, T., Li, Q., & Gu, C. (2022). Social networking site use and loneliness: A meta-analysis. *The Journal of Psychology*, *156*(7), 492–511. https://doi.org/10.1080/00223980.2022.2101420

Zimbardo, P. G. (1977). *Shyness: What it is, what to do about it*. Addison-Wesley Pub. Co.

Zuo, X.-N., Xu, T., & Milham, M. P. (2019). Harnessing reliability for neuroscience research. *Nature Human Behaviour*, *3*(8), 768–771. https://doi.org/10.1038/s41562-019-0655-x

Zywica, J., & Danowski, J. (2008). The faces of facebookers: Investigating social enhancement and social compensation hypotheses; predicting Facebook[TM] and offline popularity from sociability and self-esteem, and mapping the meanings of popularity with semantic networks. *Journal of Computer-Mediated Communication*, *14*(1), 1–34. https://doi.org/10.1111/j.1083-6101.2008.01429.x

The following references of studies are included in the meta-analysis.

Akhter, S., Islam, M. H., Haider, S. K. U., Ferdous, R., & Runa, A. S. (2022). Moderating effects of gender and passive Facebook use on the relationship between social interaction anxiety and preference for online social interaction. *Journal of Human Behavior in the Social Environment*, *32*(6), 719–737. https://doi.org/10.1080/10911359.2021.1955801

Berryman, C., Ferguson, C. J., & Negy, C. (2018). Social media use and mental health among young adults. *Psychiatric Quarterly*, *89*(2), 307–314. https://doi.org/10.1007/s11126-017-9535-6

Charmaraman, L., Lynch, A. D., Richer, A. M., & Zhai, E. (2022). Examining early adolescent positive and negative social technology behaviors and well-being during the COVID-19 pandemic. *Technology, Mind, and Behavior*, *3*(1). https://doi.org/10.1037/tmb0000062

Creasy, B. (2012). *The Association of social anxiety and parenting factors with adolescent use of Facebook* [Doctoral dissertation, West Virginia University]. ProQuest.

Davidson, T., & Farquhar, L. K. (2014). Correlates of social anxiety, religion, and Facebook. *Journal of Media & Religion*, *13*(4), 208–225. https://doi.org/10.1080/15348423.2014.971566

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. Scopus. https://doi.org/10.1016/j.abrep.2018.100150

Erliksson, O. J., Lindner, P., & Mörtberg, E. (2020). Measuring associations between social anxiety and use of different types of social media using the Swedish social anxiety scale for social media users: A psychometric evaluation and cross-sectional study. *Scandinavian Journal of Psychology*, *61*(6), 819–826. Scopus. https://doi.org/10.1111/sjop.12673

Fardouly, J., Magson, N. R., Rapee, R. M., Johnco, C. J., & Oar, E. L. (2020). The use of social media by Australian preadolescents and its links with mental health. *Journal of Clinical Psychology*, *76*(7), 1304–1326. https://doi.org/10.1002/jclp.22936

Hawes, T., Zimmer-Gembeck, M. J., & Campbell, S. M. (2020). Unique associations of social media use and online appearance preoccupation with depression, anxiety, and appearance rejection sensitivity. *Body Image*, *33*, 66–76. https://doi.org/10.1016/j.bodyim.2020.02.010

Hoffman, Y. S. G., Grossman, E. S., Bergman, Y. S., & Bodner, E. (2021). The link between social anxiety and intimate loneliness is stronger for older adults than for younger adults. *Aging & Mental Health*, *25*(7), 1246–1253. https://doi.org/10.1080/13607863.2020.1774741

Hu, X., Kim, A., Siwek, N., & Wilder, D. (2017). The Facebook paradox: Effects of facebooking on individuals' social relationships and psychological well-being. *Frontiers in Psychology*, *8*, 87. https://doi.org/10.3389/fpsyg.2017.00087

Jarrar, Y., Awobamise, A. O., & Nweke, G. E. (2022). The mediating effect of social anxiety on the relationship between social media use and body dissatisfaction among university students. *Frontiers in Communication*, *95*. https://doi.org/10.3389/fcomm.2022.900257

Jiang, S., & Ngien, A. (2020). The effects of instagram use, social comparison, and self-esteem on social anxiety: A survey study in Singapore. *Social Media+ Society*, *6*(2), 2056305120912488. https://doi.org/10.1177/2056305120912488

Lake Yimer, B. (2021). Social media usage, psychosocial wellbeing and academic performance. *International Quarterly of Community Health Education*, *0*, 1–7. https://doi.org/10.1177/0272684X211033482

McCord, B., Rodebaugh, T. L., & Levinson, C. A. (2014). Facebook: Social uses and anxiety. *Computers in Human Behavior*, *34*, 23–27. https://doi.org/10.1016/j.chb.2014.01.020

Resnik, F., & Bellmore, A. (2021). Is peer victimization associated with adolescents' social media use, engagement, behavior, and content? *Merrill-Palmer Quarterly*, *67*(2), 175–202. https://doi.org/10.13110/merrpalmquar1982.67.2.0175

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

She, R., Han Mo, P. K., Li, J., Liu, X., Jiang, H., Chen, Y., Tak Fai Lau, J., & Ma, J. T. (2023). The double-edged sword effect of social networking use intensity on problematic social networking use among college students: The role of social skills and social anxiety. *Computers in Human Behavior*, *140*, 107555. https://doi.org/10.1016/j.chb.2022.107555

Thorisdottir, I. E., Sigurvinsdottir, R., Kristjansson, A. L., Allegrante, J. P., Lilly, C. L., & Sigfusdottir, I. D. (2020). Longitudinal association between social media use and psychological distress among adolescents. *Preventive Medicine*, *141*, 106270. Scopus. https://doi.org/10.1016/j.ypmed.2020.106270

Toh, L.-A., Millear, P., Allen, A., & Kannis-Dymand, L. (2022). Putting on your best face: Investigating social anxiety in Instagram users. *Australian Psychologist*, *57*(3), 197–208. Scopus. https://doi.org/10.1080/00050067.2022.2061328

Vancu, G., & Egerău, A. (2022). Impact of online activity upon social phobia in young adults. In D. Rad, T. Dughi & R. Maier (Eds.), *Applied research in digital wellbeing* (pp. 63–80). Peter Lang.

Weiss, D. E. (2013). *The relationship between internet social networking, social anxiety, self esteem, narcissism, and gender among college students* [Doctoral dissertation, Pace University]. ProQuest.

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*(3), 277–288. Scopus. https://doi.org/10.1111/sjop.12530

Yıldız Durak, H. (2020). Modeling of variables related to problematic internet usage and problematic social media usage in adolescents. *Current Psychology*, *39*(4), 1375–1387. Scopus. https://doi.org/10.1007/s12144-018-9840-8

Zheng, P., & Leung, L. (2016). Linking psychological attributes, gratifications and social networking site use to social capital of the net generation in China. *International Journal of Cyber Behavior, Psychology and Learning (IJCBPL)*, *6*(3), 17–33. https://doi.org/10.4018/IJCBPL.2016070102

Zheng, P., & Li, X. (2016). Is social media for everyone?: The role of social capital and communication anxiety in structuring use of social networking sites. *Journal of Social Media Studies*, *2*(2), 75–85. https://doi.org/10.15340/2147336622972