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Meta-analysis of associations between five-factor personality traits and problematic social media use

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Abstract
This meta-analysis quantified the relationship between the five-factor model of personality and problematic social media use and identified moderators of this relationship. The analysis used a random-effects model to calculate a correlation for each factor and included 113 samples, with a total of 53,913 participants, identified from systematic searches of four databases. Moderator analyses were used to investigate potential causes of heterogeneity. The meta-analysis found that high neuroticism ($r = .21$, $p < .001$, 95% CI [.19, .23]), low conscientiousness ($r = -.16$, $p < .001$, 95% CI [-.19, -.13]), low agreeableness ($r = -.07$, $p < .001$, 95% CI [-.10, -.05]), and low openness ($r = -.04$, $p = .001$, 95% CI [-.06, -.02]) were significantly associated with problematic social media use. Several significant moderator effects were found. The meta-analysis contributes to the understanding of the relationship between individual characteristics and problematic social media use and provides information that might be useful in preventing and treating this behaviour.

Keywords Addiction · Five-factor · Big Five · Personality · Problematic · Social media · Social networking

Introduction

Social media sites are online platforms that allow users to share messages and other content. Commonly used social media sites (also called social networking sites) include Facebook, Instagram, LinkedIn, Snapchat, YouTube, TikTok, WeChat, and Reddit. Research into the psychological consequences of social media use has grown exponentially over the past decade as Facebook and other platforms have gained huge popularity, becoming ubiquitous in the daily lives of many people worldwide (Kuss & Griffiths, 2017).

Conceptualisation and measurement of problematic social media use

There is a growing base of empirical evidence suggesting that excessive social media use may lead to symptoms traditionally associated with substance-related addictions and gambling disorder (Andreassen, 2015). However, since social media addiction lacks proper diagnostic criteria, there is a lack of consistency in how this concept is defined and measured, making it hard to provide a single definition of the phenomena (Kuss & Griffiths, 2017). Additionally, there is debate regarding whether addiction nomenclature can be appropriately applied to problematic social media use (Kardefelt-Winther et al., 2017). Due to these concerns, we will use *problematic social media use* to refer to a pattern of social media use that is characterised by the occurrence of addiction-like symptoms that lead to negative consequences.

Many studies measure problematic social media use using the following six components of addiction in a biopsychosocial model proposed by Griffiths (2005): salience, mood modification, tolerance, withdrawal, relapse, and conflict. Kuss and Griffiths (2017) presented evidence that all of these components may be present in some excessive social media users. Kuss and Griffiths stated that some individuals are intensely preoccupied with using or thinking about

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social media (salience). They use these platforms to induce mood alterations, pleasurable feelings, or a numbing effect (mood modification). An increasing amount of time using social media is required to experience the same feelings that occurred during the initial phases of usage (tolerance). When social media use is reduced, these individuals experience negative psychological and sometimes physiological symptoms (withdrawal), often leading to a reinstatement of their social media use (relapse). Finally, intrapsychic or interpersonal conflicts occur due to excessive social media use (conflict). The Bergen Facebook Addiction Scale (Andreassen et al., 2012) and Bergen Social Media Addiction Scale (Andreassen et al., 2017) are common scales for measuring problematic social media use that assess Griffiths' (2005) six components of addiction.

Other researchers have adopted different conceptualisations of problematic social media use. For example, researchers adapted the Internet Addiction Test (IAT) proposed by Young (1998) to measure addiction to social media specifically (Kircaburun & Griffiths, 2018). The conceptualisation underlying the IAT is based on the criteria for pathological gambling, with test items assessing factors such as preoccupation with Internet use and concealment of use (Young, 1998). Other studies refrain from employing addiction nomenclature and refer to the phenomenon as *problematic social media use* (Marino et al., 2018). A common conceptualisation of problematic social media use is based on the cognitive-behavioural aspects of problematic Internet use in a model proposed by Caplan (2010). Problematic social media use in this model includes the dimensions of preference for online social interaction (over in-person interaction), mood regulation, cognitive preoccupation, compulsive use, and negative outcomes (Caplan, 2010). Researchers typically adapt Young's (1998) IAT or Caplan's (2010) Problematic Internet Use Scale to specifically measure problematic social media use by replacing the word "Internet" in scale items with the type of social media they are interested in, such as "Instagram" (Kircaburun & Griffiths, 2018).

Relationships between five-factor traits and problematic social media use

Researchers have investigated how the five-factor trait model of personality is related to problematic social media use (Marino et al., 2018). This model describes five dimensions in human personality: extraversion (being energetic, enthusiastic, outgoing, and talkative), agreeableness (being generous, kind, trusting, and sympathetic), conscientiousness (being efficient, organised, reliable, and responsible), neuroticism (being anxious, touchy, and unstable), and openness (being curious, imaginative, insightful, and original; McCrae & John, 1992).

The majority of studies investigating problematic social media use have focused on problematic Facebook use; less is known about personality factors associated with problematic use of social media in general, and whether these traits differ from those associated with problematic use of Facebook specifically (Balcerowska et al., 2022). Marino et al.'s (2018) meta-analysis of five-factor traits associated with problematic Facebook use found that neuroticism and conscientiousness had the strongest associations with problematic Facebook use, with the remaining traits being weakly associated. Previous research on the associations between five-factor personality traits and problematic social media use have produced inconsistent findings for openness, agreeableness, and extraversion, with significant variations in the strength and direction of the associations (Atroszko et al., 2018; Dong et al., 2018). Some researchers have theorised that these inconsistent findings could be due to cultural factors that vary depending on the country in which the study is conducted (Błachnio et al., 2016; Błachnio et al., 2017). Błachnio et al. (2016) conducted a cross-cultural study across eight countries including 2628 participants and found that high neuroticism and low conscientiousness was significantly associated with greater problematic social media use in each sample; however, the correlations for the remaining five-factor traits were inconsistent across the eight samples, varying in strength, direction, and significance. Błachnio et al. (2017) reported similar findings across three countries and 1011 participants, finding that only neuroticism and conscientiousness were significantly associated across the three countries studied. A meta-analysis would allow the consolidation of effect sizes found regarding problematic social media use in a wider range of locations and settings and would allow investigation of whether characteristics of studies such as the scales used, mean sample age, and other demographic characteristics moderate the effect sizes.

Aim and hypotheses

The aim of this meta-analysis was to synthesise and quantify the findings of studies reporting associations between five-factor personality traits and problematic social media use. A key objective of this meta-analysis was to provide a comprehensive review of research in this field by adopting a broader conceptualisation of problematic social media use compared to previous reviews focusing on problematic Facebook use specifically. Additionally, this meta-analysis aimed to evaluate a broad range of moderators that might explain the heterogeneity in effect sizes, namely sex, age, geographical location, type of problematic social media use measured, type of scale used to measure problematic social

media use, and type of scale used to measure personality. Based on meta-analytic findings regarding a subcomponent of problematic social media use, namely problematic Facebook use (Akbari et al., 2023; Marino et al., 2018), as well as cross-cultural research on problematic Facebook use (Błachnio et al., 2016; Błachnio et al., 2017), the hypotheses for this meta-analysis were that higher neuroticism and lower conscientiousness, openness, agreeableness, and extraversion would be associated with greater problematic social media use.

Method

Search strategy

The protocol for this meta-analysis was published in the International Prospective Register of Systematic Reviews, registration number CRD42021267184. We systematically searched the following databases: EBSCO, EBSCO Open Dissertations, ProQuest, and PubMed. Keywords used were Big-Five, five-factor, neuroticism, "emotional stability", extraversion, introversion, openness, agreeableness, conscientiousness, addict*, abuse, misuse, overuse, intrusion, "excessive use", "compulsive use", "problem* use", "social media", "social network* site", "online social network*", and the names of several social networking sites (Facebook, Instagram, WhatsApp, YouTube, Twitter, Reddit, TikTok, Snapchat, LinkedIn, WeChat, and Weibo). No restrictions were placed on publication date or language. Reference lists of included articles were searched to identify additional relevant research, and then the "cited by" function in Google Scholar was used on included articles to identify further relevant research. Studies were screened by title and abstract, and then full text. This literature search was completed in October 2023.

Eligibility criteria

One requisite for inclusion in the meta-analysis was use of a valid measure for the measurement of addictive or problematic social media use. Studies were excluded if they only measured social media use rather than problematic use or if they measured problematic Internet use in general rather than problematic social media use.

Data extraction and coding

Data extracted to calculate effect sizes were the Pearson correlation *r* and the sample size. The following sample characteristics were coded: gender distribution (% of female participants), mean participant age, country in which the study was conducted, scale used to measure problematic social media use, type of problematic social media use measured, and scale used to measure personality. When studies did not report correlations, we contacted the corresponding author of the study to obtain the missing information. Missing correlations were obtained for eight studies. A third of the studies were checked by two independent coders and the agreement between the two independent coders was 97%.

Data analysis

Analyses were performed using Comprehensive Meta-Analysis Software (CMA; version 3.3.070), using the Hedges and Olkin approach to calculate effect sizes for meta-analysis. A separate meta-analysis was conducted for each five-factor trait, using *r* as the effect size. Meta-analyses were performed using a random-effects model, as the true effect size likely varies across studies due to significant heterogeneity in sample characteristics and the questionnaires used to assess personality and problematic social media use. Heterogeneity of effect sizes was evaluated using (i) Cochran's Q to test heterogeneity, (ii) the I^2 statistic of proportion of true variation in observed effects not due to sampling bias, and (iii) tau^2 to estimate variance of underlying true effects across studies.

A relative weight analysis (Johnson, 2000) was used to examine the incremental predictive validity of each five-factor trait for predicting problematic social media use. To conduct this analysis, we constructed a meta-analytic correlation matrix using the meta-analytic correlations reported in the present meta-analysis between five-factor personality traits and problematic social media use, as well as previously reported meta-analytic correlations between five-factor traits. We followed the recommendations of Park et al. (2020) and used the meta-analytic correlations between five-factor traits reported in Steel et al. (2018), since these appeared to have the largest k and N out of the reported meta-analytic estimates.

We conducted sensitivity analyses for our primary analyses of the meta-analytic effect size for each five-factor trait, using the one-study removed method. This involved running the meta-analysis for each trait multiple times with a different single study removed to evaluate whether the meta-analytic effect size was heavily influenced by any single study. Additionally, we used selection models (Vevea & Hedges, 1995; Vevea & Woods, 2005) to evaluate whether the results of the meta-analysis are distorted by publication bias. A selection model adjusts the estimated meta-analytic effect size to account for the fact that not all effect sizes are equally likely to be published. This adjusted estimate can then be compared to the unadjusted estimate to evaluate publication bias, using a likelihood ratio test (LRT).

Sex-related effects were evaluated using a continuous measure of the percentage of female participants in each sample. Age-related effects were evaluated using the mean age in each sample. The effect of sex and age on the effect size for each five-factor trait was measured using multivariate mixed-effect meta-regression models (van Houwelingen et al., 2002). Additionally, we evaluated the effects of the following categorical moderators: type of social media, type of addiction scale, type of personality scale, location (country), and location (continent).

Potential publication bias was evaluated with rank correlation Kendall tau, Egger's regression test, and the trim and fill method. The Kendall tau method was used to analyse the correlation between effect sizes and variances of these effects, for which the lack of a significant correlation can be interpreted as absence of publication bias (Begg & Mazumdar, 1994). Egger's regression test was used to test for asymmetry of the funnel plot, for which the lack of significant asymmetry can be interpreted as absence of publication bias (Egger et al., 1997). We used the trim and fill method (Duval & Tweedie, 2000) to check whether additional studies needed to be imputed and to measure how imputed studies would change the effect size estimate.

Results

Results of literature search

Studies were identified through database searches using keywords, searching reference lists, and using the "cited by" function on Google Scholar. Several of the studies included in the meta-analysis contained multiple independent samples (Błachnio et al., 2017), resulting in a total of 113 independent samples. Figure 1 presents a PRISMA Flow Diagram (Moher et al., 2009) containing information about the study selection process. The final data file for these 113 samples is at https://doi.org/10.17605/OSF.IO/EF59J.

Sample characteristics

Table 1 provides summary information for each study. The 113 independent samples analysed in the meta-analysis included data on 53,913 participants (60% females, $M_{age}=24$ years, $SD_{age}=7$ years). Samples measured problematic social media use in general ($k=42$), or problematic use of specific social media sites: Facebook ($k=64$), Instagram ($k=5$), WeChat ($k=3$), Snapchat ($k=1$), Twitter ($k=1$), QQ ($k=1$) and WhatsApp ($k=1$). Two studies measured three different types of problematic social media use (Sheldon et al., 2020; Sindermann et al., 2020b), and one study measured problematic social media use by assessing both problematic Facebook use and problematic social media use in general (Balcerowska et al., 2022). For studies that administered multiple measures of problematic social media use, the effect size of the correlation between problematic social media use and each personality trait was calculated by averaging the outcomes across the different measures of problematic social media use.

Measures used in the studies

The scales used to measure problematic social media use in the included studies are listed in Table 2. Most samples used either the Bergen Facebook Addiction Scale or the Bergen Social Media Addiction Scale ($k=59$) as a measure of problematic social media use, with the remaining samples using the Facebook Intrusion Questionnaire ($k=10$), adapted versions of the General Problematic Internet Use Scale ($k=5$), adapted versions of the Internet Addiction Test ($k=5$), the Psycho-Social Aspects of Facebook Use scale ($k=6$), the Social Media Disorder Scale ($k=5$), the Social Media Use Questionnaire ($k=3$), or other measures of problematic social media use ($k=20$).

The scales used to measure five-factor personality traits in the included studies are listed in Table 2. Approximately half of the samples ($k=51$) used the Big Five Inventory to measure five-factor traits, followed by the Ten Item Personality Inventory ($k=33$), the International Personality Item Pool ($k=7$), and the NEO Five-Factor Inventory ($k=5$).

Meta-analytic effect size

Table 3 presents the meta-analytic correlations, along with Q tests for heterogeneity, I^2, and tau^2. Forest plots of effect sizes included in the meta-analyses are presented in Figures S1-S5 in the online supplementary information. High neuroticism had the strongest correlation with problematic social media use, followed by low conscientiousness. Small but significant correlations were found between problematic social media use and low openness and low agreeableness. Extraversion was not significantly correlated with problematic social media use. Q tests were significant for each trait, indicating significant heterogeneity in the effect size for each trait across different studies. This heterogeneity indicated by the Q tests and the high I^2 values justified moderator analyses.

Relative weight analysis

A relative weight analysis was conducted to evaluate the degree to which each five-factor trait uniquely predicts problematic social media use. The results of this analysis are reported in Table 4. In addition to the raw relative weights,

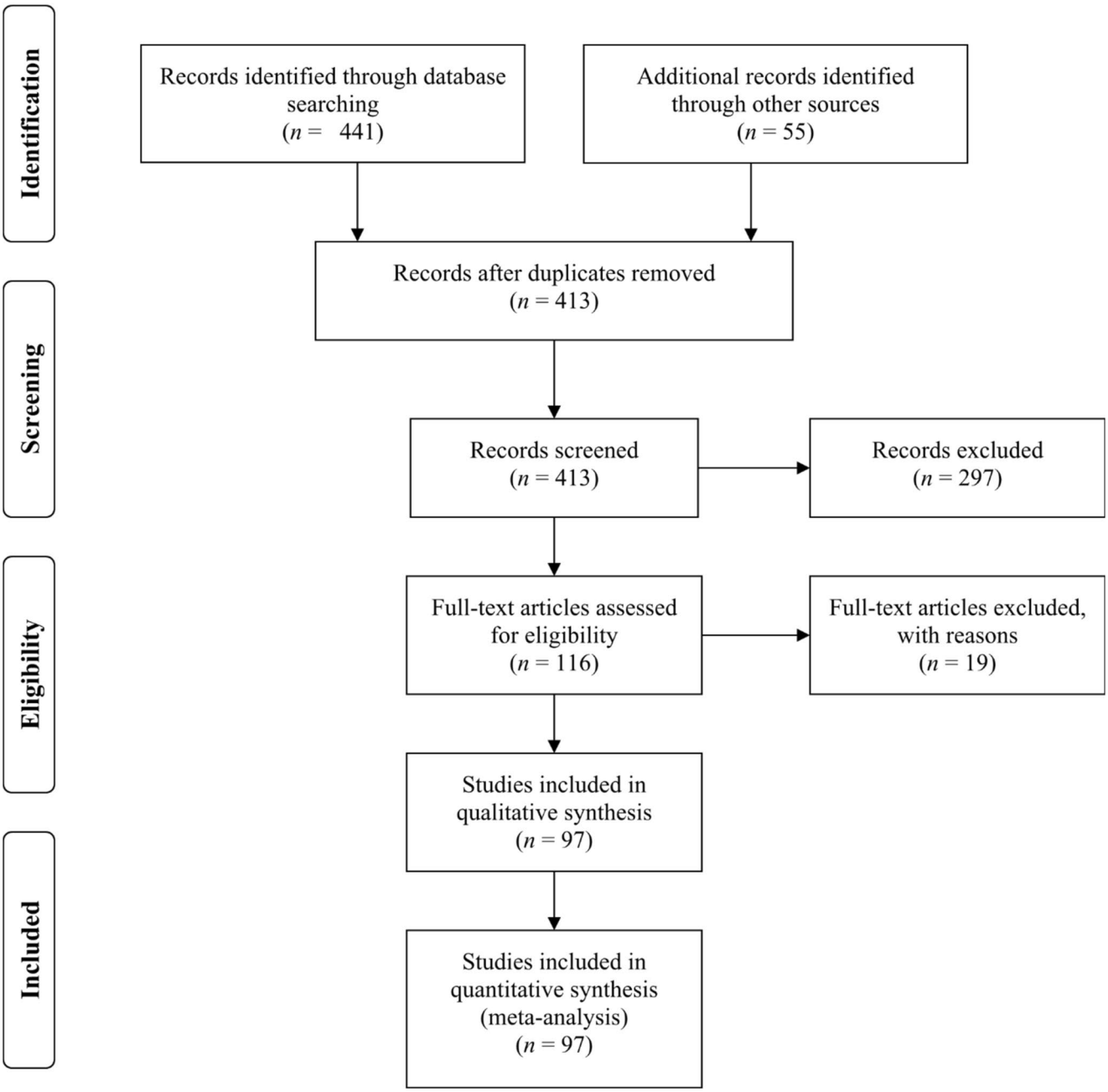

Fig. 1 PRISMA flow diagram of study selection

we reported the rescaled relative weights (% of R^2), which represent the percentage of explained variance in problematic social media use that is attributable to each predictor.

Moderator analyses

Table 5 presents the results of the continuous moderator analyses. Mean age was not reported by 22 samples that were therefore excluded from the continuous moderator analyses, which included the remaining 91 samples. None of the meta-analytic effect sizes were moderated by the percentage of females in the sample. However, the meta-analytic effect sizes for openness and extraversion were moderated by the mean age of the sample. For openness, a meta-regression showed a significant association between a higher mean age of the sample and a weaker effect size for the negative association with problematic social media use, after controlling for percentage of females. For extraversion, a meta-regression showed a significant association between a higher mean age of the sample and a stronger effect size for the positive association with problematic social media use, after controlling for percentage of females.

Table 1 Information about samples included in the meta-analysis

Study	Sample size	% female	Mean age of sample	Country	Name of personality scale	Type of social media	Name of addiction scale	Type of addiction scale	O	C	E	A	N
Abbasi and Drouin (2019)	742	64	27	USA	BFI	Facebook	FIQ	FIQ					0.100
Ahmad and Iqbal (2021)	300	50		Pakistan	IPIP	Facebook	BFAS	Bergen	-0.152	-0.306	0.298	-0.031	0.147
Akdeniz (2022)	705	69	28	Turkey	BFI	Social media	BSMAS	Bergen	-0.024	-0.361	-0.026	-0.126	0.433
Alshakhsi et al. (2023) (Arab)	251	29	31	Arab mix	BFI	Social media	SMDS	SMDS	0.010	-0.210	0.060	0.010	0.300
Alshakhsi et al. (2023) (Euro)	262	42	39	EU mix	BFI	Social media	SMDS	SMDS	0.030	-0.130	0.030	0.090	0.230
Andreassen et al. (2013)	218	78	21	Norway	NEO-FFI	Facebook	BFAS	Bergen	-0.160	-0.280	0.050	-0.150	0.120
Assunção and Matos (2017)	744	46	16	Portugal	TIPI	Facebook	GPIUS-2	GPIUS	-0.150	-0.110	-0.210	-0.070	0.050
Atroszko et al. (2021)	327	58	21	Poland	TIPI	Facebook	BFAS	Bergen	-0.060	-0.050	0.100	0.000	0.030
Atroszko et al. (2018)	1157	52	20	Poland	TIPI	Facebook	BFAS	Bergen	-0.070	-0.070	0.040	-0.050	0.150
Balcerowska et al. (2019)	486	64	22	Poland	TIPI	Facebook	BFAS	Bergen	-0.050	-0.130	0.020	-0.020	0.180
Balcerowska et al. (2022)	1099	72	21	Poland	TIPI	Facebook, social media	BFAS, BSMAS	Bergen	-0.020	-0.135	0.060	-0.030	0.220
Balta et al. (2020)	423	53	17	Turkey	ABPT	Instagram	SMUQ	SMUQ					0.260
Biolcati et al. (2018)	755	80	25	Italy	BFI	Facebook	BFAS	Bergen	-0.098	-0.289	0.024	-0.131	0.260
Błachnio and Przepiorka (2016)	452	67	21	Poland	TIPI	Facebook	BFAS	Bergen	-0.170	-0.160	-0.030	-0.080	0.140
Błachnio et al. (2016) (China)	388	63	19	China	TIPI	Facebook	FIQ	FIQ	-0.090	-0.110	0.090	-0.050	0.240
Błachnio et al. (2016) (Greece)	253	40	27	Greece	TIPI	Facebook	FIQ	FIQ	-0.360	-0.350	0.020	-0.240	0.230
Błachnio et al. (2016) (Israel)	311	81	32	Israel	TIPI	Facebook	FIQ	FIQ	0.040	-0.080	0.010	-0.070	0.200
Błachnio et al. (2016) (Italy)	317	67	25	Italy	TIPI	Facebook	FIQ	FIQ	-0.030	-0.270	0.100	-0.110	0.330
Błachnio et al. (2016) (Poland)	453	52	35	Poland	TIPI	Facebook	FIQ	FIQ	-0.200	-0.330	-0.060	-0.210	0.190
Błachnio et al. (2016) (Romania)	273	46	20	Romania	TIPI	Facebook	FIQ	FIQ	0.060	-0.030	-0.030	0.060	0.160
Błachnio et al. (2016) (Turkey)	395	69	24	Turkey	TIPI	Facebook	FIQ	FIQ	-0.160	-0.220	-0.170	-0.130	0.210
Błachnio et al. (2016) (USA)	238	72	24	USA	TIPI	Facebook	FIQ	FIQ	-0.180	-0.040	-0.120	-0.060	0.270
Błachnio et al. (2017) (Poland)	350	67	21	Poland	TIPI	Facebook	BFAS	Bergen	-0.200	-0.170	-0.060	-0.110	0.200
Błachnio et al. (2017) (Turkey)	320	66	22	Turkey	TIPI	Facebook	BFAS	Bergen	-0.130	-0.240	-0.130	-0.060	0.160
Błachnio et al. (2017) (Ukraine)	341	67	22	Ukraine	TIPI	Facebook	BFAS	Bergen	-0.090	-0.280	0.050	-0.010	0.270
Blackwell et al. (2017)	207	75	22	USA	BFI	Social media	BSMAS	Bergen			0.062		0.274
Bodroža and Jovanović (2016)[a]	804	79	27	Serbia	BFI	Facebook	PSAFU	PSAFU	-0.017	-0.313	-0.101	-0.133	0.277
Boudreaux (2022)	71	89	48	USA	BFMM	Facebook	BFAS	Bergen			-0.022		0.063
Büttner et al. (2023)	506	49	40	UK	BFI	Social media	BSMAS	Bergen	-0.060	-0.220	0.030	0.010	0.340
Caci et al. (2017) (Study 2)	300	49	46	Italy	PI	Facebook	FAIQ	IAT	0.320	0.180	0.110	0.100	0.320
Charzyńska et al. (2021)	1157	52	20	Poland	TIPI	Facebook	BFAS	Bergen	-0.070	-0.080	0.040	-0.050	0.150
Chen and Roberts (2020)	304	38		USA	IPIP	Social media	BTAS	Other	-0.040	-0.060	0.020	-0.050	-0.001
Chen (2019)	314	38	23	USA	IPIP	Facebook	BTAS	Other	0.010	-0.170	0.070	-0.050	0.140
Chi et al. (2023)	1010	53		Taiwan	TIPI	Social media	BSMAS	Bergen	-0.055	-0.191	0.086	-0.134	0.072
Chung (2018)	177	71		USA	BFI	Instagram	SMDS	SMDS	-0.120	-0.150	-0.070	-0.060	0.280
Dailey et al. (2020)	290	82	20	USA	BFI	Social media	BSMAS	Bergen		-0.293			
De Cock et al. (2013)	1000	50	43	Belgium	QBFPT	Social media	BSMAS	Bergen		-0.126	-0.029	-0.085	0.280

Table 1 (continued)

Study	Sample size	% female	Mean age of sample	Country	Name of personality scale	Type of social media	Name of addiction scale	Type of addiction scale	O	C	E	A	N
Dong et al. (2018)	1058	51	35	China	BFI	WeChat	WAS	Other	0.196	0.099	0.218	0.162	0.019
Dunbar (2020) [unpublished]	447	74	28	Australia	BFI	Social media	BSMAS	Bergen	-0.160	-0.310	-0.050	-0.130	0.360
Ďuricová and Poliach (2023)[a]	284	50	18	Slovakia	IPIP	Social media	BSMAS	Bergen	-0.130	-0.200	-0.010	0.050	0.280
Ghos et al. (2018)	232	50		India	NEO-FFI	Facebook	BFAS	Bergen	0.090	-0.735	0.860	0.000	-0.038
Gingras et al. (2023)[a]	228	49	14	Canada	BFPTSQ	Social media	BSMAS	Bergen	0.120	-0.280	0.110	-0.170	0.240
Giota and Kleftaras (2013)	143	58	24	Greece	NEO-FFI	Social media	GPIUS-2	GPIUS	0.000	-0.080	0.050	-0.280	0.420
Gomez et al. (2022a, b)	968	33	30	Australia	BFI	Social media	BSMAS	Bergen	-0.020	-0.200	0.070	-0.100	0.280
Gomez et al. (2022a, b)[a]	1236	49	36	USA	BFI	Social media	BSMAS	Bergen	-0.070	-0.419	0.096	-0.315	0.318
Gugushvili et al. (2022)	210	55	30	Estonia	TIPI	Facebook	BFAS	Bergen			-0.151		0.320
Hasan and Yasir (2016)	339			Pakistan	BFI	Facebook	BFAS	Bergen	-0.020	-0.030	-0.050	-0.040	0.000
Hawi and Samaha (2019)	512	44	21	Lebanon	TIPI	Social media	SMAQ	FIQ	-0.107	-0.112	-0.048	-0.119	0.264
Hong et al. (2014)	241	42		Taiwan	LPT	Facebook	FAS	IAT					0.180
Horzum et al. (2022)	981	73	21	Turkey	BFI	Facebook	BFAS	Bergen	-0.262	-0.199	-0.128	-0.193	0.094
Hou et al. (2018)	714	62	20	China	PQ	WeChat	WEUS	Other		-0.025	0.057	-0.153	0.118
Hussain et al. (2019)	69	68	23	UK	TIPI	Facebook	BFAS	Bergen	0.133	-0.063	0.146	0.080	0.184
Jaradat and Jebreen (2017)	380	72.9		Jordan	BFI	Social media	SMAS	Other	0.165	0.030	0.026	0.030	0.072
Jijina (2021)	800	66		India	BFI	Social media	BSMAS	Bergen					0.280
Jovanović et al. (2023) (Croatia)[a]	268	83	22	Croatia	BFI	Facebook	PSAFU	PSAFU	-0.123	-0.280	-0.082	-0.166	0.087
Jovanović et al. (2023) (Iran)[a]	311	42	30	Iran	BFI	Facebook	PSAFU	PSAFU	0.072	-0.250	0.016	-0.108	0.141
Jovanović et al. (2023) (Italy)[a]	429	50	22	Italy	BFI	Facebook	PSAFU	PSAFU	0.019	-0.183	0.066	-0.114	0.172
Jovanović et al. (2023) (Serbia)[a]	373	71	22	Serbia	BFI	Facebook	PSAFU	PSAFU	0.015	-0.275	-0.092	-0.070	0.249
Jovanović et al. (2023) (UK)[a]	251	83	24	UK	BFI	Facebook	PSAFU	PSAFU	-0.140	-0.164	-0.076	-0.041	0.262
Kanat-Maymon et al. (2018)	337	55	33	Israel	BFI	Facebook	BFAS	Bergen	-0.100	-0.200	0.010	-0.020	0.150
Kanwal et al. (2019)	290	36		Pakistan	BFI	Facebook	FAS	Other	0.240		0.260		
Kavčič et al. (2019)	459	68	22	Slovenia	BFI	Social media	SMAS	Other	-0.050	-0.240	0.060	-0.140	0.240
Kircaburun and Griffiths (2018)	752	69	20	Turkey	BFI	Instagram	IAS	SMUQ	0.020	-0.110	-0.010	-0.190	0.110
Kircaburun (2016)	365	64		Turkey	BFI	Twitter	TAS	IAT	-0.130	-0.160	-0.190	-0.220	0.020
Kircaburun et al. (2020)	1008	60	20	Turkey	TIPI	Social media	SMUQ	SMUQ	-0.060	-0.100	-0.030	0.060	0.150
Kiziloglu et al. (2021)	514	41		Turkey	TIPI	Social media	IAS	Bergen	-0.080	-0.050	0.040	0.150	0.060
Lee (2015)	304	56	22	USA	IPIP	Facebook	BFAS	Bergen		-0.169	-0.097	-0.072	0.088
Lee (2019)	204	60	23	Malaysia	BFI	Social media	BSMAS	Bergen	-0.140	-0.190	-0.050	-0.180	0.180
Lee-Won et al. (2015)	243	72	20	USA	TIPI	Facebook	FAS	Other		-0.180	-0.020	0.030	0.080
Li et al. (2023)	896	68	21	China	CBF-PI	Social media	PMS-MUAQ	Other			-0.070		0.450
Lontos (2018)	476	74	24	Australia	TIPI	Social media	SMDS	SMDS	-0.120	-0.180	0.020	-0.180	0.230
López Rosales et al. (2021)	251	59	20	Mexico	BFI	Social media	SNAQ	Other	0.049	-0.155	0.045	-0.201	0.269
Maepa and Wheeler (2022)	240	56		South Africa	JEPQ-R	Facebook	BFAS	Bergen			-0.001		0.260
Mangalagiri and Kadiyala (2019)	131	62	24	India	BFI	Facebook	BFAS	Bergen	0.060	-0.300	-0.030	-0.150	0.270

Table 1 (continued)

Study	Sample size	% female	Mean age of sample	Country	Name of personality scale	Type of social media	Name of addiction scale	Type of addiction scale	O	C	E	A	N
Marino et al. (2016b)	968	38	17	Italy	BFQ	Facebook	PFUS	GPIUS	-0.180	0.010	-0.290	-0.140	0.310
Marino et al. (2016a)	815	77	21	Italy	BFQ	Facebook	PFUS	GPIUS	-0.070	0.010	-0.180	-0.060	0.220
Mercan and Uysal (2023)	244	75	22	Turkey	SF-5FPI	Social media	SMAS	Other	0.214	0.324	-0.028	0.169	-0.076
Miceli et al. (2022)	248	73	21	Italy	PI	Facebook	FAIQ	IAT	0.050	0.220	-0.090	0.030	0.150
Milošević-Đorđević and Žeželj (2014)	861	50		Serbia	BFI	Social media	SNSATS	Other			-0.100		
Montag et al. (2021)	932	76	21	China	BFI	Social media	BSMAS	Bergen	-0.006	-0.146	-0.005	-0.164	0.219
Moore and Craciun (2020)	156	56		USA	IPIP	Social media	SMATS	Other	-0.030	-0.210	0.060	-0.070	0.230
Mu et al. (2020)	1128	65	19	China	TIPI	Social media	PSAFU	PSAFU					0.177
Mulyani et al. (2018)	235	71		Indonesia	TIPI	Facebook	BFAS	Bergen					0.370
Orosz et al. (2016) (Study 3)	531	74	24	Hungary	BFI	Facebook	BFAS	Bergen	-0.050	-0.050	0.050	0.260	0.190
Ortiz de Gortari and Gackenbach (2021)	343	41		Canada	BFI	Social media	BSMAS	Bergen	-0.054	-0.060	0.118	0.067	0.123
Packer and Flack (2023)[a]	574	61		Australia	BFI	Social media	BSMAS	Bergen			0.210		0.228
Qahri-Saremi et al. (2022)	284	40	20	USA	TIPI	Facebook	FAS	Other	0.020	-0.110	-0.020	-0.040	0.230
Rachubińska et al. (2022)[a]	556	100	34	Poland	NEO-FFI	Facebook	BFAS	Bergen	0.040	-0.160	0.040	-0.080	0.260
Rajesh and Rangaiah (2020)	114	32		India	TIPI	Facebook	BFAS	Bergen	-0.140	-0.130	-0.120	0.110	-0.040
Rajesh and Rangaiah (2019)	348	47		India	TIPI	Facebook	BFAS	Bergen	-0.130	-0.028	0.002	-0.150	-0.091
Saini et al. (2017)	140	37	21	India	BFI	Facebook	BFAS	Bergen	0.062	-0.136	-0.362	-0.243	0.184
Sheldon et al. (2020)	252	57	23	USA	BFI	Facebook, Instagram, Snapchat	BFAS, BIAS, BSAS	Bergen	0.053	0.070	0.047	0.113	-0.090
Sindermann et al. (2020a)	2629	40	31	Germany	BFI	Facebook	FUDS	Other	-0.045	-0.150	0.015	-0.064	0.197
Sindermann et al. (2020b)[a]	355	28	25	EU mix	BFI	Facebook, Instagram, WhatsApp	FUDS	Other	0.044	-0.187	0.120	-0.159	0.250
Sindermann et al. (2022b) (QQ)	256	50	22	China	BFI	QQ	BSMAS	Bergen	0.090	-0.170	-0.040	-0.180	0.290
Sindermann et al. (2022b) (Wechat)	250	50	21	China	BFI	WeChat	BSMAS	Bergen	0.050	-0.150	-0.050	-0.160	0.270
Sindermann et al. (2022a)	440	69	20	USA	BFI	Social media	BSMAS	Bergen	0.010	-0.320	0.000	-0.170	0.370
Stead and Bibby (2017)	495	69	21	UK	TIPI	Social media	GPIUS	GPIUS	-0.070	-0.110	-0.150	-0.100	0.300
Sumaryanti et al. (2020)	483			Indonesia	IPIP	Social media	BSMAS	Bergen	-0.140	-0.014	0.419	0.414	0.438
Tang et al. (2016)	894	65		Taiwan	BFMM	Facebook	FAS	Other	0.010	-0.130	0.030	-0.080	0.320
Tanrikulu (2018) (adults)	344	53	19	Turkey	BFI	Social media	BSMAS	Bergen		-0.255			0.180
Tanrikulu (2018) (children)	315	50	16	Turkey	BFI	Social media	BSMAS	Bergen		-0.240			0.180
Tesi (2018)	580	62	32	Italy	BFI	Social media	BSMAS	Bergen	-0.010	-0.140	-0.030	-0.110	0.150
Tobin and Graham (2020)	283	84	28	Australia	BFI	Facebook	BFAS	Bergen	-0.060	-0.300	-0.080	-0.270	0.230
Toma (2018)	242	72	24	Romania	BFI	Facebook	FAS	IAT	-0.059	-0.302	-0.127	-0.256	0.364
Turel et al. (2018)	215	73	27	USA	BFI	Facebook	BFAS	Bergen					0.590
Vaghefi and Qahri-Saremi (2018)	275	51	21	USA	TIPI	Facebook	FAS	Other		-0.130		-0.070	0.170
Vangeel et al. (2016)	1002	51	15	Belgium	QBFPT	Social media	BSMAS	Bergen		-0.055	-0.060	-0.120	0.186
Visconte (2016)	267	72	38	USA	IPIP	Facebook	BFAS	Bergen			0.160		
Wartberg et al. (2023)	492	44	17	USA	BFI	Social media	SMDS	SMDS	-0.090	-0.190	-0.060	-0.190	0.280

Table 1 (continued)

Study	Sample size	% female	Mean age of sample	Country	Name of personality scale	Type of social media	Name of addiction scale	Type of addiction scale	O	C	E	A	N
Wilson et al. (2010)[b]	201	76	19	Australia	NEO-FFI	Social media	SMATS	Other	-0.040	-0.140	0.140	-0.010	0.110
Wong et al. (2023)	122	61		China	BFI	Facebook	BFAS	Bergen			-0.120		
Zafar (2018)	400			Pakistan	HEXACO	Facebook	BFAS	Bergen	0.280	-0.260	0.278	-0.246	0.321

O openness to experience; *C* conscientiousness; *E* extraversion; *A* agreeableness; *N* neuroticism; *BFAS* Bergen Facebook Addiction Scale; *BSMAS* Bergen Social Media Addiction Scale, *Bergen* Bergen Facebook Addiction Scale or Bergen Social Media Addiction Scale, *FIQ* Facebook Intrusion Questionnaire, *IAT* Internet Addiction Test, *GPIUS* General Problematic Internet Use Scale, *SMDS* Social Media Disorder Scale, *SMUQ* Social Media Use Questionnaire, *Other* other custom measure of problematic social media use, *PSAFU* Psycho-Social Aspects of Facebook Use, *FAS* Facebook Addiction Scale, *FAIQ* Facebook Addiction Italian Questionnaire, *BTAS* Behavioural Technology Addiction Scale, *PMSMUAQ* Problematic Mobile Social Media Usage Assessment Questionnaire, *SMAS* Social Media Addiction Scale, *WAS* WeChat Addiction Scale, *SNAQ* Social Networking Addiction Questionnaire, *SMATS* Social Media Addictive Tendencies Scale, *FUDS* Facebook Use Disorder Scale, *SNSATS* Social Networking Site Addictive Tendencies Scale; *BFI* Big Five Inventory, *IPIP* International Personality Item Pool, *NEO-FFI* NEO Five-Factor Inventory, *TIPI* Ten Item Personality Inventory, *ABPT* Adjective Based Personality Test, *BFMM* Big Five Mini Markers, *PI* Personality Inventory, *BFPTSQ* Big Five Personality Trait Short Questionnaire, *LPT* Lai Personality Test, *PQ* Personality Questionnaire, *QBFPT* Quick Big Five Personality Test, *CBF-PI* Chinese Big Five Personality Inventory, *JEPQ-R* Junior Eysenck Personality Questionnaire – Revised, *BFQ* Big Five Questionnaire, *SF-5FPI* Short Form Five-Factor Personality Inventory

[a]Correlations are not reported in the paper and were obtained through emailing the corresponding author

[b]Correlations are not reported in the paper but were reported in Huang (2022)

Tables 6, 7, 8, 9, and 10 present the results of the categorical moderator analyses. For openness, the effect size significantly differed depending on the type of personality scale used, with studies using the BFI and NEO-FFI reporting weaker correlations in comparison to studies using the other scales.

For conscientiousness, the effect size significantly differed depending on the type of addiction scale used, with studies using the GPIUS and IAT reporting weaker correlations in comparison to studies using the other scales.

For extraversion, the effect size significantly differed depending on the type of addiction scale used, and the location of the study (both country and continent). Estimates varied widely depending on the type of addiction scale used: from -0.178 for studies using the GPIUS to 0.042 for studies using the Bergen Facebook Addiction Scale and the Bergen Social Media Addiction Scale.

For agreeableness, the effect size did not significantly differ depending on any of the moderators we examined.

For neuroticism, the effect size significantly differed depending on the country in which the study was conducted, with estimates ranging from 0.097 for Pakistan to 0.303 for the UK.

Sensitivity analyses

One-study-removed analyses for each five-factor trait revealed that none of the included studies substantially influenced the meta-analytic effect size. For each trait, when any study was removed from the analysis, the meta-analytic effect size remained within the 95% confidence interval of the meta-analytic effect size calculated by including all studies.

The LRTs comparing the adjusted and unadjusted models (using p-value cut points of 0.05, 0.01, and 0.001) were not significant for conscientiousness ($p = 0.60$), extraversion ($p = 0.20$), agreeableness ($p = 0.78$), and neuroticism ($p = 0.25$). This result suggests that the meta-analytic estimates for these traits were not significantly affected by publication bias. However, the LRT for openness was significant ($p = 0.001$), and the adjusted estimate for openness ($r = -0.005$) was considerably weaker than the unadjusted estimate ($r = -0.04$), suggesting that the meta-analytic estimate for openness may be inflated due to publication bias.

Publication bias

Results of calculations for Kendall tau, Egger's intercept test, and imputed studies using the trim and fill method (Duval & Tweedie, 2000) are shown in Table 11. For the most part, these tests suggested that the meta-analytic

Table 2 Scales used in included studies to measure problematic social media use and personality traits

Name of Scale	Reference(s)
Problematic social media use scales included in the moderator analyses	
Bergen Facebook Addiction Scale (BFAS)	Andreassen et al. (2012)
Bergen Social Media Addiction Scale (BSMAS)	Andreassen et al. (2017)
Facebook Intrusion Questionnaire (FIQ)	Elphinston and Noller (2011)
Internet Addiction Test (IAT)	Young (1998)
General Problematic Internet Use Scale (GPIUS)	Caplan (2010)
Social Media Disorder Scale (SMDS)	van den Eijnden et al. (2016)
Social Media Use Questionnaire (SMUQ)	Xanidis and Brignell (2016)
Problematic social media use scales not included in the moderator analyses	
Psycho-Social Aspects of Facebook Use (PSAFU)	Bodroža and Jovanović (2016)
Facebook Addiction Scale (FAS)	Turel (2015)
Facebook Addiction Scale (FAS)	Koc and Gulyagci (2013)
Facebook Addiction Italian Questionnaire (FAIQ)	Ferraro et al. (2006)
Behavioural Technology Addiction Scale (BTAS)	Charlton (2002)
Problematic Mobile Social Media Usage Assessment Questionnaire (PMSMUAQ)	Jiang (2018)
Social Media Addiction Scale (SMAS)	Karadağ et al. (2015)
Social Media Addiction Scale (SMAS)	Tutgun-Ünal and Deniz (2015)
WeChat Addiction Scale (WAS)	Dong et al. (2018)
WeChat Excessive Use Scale (WEUS)	Hou et al. (2017)
Social Networking Addiction Questionnaire (SNAQ)	Escurra Mayaute and Salas Blas (2014)
Social Media Addictive Tendencies (SMAT)	Wilson et al. (2010)
Facebook Use Disorder Scale (FUDS)	Sindermann et al. (2020a)
Social Networking Site Addictive Tendencies Scale (SNSATS)	Milošević-Đorđević and Žeželj (2014)
Personality scales included in the moderator analyses	
Big Five Inventory (BFI)	John (1991); Rammstedt and John (2007); Soto and John (2017)
International Personality Item Pool (IPIP)	Goldberg (1999); Goldberg et al. (2006)
NEO Five-Factor Inventory (NEO-FFI)	Costa and McCrae (1992); McCrae and Costa (2004)
Ten Item Personality Inventory (TIPI)	Gosling et al. (2003)
Personality scales not included in the moderator analyses	
Adjective Based Personality Test (ABPT)	Bacanlı et al. (2009)
Big Five Mini Markers (BFMM)	Saucier (1994)
Personality Inventory (PI)	Caci et al. (2014)
Big Five Personality Trait Short Questionnaire (BFPTSQ)	Morizot (2014)
Lai Personality Test (LPT)	Lai and Lai (2003)
Personality Questionnaire (PQ)	Leung (2011)
Quick Big Five Personality Test (QBFPT)	Vermulst and Gerris (2005)
Chinese Big Five Personality Inventory (CBF-PI)	Wang et al. (2011)
Junior Eysenck Personality Questionnaire – Revised (JEPQ-R)	Corulla (1990)
Big Five Questionnaire (BFQ)	Caprara et al. (1993)
Short Form Five-Factor Personality Inventory (SF-5FPI)	Tatar (2017)
HEXACO-60	Ashton and Lee (2009)

Table 3 Summary of main meta-analytic findings using a random-effects model

Trait	*k*	Point estimate (95% CI)	*Z*	*p*	*Q*	I^2	Tau^2
Openness	88	-0.04 (-0.06, -0.02)	-3.25	0.001	459.83**	81.08	0.009
Conscientiousness	96	-0.16 (-0.19, -0.13)	-11.40	< 0.001	845.14**	88.76	0.017
Extraversion	102	0.01 (-0.02, 0.04)	0.93	0.35	1011.78**	90.02	0.019
Agreeableness	93	-0.07 (-0.10, -0.05)	-5.86	< 0.001	629.17**	85.38	0.012
Neuroticism	108	0.21 (0.19, 0.23)	18.24	< 0.001	691.41**	84.52	0.011

** $p < 0.001$

Table 4 Relative importance of five-factor traits predicting problematic social media use

Predictor	Raw relative weight	% of R^2
Openness	0.001	1.60
Conscientiousness	0.019	29.80
Extraversion	0.003	4.42
Agreeableness	0.002	3.28
Neuroticism	0.038	60.91
Total $R = 0.06$		

Table 5 Meta-regression results for sex and age

Moderator	*k*	Trait	Coefficient (95% CI)	*p*	*SE*
% female	71	Openness	-0.001 (-0.002, 0.001)	0.40	0.001
	80	Conscientiousness	-0.001 (-0.003, 0.001)	0.52	0.001
	81	Extraversion	-0.0003 (-0.002, 0.001)	0.66	0.001
	77	Agreeableness	0 (-0.002, 0.002)	0.96	0.001
	87	Neuroticism	0.0001 (-0.002, 0.002)	0.89	0.001
Mean age	71	Openness	0.005 (0.001, 0.009)	0.02	0.002
	80	Conscientiousness	-0.001 (-0.006, 0.004)	0.65	0.002
	81	Extraversion	0.004 (0.001, 0.008)	0.01	0.002
	77	Agreeableness	0.002 (-0.002, 0.006)	0.41	0.002
	87	Neuroticism	0.003 (-0.001, 0.006)	0.15	0.002

correlation estimates for openness and agreeableness were likely impacted by publication bias. However, these tests suggest that estimates for conscientiousness, extraversion, and neuroticism were not significantly impacted by publication bias.

For openness, the trim and fill method (Duval & Tweedie, 2000) recommended imputing 13 studies to the right side of the mean, changing the effect size to $r = -0.01$, 95% CI [-0.04, 0.01]. For agreeableness, the trim and fill method recommended imputing 18 studies to the right of the mean, changing the effect size to $r = -0.04$, 95% CI [-0.07, -0.01].

Table 6 Openness categorical moderator analyses

Moderator	*k*	*r* (95% CI)	$Q_B(p)$
Type of social media			3.60 (0.17)
Facebook	49	-0.051 (-0.084, -0.017)	
Not Facebook	8	0.038 (-0.047, 0.124)	
General	31	-0.036 (-0.062, -0.011)	
Type of addiction scale			9.70 (0.08)
Bergen	43	-0.052 (-0.080, -0.023)	
FIQ	9	-0.116 (-0.194, -0.036)	
IAT	7	0.026 (-0.063, 0.113)	
GPIUS	5	-0.110 (-0.166, -0.053)	
SMDS	5	-0.064 (-0.124, -0.003)	
SMUQ	2	-0.022 (-0.100, 0.056)	
Type of personality scale			13.75 (0.003)
BFI	38	-0.017 (-0.051, 0.018)	
IPIP	6	-0.087 (-0.142, -0.031)	
NEO-FFI	5	-0.009 (-0.092, 0.074)	
TIPI	28	-0.094 (-0.122, -0.065)	
Continent			5.53 (0.14)
Asia	33	-0.011 (-0.058, 0.036)	
Australia	5	-0.080 (-0.138, -0.022)	
EU	38	-0.060 (-0.089, -0.030)	
North America	12	-0.022 (-0.064, 0.021)	
Country			9.92 (0.27)
Australia	5	-0.080 (-0.138, -0.022)	
China	5	0.050 (-0.062, 0.160)	
India	5	-0.014 (-0.120, 0.092)	
Italy	8	-0.004 (-0.097, 0.089)	
Pakistan	4	0.090 (-0.116, 0.289)	
Poland	9	-0.085 (-0.133, -0.036)	
Turkey	9	-0.072 (-0.153, 0.010)	
UK	4	-0.068 (-0.133, -0.002)	
USA	9	-0.038 (-0.083, 0.006)	

Discussion

The present meta-analysis provides a synthesis of research on the association between the five-factor model of personality and problematic social media use. The findings from 113 samples support the hypotheses that higher neuroticism and lower conscientiousness, openness, and agreeableness would be associated with problematic social media use. No support was found for the hypothesis that lower extraversion would be associated with problematic social media use. The effect sizes yielded by the present meta-analysis for

Table 7 Conscientiousness categorical moderator analyses

Moderator	*k*	*r* (95% CI)	$Q_B(p)$
Type of social media			5.32 (0.07)
Facebook	51	-0.172 (-0.210, -0.134)	
Not Facebook	9	-0.070 (-0.149, 0.010)	
General	36	-0.164 (-0.205, -0.122)	
Type of addiction scale			22.90 (< 0.001)
Bergen	49	-0.194 (-0.231, -0.157)	
FIQ	9	-0.175 (-0.253, -0.095)	
IAT	7	-0.078 (-0.189, 0.036)	
GPIUS	5	-0.050 (-0.110, 0.011)	
SMDS	5	-0.177 (-0.223, -0.129)	
SMUQ	2	-0.104 (-0.150, -0.058)	
Type of personality scale			6.02 (0.11)
BFI	41	-0.197 (-0.235, -0.158)	
IPIP	7	-0.158 (-0.236, -0.079)	
NEO-FFI	5	-0.312 (-0.554, -0.021)	
TIPI	30	-0.142 (-0.171, -0.113)	
Continent			4.95 (0.18)
Asia	35	-0.158 (-0.210, -0.106)	
Australia	5	-0.228 (-0.287, -0.167)	
EU	40	-0.150 (-0.184, -0.114)	
North America	16	-0.172 (-0.249, -0.094)	
Country			11.65 (0.17)
Australia	5	-0.228 (-0.287, -0.167)	
China	6	-0.079 (-0.174, 0.019)	
India	5	-0.300 (-0.590, 0.057)	
Italy	8	-0.061 (-0.182, 0.062)	
Pakistan	3	-0.201 (-0.358, -0.034)	
Poland	9	-0.141 (-0.191, -0.090)	
Turkey	11	-0.151 (-0.236, -0.063)	
UK	4	-0.159 (-0.221, -0.095)	
USA	13	-0.174 (-0.262, -0.082)	

Table 8 Extraversion categorical moderator analyses

Moderator	*k*	*r* (95% CI)	$Q_B(p)$
Type of social media			0.70 (0.71)
Facebook	56	0.004 (-0.043, 0.051)	
Not Facebook	9	0.025 (-0.067, 0.117)	
General	37	0.028 (-0.005, 0.061)	
Type of addiction scale			22.40 (< 0.001)
Bergen	53	0.042 (-0.003, 0.087)	
FIQ	9	-0.024 (-0.083, 0.035)	
IAT	7	-0.016 (-0.087, 0.055)	
GPIUS	5	-0.178 (-0.255, -0.099)	
SMDS	5	-0.006 (-0.054, 0.043)	
SMUQ	2	-0.021 (-0.068, 0.025)	
Type of personality scale			5.84 (0.12)
BFI	43	-0.002 (-0.033, 0.030)	
IPIP	8	0.121 (-0.017, 0.255)	
NEO-FFI	5	0.305 (-0.159, 0.658)	
TIPI	30	-0.020 (-0.052, 0.012)	
Continent			8.47 (0.04)
Asia	36	0.045 (-0.023, 0.112)	
Australia	5	0.019 (-0.050, 0.087)	
EU	42	-0.026 (-0.056, 0.005)	
North America	18	0.044 (0.000, 0.087)	
Country			18.35 (0.02)
Australia	6	0.053 (-0.033, 0.139)	
China	8	0.018 (-0.067, 0.104)	
India	5	0.153 (-0.428, 0.645)	
Italy	8	-0.041 (-0.149, 0.069)	
Pakistan	4	0.199 (0.035, 0.353)	
Poland	9	0.020 (-0.007, 0.047)	
Turkey	9	-0.072 (-0.122, -0.021)	
UK	4	-0.036 (-0.148, 0.078)	
USA	14	0.019 (-0.025, 0.062)	

neuroticism and conscientiousness can be considered small to medium according to Cohen's (1992) criteria, while the effect sizes for agreeableness and openness are small. The relative weight analysis suggests that neuroticism and conscientiousness together account for almost all (91%) of the variance in problematic social media use predicted by the five-factor traits. In comparison, the incremental predictive power offered by openness, agreeableness, and extraversion is negligible. Additionally, the relative weight analysis revealed that the total variance in problematic social media use predicted by five-factor traits is low (6%), which suggests the importance of investigating other factors in addition to these traits in research on predictors of problematic social media use.

The meta-analytic effect sizes are similar to those reported in the review conducted by Marino et al. (2018) on five-factor personality traits associated with problematic Facebook use. However, in comparison to Marino et al. (2018), the present meta-analysis provides a more comprehensive review of research on five-factor traits associated with problematic social media use by including more than five times as many studies for each five-factor trait. During the peer-review process prior to the publication of this meta-analysis, another meta-analysis with identical aims to the present paper was published, and also found similar results (Huang, 2022). However, in comparison to Huang (2022), the present meta-analysis provides a more comprehensive review of the relevant research by including approximately 40 additional samples, considering the relative weight of predictors, considering a wider range of potential moderators, and evaluating potential influences of publication bias.

To some degree, the findings of the present review are similar to those of previous meta-analyses of associations between five-factor personality traits and Internet addiction (Kayiş et al., 2016), smartphone addiction (Marengo et al., 2020), nicotine use disorder (Malouff et al., 2006), and problematic alcohol use (Malouff et al., 2007), which

Table 9 Agreeableness categorical moderator analyses

Moderator	*k*	*r* (95% CI)	$Q_B(p)$
Type of social media			0.26 (0.88)
Facebook	51	-0.077 (-0.103, -0.052)	
Not Facebook	9	-0.088 (-0.200, 0.026)	
General	33	-0.064 (-0.114, -0.014)	
Type of addiction scale			2.07 (0.84)
Bergen	46	-0.068 (-0.108, -0.028)	
FIQ	9	-0.106 (-0.161, -0.051)	
IAT	7	-0.091 (-0.164, -0.018)	
GPIUS	5	-0.109 (-0.162, -0.056)	
SMDS	5	-0.073 (-0.182, 0.038)	
SMUQ	2	-0.065 (-0.303, 0.180)	
Type of personality scale			4.95 (0.18)
BFI	38	-0.106 (-0.147, -0.064)	
IPIP	7	0.033 (-0.129, 0.194)	
NEO-FFI	5	-0.097 (-0.182, -0.010)	
TIPI	30	-0.060 (-0.091, -0.030)	
Continent			
Asia	33	-0.063 (-0.115, -0.011)	
Australia	5	-0.141 (-0.209, -0.071)	
EU	40	-0.073 (-0.101, -0.045)	
North America	15	-0.078 (-0.152, -0.004)	
Country			5.41 (0.71)
Australia	5	-0.141 (-0.209, -0.071)	
China	6	-0.089 (-0.218, 0.044)	
India	5	-0.091 (-0.201, 0.020)	
Italy	8	-0.075 (-0.126, -0.024)	
Pakistan	3	-0.109 (-0.250, 0.037)	
Poland	9	-0.066 (-0.102, -0.031)	
Turkey	9	-0.063 (-0.157, 0.032)	
UK	4	-0.035 (-0.101, 0.030)	
USA	12	-0.073 (-0.157, 0.012)	

Table 10 Neuroticism categorical moderator analyses

Moderator	*k*	*r* (95% CI)	$Q_B(p)$
Type of social media			6.13 (0.047)
Facebook	58	0.195 (0.168, 0.221)	
Not Facebook	10	0.150 (0.078, 0.222)	
General	40	0.238 (0.202, 0.273)	
Type of addiction scale			5.76 (0.33)
Bergen	56	0.209 (0.177, 0.241)	
FIQ	10	0.216 (0.171, 0.260)	
IAT	8	0.227 (0.156, 0.295)	
GPIUS	5	0.255 (0.142, 0.361)	
SMDS	5	0.261 (0.215, 0.305)	
SMUQ	3	0.168 (0.090, 0.244)	
Type of personality scale			3.81 (0.28)
BFI	45	0.223 (0.189, 0.255)	
IPIP	7	0.194 (0.067, 0.315)	
NEO-FFI	5	0.177 (0.033, 0.313)	
TIPI	33	0.178 (0.147, 0.209)	
Continent			3.95 (0.27)
Asia	41	0.183 (0.139, 0.225)	
Australia	5	0.254 (0.185, 0.320)	
EU	41	0.223 (0.199, 0.246)	
North America	20	0.205 (0.141, 0.269)	
Country			24.58 (0.002)
Australia	6	0.251 (0.195, 0.305)	
China	8	0.225 (0.118, 0.326)	
India	6	0.097 (-0.064, 0.253)	
Italy	8	0.240 (0.189, 0.289)	
Pakistan	3	0.160 (-0.034, 0.342)	
Poland	9	0.173 (0.137, 0.209)	
Turkey	12	0.153 (0.078, 0.227)	
UK	4	0.303 (0.253, 0.351)	
USA	16	0.203 (0.121, 0.282)	

all reported a personality profile of high neuroticism, low conscientiousness, and low agreeableness.

The findings of this meta-analysis are consistent with possible causes of problematic social media use that have been identified in previous research. Individuals with high neuroticism tend to be anxious, tense, touchy, and unstable (McCrae & John, 1992). Researchers have hypothesised that individuals with high neuroticism may use social media frequently as a strategy to regulate the various negative emotions they experience (Andreassen et al., 2012).

Individuals with high conscientiousness are organised and industrious (McCrae & John, 1992). Researchers have speculated that conscientiousness may act as a protective factor against the development of problematic social media use (Andreassen et al., 2013). This analysis is in line with research findings showing that high conscientiousness is associated with lower levels of other problematic behaviour such as addictive use of tobacco (Malouff et al., 2006) and alcohol (Malouff et al., 2007). The present set of findings suggests that individuals with low conscientiousness may be less occupied with important duties and deadlines and therefore more likely to use social media in a problematic or addictive manner for short-term gratification (Marino et al., 2018).

Low agreeableness is characterised by tendencies toward being antisocial and inconsiderate (McCrae & John, 1992). Low agreeableness has been found to be associated with higher levels of dark triad personality traits such as narcissism (O'Boyle et al., 2015), which are associated with problematic social media use (Lee, 2019). Therefore, low

Table 11 Summary of analyses evaluating publication bias

	Kendall's tau (*p*)	Egger's intercept test (*p*)	Imputed studies
Openness	0.13 (0.08)	0.82 (0.29)	13
Conscientiousness	-0.09 (0.19)	-0.83 (0.40)	0
Extraversion	-0.01 (0.91)	0.63 (0.52)	0
Agreeableness	0.07 (0.31)	0.50 (0.57)	18
Neuroticism	-0.002 (0.97)	-0.20 (0.80)	0

p values for Kendall's tau and Egger's test are two-tailed

agreeableness may be associated with other traits that might lead to problematic engagement in social media use.

Individuals with low openness tend to be closed-minded and change-avoidant (McCrae & John, 1992). Research has found that individuals higher on openness have a lower risk of mortality and physical ailment (Lee, 2019). Therefore, high openness may be a protective factor against developing maladaptive patterns of behaviour like problematic social media use (Lee, 2019), making it more likely for individuals with low openness to develop this behaviour.

The association between problematic social media use and extraversion appeared to be almost null, consistent with the findings of Marino et al. (2018), and suggesting that extraversion may not be relevant for predicting problematic social media use.

Age was found to have a small association with the effect size for openness and extraversion, offering a possible explanation for some of the heterogeneity found between studies in the effect sizes for these traits. The negative association between openness and problematic social media use was weaker in studies with a higher mean age.

This meta-analysis has significant advantages over any single study in that it included results from many researchers in different countries, using different measures and participants. The variety and number of participants included in this meta-analysis increases the generalisability of the findings.

Implications for treatment

Low conscientiousness and high neuroticism may create difficulties when treating problematic social media use since this personality profile predicts lower treatment adherence and poorer treatment outcomes (Bagby et al., 2016; Hooten et al., 2005). Efforts to treat or prevent problematic social media use might focus on increasing conscientiousness and lowering neuroticism to improve treatment adherence and outcomes. Effective treatment might include providing strategies to reduce negative emotions and providing strategies to improve organisation and productivity. However, since the relative weight analysis suggested that only approximately 5% of the variance in problematic social media use can be attributed to neuroticism and conscientiousness, practitioners should consider also targeting other factors in treatment that are responsible for more of the variance in problematic social media use than the small portion attributable to these personality traits. Interventions aiming to reduce problematic social media use may be more effective if they target conscientiousness and neuroticism alongside psychosocial factors strongly associated with problematic social media use such as social anxiety, loneliness, and fear of missing out (see Wegmann & Brand, 2019).

While the present meta-analysis found that openness and agreeableness were significantly negatively associated with problematic social media use, the relative weight analysis suggests that these traits have very little incremental predictive validity for predicting problematic social media use when accounting for neuroticism and conscientiousness, which together predicted almost all of the variance observed in problematic social media use. This result suggests that openness and agreeableness may not be as relevant to consider as neuroticism and conscientiousness in order to obtain positive treatment outcomes. This conclusion is further supported by the trim-and-fill analyses, which suggested that the meta-analytic correlations estimated for openness and agreeableness may be overinflated due to publication bias, with the recommended adjusted correlation for agreeableness decreasing in strength considerably to $r = -0.04$, and the recommended adjusted correlation for openness no longer significant, $r = -0.01$, 95% CI [-0.04, 0.01].

Limitations

Limitations of the findings include the following: (1) only correlational (cross-sectional) studies were included in this meta-analysis, and correlation does not imply causation; (2) the included studies relied entirely on self-report measures of problematic social media use; and (3) we did not measure differences in effect sizes between different types of social media because few studies measured problematic use of social networking platforms other than Facebook. We created the "not Facebook" group to have a valid comparison group to Facebook other than general social media.

Future research

Longitudinal studies on the relationship between five-factor traits and problematic social media use could help identify long-term relationships between the traits and problematic social media use. Future research could investigate five-factor traits associated with social networking sites other than Facebook. Researchers could consider using measures of problematic social media use other than self-report. For example, objective measures of problematic social media use could be created by recording use times (see Ryding & Kuss, 2020). Once more studies are published on problematic use of social media platforms other than Facebook, future meta-analyses could evaluate whether the type of social media platform used is a significant moderator of the relationship between problematic social media use and five-factor traits. Future research should evaluate interventions for problematic social media use that target neuroticism and conscientiousness in addition to psychosocial factors strongly correlated with problematic social media use.

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Data availability The datafile that was generated and analysed in the current study is available in the OSF repository, https://doi.org/10.17605/OSF.IO/EF59J.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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*Indicates studies included in the meta-analysis.

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