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Correlations of Online Social Network Size With Well-Being and Distress: A Meta-Analysis

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Abstract

This meta-analysis examines the correlations of the number of social network site (SNS) friends with well-being and distress, based on 90 articles consisting of 98 independent samples on correlations of online social network size (OSNS) with happiness, life satisfaction, self-esteem, anxiety, depression, combined anxiety and depression, loneliness, social anxiety, social loneliness, well-being and distress. The correlations between OSNS and well-being indicators are positively weak (from .06 to .15), whereas those for distress indicators are inconclusive (from -.19 to .08). Studies recording the OSNS based on the participant profile have larger mean effect sizes for well-being (.21) and self-esteem (.31) than those based on self-reporting (.06 and .05, respectively). The correlation between OSNS and self-esteem is stronger in samples with a smaller mean network size.

Keywords: Social network; well-being; distress; meta-analysis

Introduction

The traditional definition of mental health is the absence of mental illness (Westerhof & Keyes, 2010). This traditional view is a one-dimensional model focused on psychopathology, such as depression and anxiety. The dual-factor model (Suldo & Shaffer, 2008) or two-continuum model (Westerhof & Keyes, 2010) proposes two related dimensions for the presence or absence of mental health and of mental disorders. Thus, the first continuum focuses on well-being, and the second focuses on distress. Based on the two-continuum model, Keyes (2007) suggested that both positive and negative mental health indicators should be measured for a complete assessment of mental health.

Two major philosophical models are proposed to conceptualize well-being. From the hedonic perspective, well-being is defined as happiness, comprising satisfaction with life and with other important domains, positive affect and low negative affect (Deci & Ryan, 2008; Diener, 2000). From the eudaimonic perspective, well-being is defined as good functioning and fulfillment of life. Ryff (1989) defined the six components of well-being as self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth. Hence, the hedonic standpoint views well-being as an outcome of happiness, whereas the eudaimonic approach considers well-being as a process of actualizing an individual's potential (Deci & Ryan, 2008).

Two theories of social relationships have been developed for predicting the correlations of social network size with well-being and distress. The social convoy model (Antonucci et al., 2014; Levitt et al., 1993) suggests that family and friends served as a protective layer that can provide social support to help an individual to cope with life stress. Social convoys vary in their closeness. The closest social partners are considered to be in the inner circle, followed by those in the middle and peripheral circles. The relationships with peripheral-circle members are

less stable than those for inner- and middle-circle members. The number of contacts in the peripheral circle decreases in adulthood, whereas that in the inner circle is maintained throughout a person's life span (Wrzus et al., 2013). The assessment of social convoys is both objective and subjective. The objective measure of social relations refers to the structure, and the subjective measure is the perceived quality of social support. The structure of social convoys, such as total network size, is related to health (Fiori et al., 2007). Furthermore, a sufficient number of social ties is essential to maintain the quality of social relations (Antonucci et al., 2014). Thus, social network size is expected to be an important determinant of well-being and distress. The socioemotional selectivity theory (Carstensen, 1995; Carstensen et al., 1999) posits that the social network size depends on social goals that change with various life stages. Goals can be classified into present- and future-oriented. Future-oriented goals, such as making new friends and acquisition of knowledge, are valuable in the future. The present-oriented goal is related to emotional regulation. Old adults do not perceive an unlimited future life span, and they tend to adopt present-oriented goals. To maximize emotional meaning, old adults decrease the network size and increase social interactions with close ties (Löckenhoff & Carstensen, 2004). In other words, the maintenance of high emotional closeness with a relatively small number of social partners is related to high emotional well-being for old adults. In contrast, adolescents and young adults perceive an unlimited future life span, and tend to adopt future-oriented goals, such as information acquisition. Adolescents and young adults are likely to maintain large social networks in order to facilitate news-seeking. Thus, increasing social network size facilitates well-being for youths and young adults.

Because social networks can provide social support, social influence, social engagement, face-to-face contacts and access to resources, Smith and Christakis (2008) suggested that such networks are an important determinant of health. Empirical evidence indicates that offline social network size is correlated with well-being and distress. For example, Domènech-Abella et al. (2017) sampled 3,535 Spanish adults older than 50 years, and found that individuals with a smaller social network were more likely to feel lonely. An international study by Litwin and colleagues (2015), who sampled 28,756 adults older than 65 years from Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland, found a negative correlation between social network size and depression (r = -.03). Cross-cultural evidence was found in a Chinese population: Chan and Lee (2006) selected adults older than 60 years from Beijing and Hong Kong, and found that individuals with a larger social network felt happier than those with a smaller social network (r = .18). Moreover, the presence of a positive correlation between social network size and subjective well-being (r = .39) was also supported by Wang (2016). However, most of these studies have focused on adults in later life, with relatively few studies examining this correlation among adolescents or young adults.

The increasingly widespread and intensive use of social network sites (SNSs) has changed how individuals make friends and connect with others, potentially enlarging their social networks. Especially for shy individuals, SNSs provide a non-stressful platform to connect with others (L. R. Baker & Oswald, 2010). However, as the number of friends increases, the amount of time devoted to each friend decreases. An increase in social network size may occur at the expense of the quality of social relationships, reducing support from social partners (Manago et al., 2012). A larger social network may be correlated with higher distress and lower well-being.

Research on the Correlations of OSNS With Well-Being and Distress

Empirical findings about the direction of the correlation between OSNS and well-being have been inconsistent. For example, Yang and Brown (2016) sampled 218 freshmen, and found a positive correlation between the number of Facebook friends and self-esteem, with r = .22. In contrast, Kalpidou and colleagues (2011) found negative correlations when they sampled 35 first-year and 35 upper-class undergraduate students, with r = -.29 and r = -.04, respectively. Further, the magnitude of the correlation between OSNS and well-being has also varied. Weak correlations were found by Utz and colleagues (2012), who used two samples of Dutch users to examine the correlation between the number of SNS friends and self-esteem, and found r = 0 and r = .04. In contrast, Brailovskaia and Bierhoff (2020) found moderate-to-strong correlations between the number of Facebook friends and self-esteem when they sampled 138 late millennials and 116 early millennials in Germany, with r = .37 and r =.43, respectively. Similarly, the direction and magnitude of the correlation between OSNS and distress have also varied. Specifically, the correlation between OSNS and loneliness has varied from weakly positive (Bourke, 2013) to moderately negative (Arianna, 2014).

Source Descriptors

Findings about the directions and magnitudes of the correlations of OSNS with well-being and distress are inconclusive, and moderator effects are possible. Potential moderators were source descriptors (Lipsey & Wilson, 2001), such as study country and publication status. To study the country effect, Lönnqvist and Deters (2016) sampled 153 US undergraduate students and 187 German university students and found a noticeable difference between the two samples. The correlations between the number of Facebook friends and life satisfaction were r = .29 and r = .15, respectively. Regarding the effect of publication status, Ferguson and Heene (2012) suggested that studies producing significant findings were more likely to be published than those producing non-significant findings. Publication bias refers to "the overrepresentation in the literature of studies with significant outcomes compared with studies with null results" (Augusteijn et al., 2019, p. 117) due to the publication decision and the intention of researchers to submit a manuscript.

Moderators Related to Research Context

Another category of moderators is related to research context. For example, the mean number of friends in the sample may moderate the correlations of OSNS with well-being and distress. While SNSs provide platforms to establish large social networks, time constraints may affect the frequency of communication with friends. As the social network size increases, the time available to maintain each friendship decreases, and so the individual relationships may weaken. Individuals with a small social network may spend more time with each friend, resulting in a high emotional intensity (Pollet et al., 2011; Roberts & Dunbar, 2011). Hence, the correlations of social network size with well-being and distress may be weaker for studies involving larger social networks. Other context variables included study SNS and how the information about the OSNS was obtained. Most studies measured Facebook friends, while some studies assessed global number of SNS friends or Instagram followers. Further, many studies obtained the number of SNS friends from self-report measures, whereas some others recorded the number of SNS friends from participant profiles. The moderator effects of these context variables were rarely examined in empirical studies and this meta-analysis tested the possibilities.

Demographic Moderators

Few studies have examined the effect of demographic variables, including participant gender and age, on the correlations of OSNS with well-being and distress. One exception was by Bandyopadhyay (2016), who sampled 100 male and 100 female undergraduate students and found that the coefficients for the correlation between self-esteem and the number of Facebook friends were .25 and .13, respectively.

Previous Meta-Analyses

Pinquart and Sörensen (2000) synthesized the correlation between social network and subjective well-being for older adults with a mean age over 55 years. Those authors included studies investigating both quantitative and qualitative measures of social networks. The quantitative measures of social networks referred to the social network size and the frequency of social communication, while the qualitative measures referred to social support. The analysis identified 295 correlations between social network and life satisfaction, and obtained a weighted mean correlation coefficient of r = .15. The mean coefficient for the correlation between the social network and self-esteem was r = .11 (k = 63), and that between social network and happiness was r = .18 (k = 78). However, that meta-analysis was limited in three ways. First, only positive indicators were investigated, and distress indicators were not examined. Second, it included studies examining older adults, but none examining children, adolescents or young adults, so its research findings cannot necessarily be generalized to younger populations. Third, the study focused on offline social networks. Since both the quality and size of offline and online social networks can be different, those research findings might not be generalizable to online social networks.

D. Liu and Baumeister (2016) identified 11 studies on the correlation between the number of SNS friends and self-esteem, and found a mean correlation coefficient of .07. Since the number of effect sizes was small, the moderator effects on the correlation were not examined.

Purpose

Online friends can be different from real-life friends (Perry et al., 2018). Therefore, the links of OSNS with well-being and distress might be different from those for offline social network size. Estimating the strength of correlations of OSNS with well-being and distress can help to determine whether online social network is beneficial or detrimental, and to understand the degree of the impact. Yet, few meta-analyses have been undertaken to estimate the relations, and therefore a meta-analysis is warranted. The purpose of the present study was to determine the magnitude and direction of the correlations of OSNS with well-being and distress.

Method

Literature Search

The PsycINFO, ERIC, and ProQuest Dissertations and Theses Global databases were searched using a combination of terms related to SNSs (namely, Facebook, Twitter, Instagram, MySpace, social media, online social network*, and social network* site*) and terms related to well-being and distress (namely, self-concept, self-esteem, self-worth, depress*, loneliness, life satisfaction, happ*, "mental health", anxi*, and distress*) through to May 24, 2019. The reference lists for all relevant articles as well as previous review articles (D. A. Baker & Algorta, 2016; Best et al., 2014; Dobrean & Păsărelu, 2016; Frost & Rickwood, 2017; Huang, 2017; Keles et al., 2020; D. Liu & Baumeister, 2016; Seabrook et al., 2016; Song et al., 2014; Vahedi & Zannella, 2019; Yoon et al., 2019) were subsequently searched for additional relevant studies that were not identified in the computer-based searches. Articles were initially screened to obtain full texts by reading their titles and abstracts. The full texts were then reviewed to determine eligibility based on the following inclusion criteria: (1) reporting at least one of the correlations of the number of SNS friends with well-being and distress; (2) reporting the sample size so that weighted mean correlations could be calculated; (3) the level of well-being and distress being reported by the participant, with studies assessing well-being or distress using other sources excluded (e.g., the study by Moreno et al. (2011) that coded participant Facebook profiles to indicate depression); and (4) published in English.

Dependence

All correlations of OSNS with well-being and distress indicators were coded. Since this meta-analysis analyzed well-being and distress separately, each independent sample could contribute at most one correlation each for well-being and distress. To resolve the issue of dependence, the mean correlation was computed to correct for interdependent effect sizes for well-being and distress.

Analysis

Since the Pearson Product-Moment correlation coefficient (r) has some undesirable properties (Lipsey & Wilson, 2001), it was transformed into Z_r using Fisher's transformation equation. The inverse variances were used as a weight to compute the weighted mean correlation coefficients. The weighted mean of Z_r was then transformed back to correlation coefficient. The random-effects model is more general than the fixed-effect model. Moreover, type I error tends to be inflated in fixed-effect models (Hunter & Schmidt, 2000). Therefore, this study used random-effects models. Comprehensive Meta-Analysis (Borenstein et al., 2013) was used to perform trim and fill examinations (Duval & Tweedie, 2000) and other analyses were performed by MetaWin (M. S. Rosenberg et al., 2000).

To test whether the effect size distribution was homogenous, the Q_T statistic was used, distributed approximately as χ^2 with degrees of freedom equal to the number of effect sizes minus 1. To test the effects of categorical moderators, the Q_B statistic was used with degrees of freedom equal to the number of categories minus 1. A significant Q_B indicates heterogeneity among groups of effect sizes (Lipsey & Wilson, 2001).

Results

This meta-analysis included 90 articles involving 98 independent samples on correlations of the number of SNS friends with well-being and distress. These studies involved 33,329 participants, with a mean sample size of 340.09 participants and sample sizes range from 30 to 4,701 participants. The participants were assessed at ages of 13.30 and 20.92 years in Mikami et al. (2010); for the remaining cross-sectional studies, the mean age of the sample was available in 87 samples with a mean age of 24.47 years, ranging from 14 to 60 years. The mean social network size was available for 60 samples, with a weighted mean (by sample size) of 240.30 friends, ranging from 64 to 740 friends. Table 1 presents the summaries of the included studies.

Table 1. *Summary of Studies on the Relation of Online Network Size With Well-Being and Distress*.

Study	PO	Country	*N*	Age	Sex	WB/D	SNS	infoNS	Friends	*r*
Acar (2008)	J	US	427	19.50	.51	self-esteem, anxiety	Facebook	SR & PF	217[b]	.11, -.08
Ahmad et al. (2016)	J	Pakistan	461[a]	22.28	.57	self-esteem	SNS	SR	NA	.05[a]
Arianna (2014)	M	miscellaneous	147	25.16	.70	self-esteem, loneliness, social anxiety	Facebook	SR	344.31	.16, -.27, -.34
Ballinger (2018)	D	US	97	59.90	.77	loneliness	Facebook	PF	NA	-.02
Bandyopadhyay (2016), #1	M	US	100	19.59	0	self-esteem, social anxiety	Facebook	SR	516.53	.25, -.17
Bandyopadhyay (2016), #2	M	US	100	19.59	1	self-esteem, social anxiety	Facebook	SR	738.77	.13, -.10
Banjanin et al. (2015)	J	Serbia	336	18	.66	depression	Facebook	SR	NA	.04
Barry et al. (2017)	J	US	128	20.46	.85	self-esteem	Instagram	PF	NA	.13[a]
Bazarova et al. (2017)	J	US	238	20.92	.75	depression & anxiety	Facebook	NA	739.92	-.14
Bevan-Dye (2012)	J	South Africa	346	NA	.55	self-esteem	Facebook	SR	NA	.12
Bourke (2013)	B	Ireland	165/145/165	13.66	.57	self-esteem, loneliness, social anxiety	Facebook	SR	440.19	.05, .16 -.18
Brailovskaia & Bierhoff (2020), #1	J	Germany	138	17.54	.53	self-esteem	Facebook	PF	349.46	.37
Brailovskaia & Bierhoff (2020), #2	J	Germany	116	26.57	.47	self-esteem	Facebook	PF	154.67	.43
Buglass et al. (2017)	J	UK	506	20.58	.47	self-esteem	Facebook	SR	424.28	-.09
Burrow & Rainone (2017)	J	US	246	32.63	.49	self-esteem	Facebook	SR	371	.13
Carpenter (2012)	J	US	294	23.26	.68	self-esteem	Facebook	SR	652.58	.04
Chang et al. (2015)	J	US	577	42.64	.59	loneliness	Facebook	SR	291.79	.05
Chen et al. (2015)	J	miscellaneous	352	NA	.49	self-esteem	Facebook	SR	NA	.05
Chow & Wan (2017)	J	US	282	33.19	.30	depression	Facebook	SR	316.29	0
Deatherage (2016)	D	US	208	20.50	.63	loneliness, life satisfaction	Facebook	SR	563.4	-.21, .25
Dumas et al. (2017), #1	J	US	198	25	.44	loneliness	Instagram	SR	307.53	-.12
Dumas et al. (2017), #2	J	US	265	25	.47	loneliness	Instagram	SR	355.73	.02

Durak & Seferoğlu (2019)	J	Turkey	580	NA	.60	loneliness, social anxiety	SNS	SR	351	-.10, -.06
Ellison et al. (2007)	J	US	286	20.10	.66	self-esteem, life satisfaction	Facebook	SR	NA	.07[a], .22[a]
Fernandez et al. (2012)	J	US	62	19	.63	depression, social anxiety	Facebook	PF	NA	.05, -.45
Flynn et al. (2018)	J	miscellaneous	715	31	.81	depression, anxiety, self-esteem	Facebook	SR	370	.06, .11, -.03
Gallagher (2017)	M	US	111	16.21	.71	self-esteem	SNS	SR	NA	.14
Gerson et al. (2016)	J	UK	337	36.50	.60	life satisfaction	Facebook	SR	NA	.13[a]
Greitemeyer et al. (2014), #1	J	Austria	458	22.70	.68	loneliness, self-esteem	Facebook	SR	454	-.13, .03
Greitemeyer et al. (2014), #2	J	Austria	1244	NA	.73	loneliness, self-esteem	Facebook	SR	244	-.11, .04
Hill (2014)	D	US	56	NA	.41	self-esteem	Facebook	SR	NA	.12
Hollenbaugh & Ferris (2014)	J	US	285[a]	31.85	.77	self-esteem	Facebook	SR	434.98	.01[a]
Hong et al. (2017)	J	US	421[a]	34.79	.62	self-esteem	Facebook	SR	NA	.04[a]
Hood et al. (2018)	J	Australia	149	20.31	.81	social loneliness	SNS	SR	172.64	-.09
Jin (2013)	J	Korea	536	34	.50	loneliness	Facebook	SR	63.50	-.13
Kalpidou et al. (2011) #1	J	US	35	18.31	.67	self-esteem	Facebook	SR	NA	-.29
Kalpidou et al. (2011) #2	J	US	35	20.91	.67	self-esteem	Facebook	SR	NA	-.04
Kokkinos & Saripanidis (2017)	J	Greece	227[a] /232[a] /232[a]	21.54	.55	self-esteem, depression, loneliness	Facebook	SR	NA	-.07[a], .08[a], -.12[a]
Krishnan (2011)	D	US	674	19.64	.56	self-esteem	SNS	SR	695.52	.04
Labrague (2014)	J	Philippines	75	18.64	.82	depression, anxiety	Facebook	SR	NA	.14, .16
Landauer (2014)	D	US	312	19.68	.82	depression, self-esteem	Facebook	SR	600.64	-.03, .06
LaRose et al. (2011)	C	US	364	17.76	.70	self-esteem, loneliness	Facebook	SR	499.93	.04, -.24
Lee et al. (2012)	J	US	234	19.68	.69	self-esteem	Facebook	SR	566.32	-.12
Lee & Jang (2019)	J	Korea	708	37.90	.50	social anxiety	Facebook	SR	NA	-.00
Lima et al. (2017), #1	J	Portugal	223[a]	46.40	.44	self-esteem, life satisfaction, loneliness	Facebook	SR	NA	.03[a], .02[a], -.02[a]
Lima et al. (2017), #2	J	Portugal	770[a]	44.10	.50	self-esteem, life satisfaction, loneliness	Facebook	SR	NA	.06[a], .03[a], -.03[a]
J. Liu et al. (2016)	J	US	163	32.71	.53	self-esteem	Facebook	SR	NA	-.14[a]
Locatelli et al. (2012)	J	US	251	18.72	.72	life satisfaction, depression	Facebook	SR	585.30	.01, .06
Long (2012)	PP	US	53	15.20	.61	depression	Facebook	SR	325.70	.12
Lönnqvist & Deters (2016), #1	J	US	153	20.20	.61	happiness, life satisfaction	Facebook	PF	523.30	.21, .29
Lönnqvist & Deters (2016), #2	J	Germany	187	23.50	.79	happiness, life satisfaction	Facebook	PF	213.60	.16, .15

Lönnqvist & Itkonen (2014)	J	Finland	4701	32.60	.66	life satisfaction, happiness	Facebook	PF	251.93	.08, .09
Manago et al. (2012)	J	US	69	20.64	.76	life satisfaction, self-esteem	Facebook	SR	440	.29, .13
Marshall et al. (2015)	J	US	514[a]	30.90	.59	self-esteem	Facebook	SR	NA	.03[a]
Mazurek (2013)	J	US	108	32.40	.47	loneliness	SNS	SR	219.62	-.12[a]
Mersin & Acılar (2015)	J	Turkey	696	21.99	.70	self-esteem	Facebook	SR	NA	-.00
Metzler & Scheithauer (2017)	J	Germany	217	16.70	.68	self-esteem	Facebook	SR	290	.22
Mikami et al. (2010)	J	US	92	13.30 & 20.92	.58	depression	Facebook & MySpace	PF	298.60	-.11
Moorman (2012)	M	Canada	431	20.40	.71	depression	Facebook	SR	NA	.15
Morgan (2010)	D	US	79	32.30	.23	depression, life satisfaction	Facebook	SR	NA	-.12, -.01
Morin-Major et al. (2016)	J	Canada	94	14.50	.53	depression, self-esteem	Facebook	SR	124	-.03, .18
Murphy (2013)	HD	Ireland	167	15.07	.57	distress, self-esteem	Facebook	SR	463.47	.04, -.10
Nabi et al. (2013)	J	US	401	19.90	.78	life satisfaction	Facebook	SR	375	.20
Oh et al. (2014)	J	US	295	28	.51	life satisfaction	SNS	SR	574.26	.09
Ophir et al. (2019)	J	Israel	162	NA	.51	depression	Facebook	PF	534.26	.14
S. Park et al. (2015)	C	Korea	212	25.61	.24	depression	Facebook	PF	NA	-.25
S. Y. Park & Baek (2018)	J	Korea	331	32.05	.53	life satisfaction	Facebook	SR	148.43	.10[a]
Petrocchi et al. (2015)	J	US	205	20.50	NA	loneliness	Facebook	SR	583.70	-.04
Phu & Gow (2019)	J	UK	332	21.54	.71	happiness, loneliness	Facebook	SR	623	.22, -.21
Reinecke & Trepte (2014)	J	Germany	374	26	.62	life satisfaction	SNS	NA	138.83	.12[a]
Rogers (2017)	M	US	30	15.02	.30	depression, self-esteem	Facebook	SR	615.90	.01, .10
Rosen et al. (2013)	J	US	943[a]	30.74	.60	depression	Facebook	SR	NA	-.05[a]
Schwartz (2010)	D	US	213	21	.60	self-esteem, loneliness	Facebook	SR	NA	.00, -.01
Seo et al. (2016)	J	Korea	285	21.81	.39	loneliness	Facebook	PF	303.08	-.17[a]
Seto (2012)	HP	US	175	19.20	.84	self-esteem	Facebook	SR	702.56	-.04
Shchebetenko (2019)	J	Russia	829[a]	19.59	.72	self-esteem	VK.com	SR	244.69	.11[a]
Sheldon (2012)	J	US	327	27	.62	loneliness	Facebook	SR	447	-.18[a]
Sherlock & Wagstaff (2019)	J	Australia	129	24.60	1	depression, anxiety	Instagram	SR	NA	.22, .28
Singh (2014)	M	US	56	NA	.59	self-esteem, loneliness	Facebook	SR	499.82	-.13, .10
Skues et al. (2012)	J	Australia	393	20.59	.76	self-esteem, loneliness	Facebook	SR	349.97	.04, -.17
Tang & Livingston (2012)	C	Hong Kong	257	NA	.58	loneliness, depression	Facebook	SR	552	-.19, -.07
Turel & Bechara (2016)	J	US	457	23.40	.51	self-esteem	Facebook	SR	339.87	.08
Turel & Qahri-Saremi (2016)	J	US	341	23	.52	self-esteem	Facebook	SR	348	.11
Utz et al. (2012), #1	J	Netherlands	255	23.70	.65	self-esteem	SNS	SR	224.89	0

Utz et al. (2012), #2	J	Netherlands	198	21.40	.73	self-esteem	SNS	SR	220.80	.04
Vanman et al. (2018)	J	Australia	138	22.43	.63	life satisfaction	Facebook	SR	506.11	.11
Wang et al. (2018)	J	China	325	32.67	.54	self-esteem	WeChat Moments	SR	NA	.22
Weidman & Levinson (2015)	J	US	77	18.91	.77	social anxiety	Facebook	PF	NA	-.36
Wilcox & Stephen (2013)	J	US	380[a]	29.85	.56	self-esteem	Facebook	SR	NA	.13[a]
Wright et al. (2013)	J	US	361	20.26	.53	depression	Facebook	SR	560.09	-.02
Yang (2016)	J	US	208	19.43	.78	loneliness	Instagram	SR	NA	-.10[a]
Yang & Brown (2016)	J	US	218	18.07	.64	self-esteem	Facebook	SR	NA	.22[a]
Yoo & Jeong (2017)	J	Korea	477	NA	.43	life satisfaction, loneliness, depression	SNS	SR	NA	.01, -.18 -.08
Young (2015)	M	US	94	19.50	.47	self-esteem	Facebook	SR	NA	.22
Zabawska (2013)	B	Ireland	123	33.74	.57	self-esteem	Facebook	SR	NA	.06
Zeeni et al. (2018)	J	Lebanon	244	18.10	.64	anxiety, depression	Facebook/Instagram	NA	NA	-.01, -.06
Zell & Moeller (2018)	J	US	307[a]	26.46	.77	self-esteem	Facebook	SR	611.24	.03[a]
Zhang (2017)	J	Hong Kong	573	NA	.60	depression, life satisfaction	Facebook	SR	NA	0, -.03

Notes. [a] The information was not reported, but was obtained by contacting the authors.
[b] The mean network size was computed based on 100 participants.
NA = not available.
PO = publication outlet, J = journal article, B = Bachelor's thesis, M = Master's thesis, D = Doctoral dissertation, C = conference paper, HD = Higher Diploma, HP = thesis for honor program, PP = Master's professional paper; age = Mean age of the sample; Sex = proportion of females; WB/D = indicator of well-being and distress; InfoNS = information about social network size, SR = self-report, PF = the number of SNS friends were obtained from the participant profile; friend = the mean number of SNS friends.

Outlier Analyses

Table 2 presents unweighted mean, standard deviation, minimum and maximum values of the Pearson Product-Moment correlation of each indicator with OSNS. The correlation between OSNS and self-esteem in the freshman sample (r = -.29) of Kalpidou and colleagues (2011) was 2 standard deviations below the unweighted mean. As shown in Table 3, the weighted mean correlation was r = .06. When this study was excluded, the weighted mean correlation changed to r = .07. The effect size (r = .43) reported in the early millennial sample of Brailovskaia and Bierhoff (2020) was 2 standard deviations above the unweighted mean. The weighted mean correlation between OSNS and self-esteem remained the same when that study was excluded. For depression, the effect size (r = -.25) in S. Park et al. (2015) was 2 standard deviations below the unweighted mean. The weighted mean increased from r = .01 to .02 when that study was excluded. Bourke (2013) reported the correlation between OSNS and loneliness as r = .16, which is 2 standard deviations above the unweighted mean. The weighted mean remained the same (r = -.11) when that study was excluded. As the influence of these extreme values was minimal, they remained in the subsequent analyses. Extreme values were not observed for other indicators.

Table 2. *Summary Statistics for Effect Sizes.*

	r	*SD*	*Min*	*Max*
Happiness	.17	.06	.09	.22
Life satisfaction	.11	.10	-.03	.29
Self-esteem	.07	.12	-.29	.43
Anxiety	.09	.14	-.08	.28
Social anxiety	-.21	.16	-.45	.00
Depression	.01	.11	-.25	.22
Loneliness	-.10	.11	-.27	.16

Table 3. *Summary of the Relations Between the Number of SNS Friends and Well-Being and Distress*.

	k	*r*	95%		Q_T
			lower	upper	
Well-being	69	.08	.05	.10	85.52
Happiness	4	.15	.02	.28	1.95
Life satisfaction	18	.10	.06	.15	21.02
Self-esteem	54	.06	.04	.09	65.16
Distress	54	-.06	-.09	-.03	57.08
Anxiety	5	.08	-.09	.24	4.40
Social anxiety	8	-.19	-.32	-.06	7.58
Depression	23	.01	-.04	.05	23.25
Loneliness	26	-.11	-.14	-.07	27.61

Note. Q_T = total homogeneity statistic.

Publication Bias

The effect of publication bias for each indicator with more than 1 effect size was tested by the trim and fill technique. No cases were imputed for self-esteem, anxiety, social anxiety, and loneliness. One effect size for life satisfaction was trimmed and yet the weighted mean effect size remained the same (r = .10). Two effect sizes for happiness was trimmed and the mean correction decreased from r = .15 to .10. Four effect sizes for depression were trimmed and the mean correction changed from r = .01 to -.02.

Mean Correlations

Correlations between the number of SNS friends and well-being were reported in 69 samples and those between the number of SNS friends and distress in 54 samples. Coding multiple effect sizes for each sample yielded 141 correlations. The numbers of effect sizes were 1 for each of distress, combined anxiety and depression, and social loneliness, 5 effect sizes for anxiety, 23 for depression, 4 for happiness, 18 for life satisfaction, 26 for loneliness, 54 for self-esteem, and 8 for social anxiety. Table 3 lists the weighted mean correlations for indicators with more than one effect size. The mean correlations between the number of SNS friends and well-being indicators were positively weak based on the guidelines of Cohen (1988). Specifically, the correlations of SNS friends with well-being, happiness, life satisfaction, and self-esteem were r = .08, .15, .10, and .06, respectively. The 95% confidence intervals did not include 0, indicating that these correlations were significantly different from 0. In contrast, the strengths of the correlations for distress indicators varied. For example, the correlation between OSNS and social anxiety was low-to-moderate and negative (r = -.19), while the effect sizes for anxiety and depression did not differ significantly from 0.

Moderator Analyses

Since general well-being, distress, and self-esteem had sufficiently large numbers of effect sizes, moderator analyses were conducted for these three indicators. When the moderators are categorical, the weighted mean of Z_r for each category was computed and back transformed into the correlation coefficient.

Well-Being

Four categorical moderators were examined. As indicated in Table 4, most studies were reported in journals (k = 51). The mean correlation between OSNS and well-being was significant for journal articles (r = .08) and Master's theses (r = .14). Publication outlet was not related to the correlation between the number of SNS friends and well-being. In contrast, the study country was significantly correlated with effect size. The correlation for studies conducted in Germany was moderate (r = .24), while zero-to-low effect sizes were observed for the other countries. Most studies measured Facebook friends (k = 58), and found a low and positive relation between number of

Facebook friends and well-being with r = .07. In contrast, the correlation between global online friends and well-being was not significantly different from 0 (r = .06). The moderating effect of study SNS was not significant, with Q_B = .31. The number of SNS friends can be self-reported by the participant or obtained from the participant profile, and the method of obtaining information about the OSNS was significantly related to the correlation between OSNS and well-being, with Q_B = 12.27. The mean correlation for studies using a self-report measure had a small effect size (r = .06), while that for studies that recorded the OSNS from the participant profile was low-to-moderate, at r = .21.

Table 4. *Moderator Analyses for Well-being*

Indicator	*k*	*r*	95% CI		Q_B
			upper	lower	
Publication outlet					1.96
Journal	51	.08	.05	.10	
Bachelor	2	.05	-.73	.77	
Master	7	.14	.03	.26	
Doctor	6	.08	-.03	.18	
Country					16.60*
US	36	.08	.04	.11	
Ireland	3	-.00	-.27	.27	
Germany	5	.24	.12	.36	
UK	3	.08	-.14	.29	
Austria	2	.04	-.60	.65	
Portugal	2	.04	-.64	.68	
Korea	2	.05	-.63	.69	
Australia	2	.07	-.67	.74	
Netherlands	2	.02	-.70	.72	
Site					0.31
Facebook	58	.07	.05	.10	
SNS	8	.06	-.02	.13	
How the Information about the Social Network Size Was Obtained					12.27*
Self-report	61	.06	.04	.09	
Profile	6	.21	.11	.31	

Notes. Q_B = between-group homogeneity statistic; How the information about the social network size was obtained, profile = the number of SNS friends were obtained from the participant profile.
*p < .05.

Table 5. *Effects of Continuous Moderators*.

Variable	*k*	a^a	b^b	*p*
Well-being				
female	69	.12	-.07	.44
mean age	62	.12	-.00	.35
mean network size	43	.15	-.00	.10
Distress				
female	53	-.13	.11	.22
mean age	46[a]	-.11	.00	.38
mean network size	35	-.07	.00	.87
Self-esteem				
female	54	.17	-.18	.07
mean age	49	.09	-.00	.58
mean network size	32	.17	-.00	.02

Notes. Mean age was available in 44 samples adopting the cross-sectional design. The Mikami et al. (2010) using the longitudinal design was excluded from the analysis. female = proportion of female; mean network size = mean number of SNS friends of the sample.
[a] intercept in the meta-regression model.
[b] slope in the meta-regression model.

Table 5 presents the effects of continuous moderators, namely the proportion of females, mean age and mean OSNS of the sample. The proportion of females in the sample was available in 69 samples; mean age of the sample in 62 samples, and mean number of online friends in 43 samples. Since the *p* values of regression coefficients (*b*) were all larger than .05, the null hypotheses that regression coefficients were 0 were not rejected. Thus, all continuous moderators were unrelated to the correlation between OSNS and well-being.

Distress

Table 6 presents the categorical effects for the effect sizes of distress. The mean correlations for journal articles was significantly different from 0 (r = -.05), while those for Master's theses, doctoral dissertations and conference papers were 0. Again, most studies were conducted in US. All other means, except the weighted means for US (r = -.08) and Korea (r = -.13), were not significantly different from 0. The non-significance may be caused by the low statistical power due to the small numbers of effect sizes. Facebook again attracted the most research attention, and the mean for Facebook friends was significantly different from 0. A self-report measure was the most popular method for measuring the OSNS. The weighted mean correlation between OSNS and distress was significantly different from 0 when measuring the OSNS by self-reporting (r = -.05) or from participant profiles (r = -.13). None of the categorical moderator analyses demonstrated significant effects on the correlation between OSNS and distress. As indicated in Table 5, *p* values of regression coefficients were again larger than .05, indicating that none of the continuous moderators were statistically significant.

Table 6. *Moderator Analyses for Distress*.

Indicator	*k*	*r*	95% CI		Q_B
			upper	lower	
Publication outlet					6.88
Journal	37	-.05	-.08	-.01	
Master	6	-.05	-.19	.08	
Doctor	5	-.08	-.22	.07	
Conference	3	-.21	-.44	.05	
Country					9.63
US	27	-.08	-.12	-.03	
Ireland	2	.02	-.75	.77	
Austria	2	-.12	-.71	.57	
Australia	3	-.03	-.29	.22	
Korea	5	-.13	-.24	-.01	
Portugal	2	-.02	-.69	.66	
Canada	2	.09	-.69	.77	
Hong Kong	2	-.06	-.71	.65	
Site					1.21
Facebook	44	-.06	-.10	-.03	
Instagram	4	.00	-.18	.19	
SNS	4	-.05	-.23	.13	
How the information about the social network size was obtained					2.78
Self-report	44	-.05	-.08	-.01	
Profile	7	-.13	-.25	-.01	

Note. Q_B = between-group homogeneity statistic; How the information about the social network size was obtained, profile = the number of SNS friends were obtained from the participant profile.

Self-Esteem

Since all effect sizes for self-esteem were also included in those for well-being, the results of the categorical moderator analyses for self-esteem were similar to those for well-being. As indicated in Table 7, the mean correlations for publication outlets with relatively large numbers of effect sizes (journal articles and Master's theses) were significantly different from 0 (r = .06 and .14, respectively), while those with small numbers of effect sizes (Bachelor's Theses and doctoral dissertations) were not (r = .05). The effect of publication status was not significant, with Q_B = 2.74. Conversely, the effect of country where the study was conducted was significant, with Q_B = 28.83. The effect size was moderate for Germany (r = .32), but zero-to-low for all of the other countries. The study SNS was not related to the correlation between OSNS and self-esteem with Q_B = .09. The effect of how the information of social network size obtained was significant. The mean effect size for self-report measures (r = .05) was small, while mean correlation for that obtained from the participant profile was moderate (r = .31). The patterns of continuous moderators of effect sizes for self-esteem and for well-being were somewhat different. The effect of the mean number of SNS friends of the sample was significant. The weighted regression equation was Z_r = .17 + (-.0003) × (mean social network size). The expected coefficients for the correlation between OSNS and self-esteem were about r = .14, r = .11, and r = .08 for samples with means of 100, 200, and 300 SNS friends, respectively. In other words, the correlation between OSNS and self-esteem weakened as the mean OSNS increased. The gender composition and mean age did not exert significant effects on the correlation between the number of SNS friends and self-esteem.

Table 7. *Moderator Analyses for Self-Esteem*.

Indicator	*k*	*r*	95% CI		Q_B
			upper	lower	
Publication outlet					2.74
Journal	38	.06	.03	.10	
Bachelor	2	.05	-.73	.78	
Master	7	.14	.02	.26	
Doctor	4	.05	-.11	.20	
Country					28.83***
US	30	.06	.03	.09	
Ireland	3	-.00	-.23	.22	
Germany	3	.32	.11	.51	
Austria	2	.04	-.44	.50	
Portugal	2	.05	-.49	.56	
Netherlands	2	.02	-.60	.63	
Site					0.09
Facebook	46	.06	-.03	.09	
SNS	5	.05	-.07	.16	
How the information about the social network size was obtained					19.07***
Self-report	50	.05	.03	.08	
Profile	3	.31	.06	.53	

Notes. How the information about the social network size was obtained, profile = the number of SNS friends were obtained from the participant profile.
***p < .001.

Discussion

There has been a considerable amount of research into the effect of social network on health and distress (Santini et al., 2015; Smith & Christakis, 2008). The purpose of the present meta-analysis was to estimate the directions and magnitudes of the correlations of OSNS with well-being and distress. Since most Facebook users are aged 18–34 years (Statista, 2019), the present study provided crucial information for understanding the links of social network size with well-being and distress among adolescents and young adults.

To ensure the validity of findings of this study, the trim and fill method was performed to correct the effect of publication bias. No publication bias was found in most indicators. For the indicators of life satisfaction, happiness, and loneliness, the decrement of effect size ranged from .00 to .05 after the trim and fill techniques. Hence, the impact of publication bias was not substantial.

Overall Relations of the Number of SNS Friends With Well-Being and Distress

Substantially meaningful relations between OSNS and well-being indicators were observed, as all the correlations were significant and positive. These findings indicated that larger OSNS was related to higher level of well-being. The most frequently examined indicator of well-being was self-esteem, and the coefficient for its correlation with OSNS was r = .06, which is comparable to D. Liu and Baumeister (2016) reporting a coefficient of r = .07. However, the current study had a smaller effect size than that of Pinquart and Sörensen (2000). The inter-study difference may be explained by variations in the sample ages, and in the indexes used to measure social networks. Pinquart and Sörensen (2000) included studies that examined offline social networks for participants with a mean age over 55 years. Furthermore, the social networks were characterized by the network size, communication frequency, and social support. The correlations of online network size with life satisfaction and happiness found in the present study were also weaker than those found by Pinquart and Sörensen (2000).

This study found mixed relations between OSNS and distress indicators. Correlations of loneliness and social anxiety with OSNS were negative, whereas the correlation coefficients for anxiety and depression did not differ significantly from 0. Furthermore, social anxiety had the strongest correlation with OSNS, with a low-to-moderate effect size (r = -.19). The direction and magnitude of the correlation between OSNS and distress indicators varied, and thus future research studies should include multiple distress indicators to help understand their links with OSNS.

Moderator Effects

The moderator analyses indicated that moderate correlations between OSNS and well-being were found in studies conducted in Germany. Further examination revealed that two samples from Brailovskaia and Bierhoff (2020) had unusually strong correlations (r = .37 and r = .43). The mean correlation coefficient for Germany after these two potential outliers were removed was r = .16, which was still larger than those for the other countries. Since the moderator analyses for well-being also included all effect sizes for self-esteem, the effect of study country on the correlation between OSNS and self-esteem was also significant. Two of the three German samples assessing self-esteem were from Brailovskaia and Bierhoff (2020). Other countries, except US, had smaller numbers of samples, and more research into the country effect is needed.

The size of an online social network can be accurately determined from the participant profile. The use of this measure yielded an about moderate effect size for self-esteem, while that for the self-report measure was small. This finding indicated that magnitude of the link between OSNS and self-esteem depends on accuracy of the measure used to quantify the OSNS. The use of a proxy measure of OSNS underestimated the strength of the correlation. Hence, future research should adopt an accurate measure, rather than a proxy measure, when attempting to precisely determine the magnitude of correlations.

The mean social network size was related to the correlation between OSNS and self-esteem. Studies involving smaller social networks yielded stronger correlations than those involving larger social networks. Weak relationships, such as those that are common on online social networks (Donath & boyd, 2004), may replace strong relationships in samples involving extremely large networks. This possibility suggests that more research is needed into the correlations of the number of close SNS friends with well-being and distress (e.g., Lemieux et al., 2013). Further research should also consider other potential moderators, such as representativeness of sample, measure of research variable (multi-item versus single-item scale) and socio-economic status.

Although the meta-analysis by Pinquart and Sörensen (2000) reported the mean correlation between social network and subjective well-being, they focused on the relations between offline social networks and positive indicators for older adults. D. Liu and Baumeister (2016) focused on online social networks, but only included a small number of studies, and only examined self-esteem as an indicator. This meta-analysis contributes beyond previous meta-analyses because of its research scope and addition of indicators of well-being and distress. This study shifts the research scope to offline social network and to participants from all age groups, and incorporates several positive and negative indicators to provide a comprehensive assessment of mental health.

Limitations

This study has some limitations. First, this study focused on the size of social networks, and so does not determine the correlations between the quality of online social network with well-being and distress. Second, because the establishment of criteria to determine study quality of primary research is difficult in correlational research (Lipsey & Wilson, 2001; Valentine 2009), the moderator of study quality was not examined. Lastly, the effects of well-being and distress measures were not examined, because the same scales have been widely used to measure self-esteem, loneliness and life satisfaction. Specifically, the Rosenberg Self-esteem Scale (M. Rosenberg, 1965) is frequently used to measure self-esteem, the UCLA Loneliness Scale (Russell, 1996) is used for measuring loneliness, and the Satisfaction with Life Scale (Diener et al., 1985) is used to assess life satisfaction. Very few studies have used different measures, so this study did not investigate the moderator effects of measures.

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