



Social Networks Use Disorder and Associations With Depression and Anxiety Symptoms: A Systematic Review of Recent Research in China

Zaheer Hussain^{1*}, Elisa Wegmann², Haibo Yang³ and Christian Montag^{4,5}

¹ School of Social Sciences, Nottingham Trent University, Nottingham, United Kingdom, ² General Psychology: Cognition and Center for Behavioral Addiction Research, University of Duisburg-Essen, Duisburg, Germany, ³ Academy of Psychology and Behavior, Tianjin Normal University, Tianjin, China, ⁴ Molecular Psychology, Institute of Psychology and Education, Ulm University, Ulm, Germany, ⁵ neuSCAN Laboratory, MOE Key Laboratory for Neuroinformation, The Clinical Hospital of Chengdu Brain Science Institute, University of Electronic Science and Technology of China, Chengdu, China

OPEN ACCESS

Edited by:

Roumen Kirov,
Institute of Neurobiology
(BAS), Bulgaria

Reviewed by:

Andreas Becker,
Universitätsmedizin
Göttingen, Germany
Dena Sadeghi Bahmani,
University Psychiatric Clinic
Basel, Switzerland
Serge Brand,
University Psychiatric Clinic
Basel, Switzerland

*Correspondence:

Zaheer Hussain
zaheer.hussain@ntu.ac.uk

Specialty section:

This article was submitted to
Psychopathology,
a section of the journal
Frontiers in Psychology

Received: 25 July 2019

Accepted: 30 January 2020

Published: 21 February 2020

Citation:

Hussain Z, Wegmann E, Yang H and Montag C (2020) Social Networks Use Disorder and Associations With Depression and Anxiety Symptoms: A Systematic Review of Recent Research in China. *Front. Psychol.* 11:211. doi: 10.3389/fpsyg.2020.00211

Background: An increasing number of studies have investigated Social Networks Use Disorder (SNUD) among Western samples. In this context, the investigation of SNUD in Asia and especially in China has been much neglected. This poses a gap in the literature; it has been estimated that more than one billion Chinese people are using Chinese social networking sites (SNSs). Of note, many of these Chinese SNSs are rather unknown to researchers in Western countries.

Aims: The primary objective of the present systematic review was to identify and evaluate studies that investigated Chinese SNS use and associations between SNUD and depression and anxiety symptoms.

Method: A comprehensive search strategy identified relevant studies in PsycINFO, PsycARTICLES, Psychology and Behavioral Sciences Collection, MEDLINE, ProQuest, Web of Science, PubMed, Google Scholar, and the Chinese National Knowledge Infrastructure database (CNKI).

Results: The search strategy identified 35 potential studies, 13 studies were identified after shortlisting and full-text reviews of the studies, and finally 10 studies were included in the full review. Associations between SNUD, depression, and anxiety were reported in 10 studies. In eight (of the 10) studies, symptom severity of SNUD was associated with depression. Four studies reported associations between SNUD and anxiety. Most studies had utilized cross-sectional survey designs.

Conclusions: Most associations were found between SNUD and depression symptoms, but effect sizes were higher between SNUD and anxiety symptoms. The results have the potential to inform prevention and interventions on SNUD in Eastern cultures, although we explicitly state that our work focuses on China, the transfer of the present observations to other Asian countries (and their cultures) still needs to be established.

Keywords: addiction, WeChat®, Weibo®, Social Networking Sites, depression, anxiety

INTRODUCTION

In 2012, China already had one of the world's most active environments for social networking site (SNS) use with more than 300 million users (Chiu et al., 2012). In 2014, there were more than 480 million Chinese SNS users (Socialmediatoday.com, 2014). By December 2018, the number of Internet users in China had reached 829 million, with a penetration rate of 59.6%, and the proportion of Internet users using smartphones is currently 98.6% (China Internet Network Information Center, 2019). Mak et al. (2014) reported that 70% of participants from the Chinese mainland and 65% from Hong Kong use SNSs suggesting that the use of SNSs is increasing rapidly in China. There are different SNSs used in China, among these are WeChat[®], Weibo[®], Qzone[®], and QQ[®] (see also recent developments with the TikTok[®] platform showing huge growth rate in user numbers). The use of WeChat[®] has gained substantial popularity in China due to its multi-purpose character including payment functions and combining features of WhatsApp[®] and Facebook[®] (Gao and Zhang, 2013; Lien and Cao, 2014; Sampasa-Kanyinga and Hamilton, 2015; Montag et al., 2019a). According to statista.com, it has been reported that there are over one billion active WeChat[®] users (Statista.com, 2019) and it had reached 1.082 billion users by January 2019 (Weixin.qq.com., 2019), thereby showing the dramatic increase from the 300 million users in 2012. Weibo[®] represents a micro-blog platform and allows users to make 140-character posts, similar to Twitter[®], it focuses on the sharing of opinions and information exchange (Sullivan, 2013). Qzone[®] is built around basic information presented by users, as well as pictures, comments, and videos posted by users and their friends (Apaolaza et al., 2014). QQ[®] consists of a large virtual community merged with interactive channels of searching, blogging, gaming, transactions, and social networking (Huang et al., 2013).

Given that, researchers should abstain from overpathologizing everyday life behaviors (Billieux et al., 2015), it is important to mention that SNS use can have positive effects on well-being. In this context, research observed that non-problematic use of SNSs was associated with higher external locus of control, greater online social interaction skills and higher life satisfaction (Nadkarni and Hofmann, 2012; Liu et al., 2016; Hou et al., 2017; Zhou et al., 2017). Active (vs. passive) use of SNSs together with meaningful interaction between people represents non-problematic use of SNSs (e.g., Escobar-Viera et al., 2018). In this context, research (Allen et al., 2014; Siddiqui and Singh, 2016) has reported that SNSs can improve social connectedness among users and can facilitate in the sharing of ideas between people and businesses across geographical boundaries. In this context, users do not experience negative consequences due to the usage of those platforms but rather experience the achievement and gratification of specific goals and needs. The term "problematic" is in itself problematic, because it is not clear if it describes the end of the spectrum or a transit zone from healthy via problematic to psychopathological SNS use. In any case, passive SNS use could cause mental health problems, in particular when users engage in upward social comparison processes (Tiggemann and Polivy, 2010; Vogel et al., 2014, 2015; Appel et al., 2015). Moreover, there

are a growing number of individuals suffering from negative consequences due to the use of SNSs and given these potential negative outcomes, studies have shown associations between problematic SNS use and a range of mental health problems (Sampasa-Kanyinga and Hamilton, 2015; Sun et al., 2016). Recent research proposes that problematic SNS use or excessive overuse might even represent a distinct potential mental health problem (e.g., Balci and Gölcü, 2013; Montag et al., 2017, 2018b; Marino et al., 2018; Sha et al., 2019). Therefore, Van Rooij et al. (2017) called for the examination of specific online behaviors, such as problematic SNS use that show similarities to other addictive Internet-use patterns [see also exemplarily works by Montag and Becker (2018), Potenza et al. (2018), Sariyska et al. (2015), Tang et al. (2017), Tateno et al. (2018), Montag et al. (2015), Müller et al. (2017) and Wegmann et al. (2018)]. Andreassen and Pallesen (2014) describe the excessive, uncontrolled, or problematic use of SNS as "being overly concerned about SNSs, driven by a strong motivation to log on to or use SNSs, and to devote so much time and effort to SNSs that it impairs other social activities, studies/job, interpersonal relationships, and/or psychological health and well-being" (p. 4054). However, despite the initial state of research, to date there has been no classification of the disorder or specific terminology for it. Past research has used various terms such as Facebook addiction, social media addiction, problematic social-networks use, Internet-communication disorder, and social networks use disorder (SNUD; Montag et al., 2019b). We prefer the term SNUD, which is based on the terminology and the definition of gaming disorder in the ICD-11 of the World Health Organization (Pontes et al., 2019; World Health Organization, 2019). SNUD focuses on the interactive, social, communicative online activity, instead of highlighting one specific platform or the specific device while using a SNS (Wegmann et al., 2018).

The I-PACE (Interaction of Person-Affect-Cognition-Execution) model by Brand et al. (2016, 2019), is a theoretical framework investigating addictive behavior; it describes how predisposing variables interact with further cognitive and affective mechanisms, which could result in a loss of control when using a specific Internet application such as a SNS. The definition of predisposing variables to develop SNUD described in the I-PACE model includes psychopathological symptoms such as depression, anxiety, and interpersonal sensitivity to be a risk factor for the development and maintenance of an addictive behavior. In line with theoretical considerations, recent reviews have reported associations between SNUD and psychological factors. For instance, Kuss et al. (2014) reviewed epidemiological studies of SNUD and found that factors associated with SNUD appear to be complex. The factors included sociodemographic factors, (e.g., gender, family income), Internet usage factors (e.g., frequency and length of internet use), psychosocial factors (e.g., stress, emotional stability, and personality), and comorbid symptoms (e.g., alcohol use, depression, and anxiety; see Mythily et al., 2008; Liu et al., 2011). Furthermore, several studies have reported findings of SNUD being associated with negative consequences in peoples' lives such as poor sleep quality (e.g., Wolniczak et al., 2013; Xanidis and Brignell, 2016). Associations between psychopathological symptoms and SNUD have also been reported. Several studies have reported associations

between SNUD and depression (e.g., Andreassen et al., 2016; Donnelly and Kuss, 2016; Sun et al., 2016; Wegmann and Brand, 2016; Shensa et al., 2017; Kircaburun et al., 2018). Furthermore, several studies have reported associations between SNUD and anxiety as well as interpersonal sensitivity (Wegmann and Brand, 2016; Lian et al., 2017; Oberst et al., 2017; Pontes, 2017; Van Rooij et al., 2017; Atroszko et al., 2018). These are just a few examples of studies on the topic of psychopathology and associations with SNUD symptoms. Altogether, these research findings show that SNUD may have implications for health and well-being (Andreassen and Pallesen, 2014; Zhou et al., 2017). Beyond that, most of the studies and reviews reporting associations between SNUD and psychopathological symptoms have been undertaken or reported on Western samples. This is a view too narrow-minded when considering the rise of SNSs in China, therefore we believe that a review of non-western SNS use and associations with psychopathological symptoms with a focus on China is much needed to gain a better understanding on this issue.

Review Aims/Rationale

In sum, with the growing popularity of Chinese SNSs, a review of Chinese SNS use is much needed. We focus on Chinese SNSs in the present work, because with its hundreds of millions of users and mighty social media platforms such as Tencent's WeChat® it represents without doubt one of the most important digital forces in a connected world. In this part of the world, unintended side effects of digitization such as the development of addictive behaviors toward diverse online content need to be investigated (Montag and Diefenbach, 2018; Scholz et al., 2018). Furthermore, prevalence rates outline that SNUD seems to be a serious problem in Eastern cultures, especially when comparing those prevalence rates to Western cultures (e.g., Khumsri et al., 2015; Guedes et al., 2016; Stodt et al., 2018; Yang et al., 2019). We believe that a focus on Chinese SNSs is timely and relevant because much of what has been presented in the literature represents the Western view on the topic (including a strong focus on Western SNSs such as Facebook® see Sindermann et al., 2020). Therefore, reviewing literature on SNUD and associations with anxiety and depression from an Eastern perspective helps to get a more balanced view on the topic. Furthermore, Chinese SNS use is rapidly growing and focusing on Chinese SNS use is important because platforms such as WeChat® are not fully comparable to its Western equivalents (such as Facebook® or WhatsApp®; see Montag et al., 2018a). Therefore, the question arises of whether associations between SNUD and psychopathological variables are valid both in Western and Eastern parts of the world. In the current review, we set out to discover whether associations exist between the above-mentioned variables in Chinese SNSs. Moreover, we were interested in gaining insights into the strength of associations. In order to accomplish this objective, a systematic review of Chinese SNSs use was conducted.

METHODS

Search Strategy

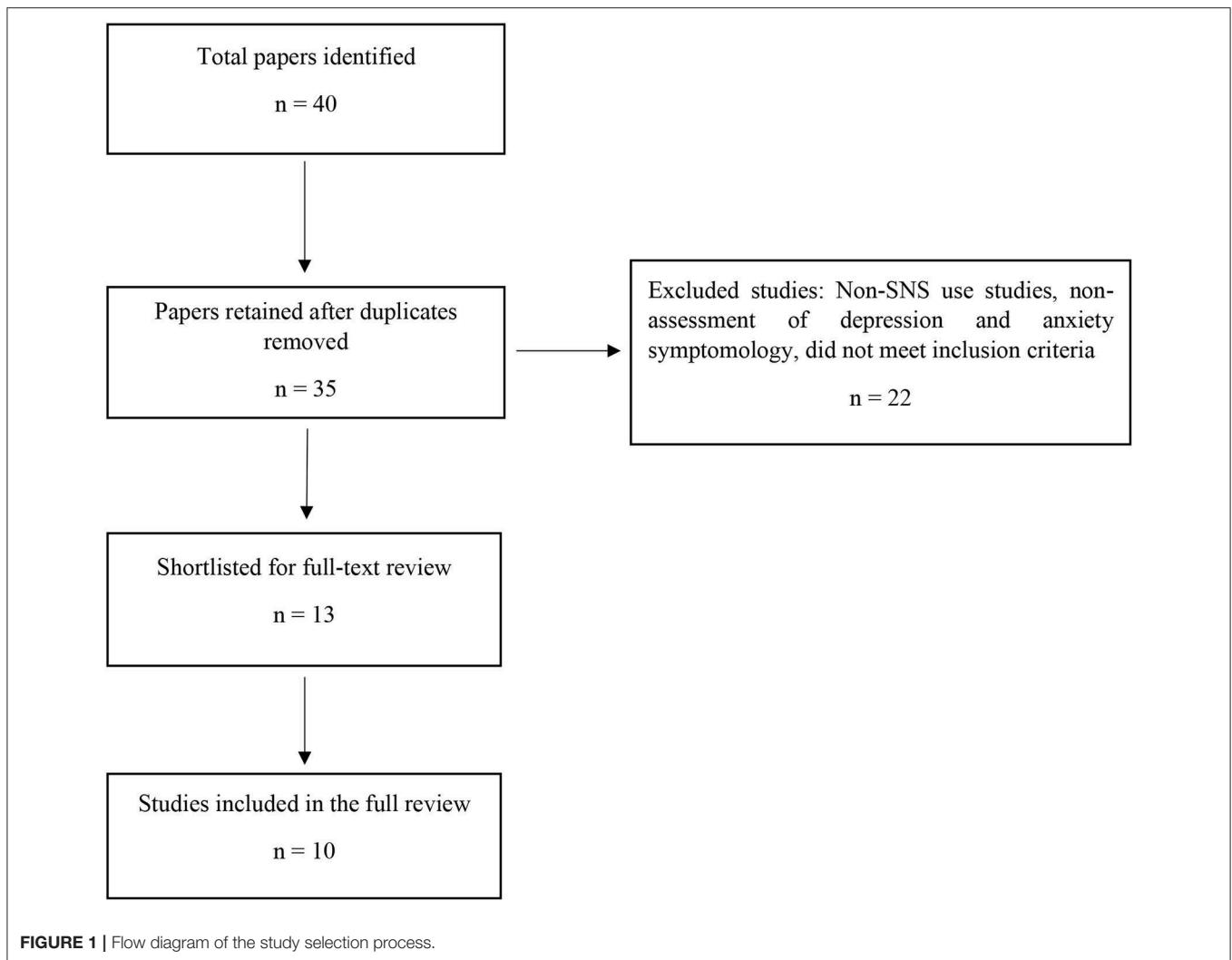
The preferred reporting items for systematic reviews and meta-analysis (PRISMA; Moher et al., 2010) were closely adhered

to during the review process (see **Figure 1**). A systematic review of publications from January 2014 to June 2019 was conducted. The focus was on recent Chinese SNUD studies. Searches were completed on the following databases: PsycINFO, PsycARTICLES, Psychology and Behavioral Sciences Collection, MEDLINE, ProQuest, Web of Sciences, PubMed, Google Scholar, and the Chinese National Knowledge Infrastructure database (CNKI; this is a Chinese language database, the third author extensively searched the Chinese research literature). Terms to search for papers included “China” OR “Chinese,” and in combination with (using the AND Boolean operator) “social networking site” OR “social media” AND “patholog*” OR “problem*” OR “addict*” OR “compuls*” OR “dependen*” OR “disorder*” AND “depression” OR “anxiety.” Finally, relevant journals were searched for recently added papers, including *Cyberpsychology, Behavior, and Social Networking*, *Journal of Behavioral Addictions*, and *Computers in Human Behavior*. Each study's title and abstract were screened for eligibility. Full texts of all potentially relevant studies were then retrieved and further examined for eligibility. Studies were systematically and independently reviewed by the authors and assessed regarding the study type, study population, methodology, measures used, and interpretation of the results.

Inclusion/Exclusion Criteria

For studies to be included in the review, the following characteristics had to be met: (i) being published since 2014 onwards, (ii) having population-based studies, (iii) having specific criteria for SNUD (typically validated psychometric scales), (iv) containing empirical primary data reporting on the correlation between SNUD and the psychopathological variables of depression and anxiety, (v) examining any type of Chinese SNS use and, (vi) being published in English or Chinese/Mandarin. Studies were screened based on the titles and abstracts reporting on the topic of interest. Thereafter, studies were selected based on scientific relevance of the study and included following full-text assessment. They were evaluated if there was an observation of a full association or a finding of some type (i.e., an expected effect, null finding). Full association was considered when a correlation was found for SNUD and specific psychopathological symptoms following bivariate or multivariate analysis. The geographical distribution of studies was also mapped.

After deleting duplicate studies, a total of 35 papers were screened and identified via the systematic search strategy employed. As a result, 22 studies were excluded because they (i) dealt not with SNS use, (ii) did not assess depression or anxiety symptomology, and (iii) did not meet the aforementioned inclusion criteria. Three more studies were excluded after full text review of the studies (see **Figure 1** for a flow diagram of the review process). In total, 10 papers were included in the present review. The characteristics of the studies included in the review (see **Table 1**) are discussed below. Some studies are referred to in more than one section due to assessing more than one psychopathological symptom. The results section also briefly reports the key findings of a further seven studies that



met the inclusion criteria of assessing SNUD but did not assess psychopathological symptoms.

RESULTS

Description of Included Studies and Geographical Distribution

Nine studies were cross-sectional survey studies, only the study by (Li et al., 2018a,b) used a prospective cohort study design. All ten of the studies targeted adolescents and/or emerging adult groups. All studies examined both genders and the sample sizes ranged from 241 to 5,365. Most studies ($n = 8$) were carried out in Mainland China, one study was carried out in Hong Kong (Yam et al., 2019), and one study was carried out in Taiwan (Hong et al., 2014). Given that China, Taiwan, and Hong Kong share the same cultural background, we deemed it important to include studies from these areas of the world in the present review. Furthermore, the participants in these studies were Chinese SNS users. **Table 1** summarizes further information about the included studies and provides insights into the effect sizes observed in each study.

Methods of Assessing Social Networks Use Disorder

Various measures were used to assess SNUD with the authors of studies adapting measures into Chinese/Mandarin and to assess Chinese SNSs (i.e., western SNS name, such as Facebook[®], was exchanged for a Chinese SNS name such as WeChat[®]). Hou et al. (2019) and Wang et al. (2018) utilized adapted versions of the Facebook Intrusion Questionnaire (Elphinston and Noller, 2011; Li et al., 2018a,b) used the Online Social Networking Addiction Scale (Li et al., 2016), Liu and Ma (2018a) used the Social Media Addiction Scale (Liu and Ma, 2018b), Chen et al. (2019) used the Social Networking Websites Addiction Scale (SNWAS; Turel and Serenko, 2012) and the Social Networking Sites Addiction Tendency Scale (SNSATS; Wilson et al., 2010). (Yam et al., 2019) used the Bergen Social Media Addiction Scale (Andreassen et al., 2012), Li et al. (2017) used an adapted version of the Facebook Addiction Scale (Koc and Gulyagci, 2013), and Hong et al. (2014) used the Internet Addiction Test (Young, 1996). Two studies (Niu et al., 2018; Tian et al., 2018) used an adapted version of the Facebook Intensity Scale (Ellison

TABLE 1 | Study details and results.

Authors (year and place of study)	Sample size (age range)	Study variables	Scale used to assess SNUD	Results with SNUD	Effect sizes: bivariate results	Effect sizes: multivariate results
Chen et al. (2019, China)	437 (16–30 years)	SNUD, anxiety	Social Networking Websites Addiction Scale (SNWAS; Turel and Serenko, 2012), Social Networking Sites Addiction Tendency Scale (SNSATS; Wilson et al., 2010)	Positive and significant association with anxiety	Anxiety $r = 0.29$	High anxiety was associated with high levels of SNUD (β simple slope = 0.32, $p < 0.001$)
Hong et al. (2014; Taiwan)	241 (18–22 years)	SNUD, depression, self-esteem, extraversion, neuroticism, sense of inferiority	Internet Addiction Test (Young, 1996)	Positive and significant association with depression	Depression $r = 0.25$	Depression significantly predicted SNUD; $\beta = 0.211$
Hou et al. (2019; China)	641 (17–25 years)	SNUD, depression, anxiety, perceived stress, resilience, social support	Facebook Intrusion Questionnaire (Elphinston and Noller, 2011)	Positive and significant association with depression and anxiety	Depression $r = 0.22$ Anxiety $r = 0.22$	Depression ($\beta = 0.14, 0.12, p < 0.05$) and anxiety ($\beta = 0.14, 0.12, p < 0.05$) were positively associated with SNUD.
Li et al. (2017, China)	1,015 (7th–9th grade students: age range unreported)	SNUD, Internet use disorder, depression, insomnia,	Facebook Addiction Scale (Koc and Gulyagci, 2013)	Positive and significant association with depression	Depression $r = \text{AOR} = 3.27, 95\% \text{ CI: } 2.33, 4.59$	Insomnia partially mediated 44.8% of the effect of SNUD on depression (Sobel $Z = 3.919, p < 0.001$)
Li et al. (2018a; 2018b, China)	5,365 (mean age = 13.9 years in the longitudinal sample: age range unreported)	SNUD, depression	Online Social Networking Addiction Scale (Li et al., 2016)	Positive and significant association with depression	Baseline SNUD was significantly associated with higher incidence of depression during the follow-up period (univariate OR: 1.65, 95% CI: 1.22–2.22).	As compared to adolescents without depression, the odds of developing SNUD were 3.45 times (95% CI: 2.51–4.75) higher among those who were persistently depressed, and 4.47 times (95% CI: 3.33–5.99) higher among those who were emerging depressed
Liu and Ma (2018a, China)	519 (Male mean age 19.42, female mean age 18.81: age range unreported)	SNUD, anxiety, SNS burnout, envy	Social Media Addiction Scale (Liu and Ma, 2018b)	Positive and significant association with anxiety	Anxiety $r = 0.56$	SNUD is a significant predictor of anxiety. Anxiety was a mediator between SNUD and burnout [mediation effect = 0.0795 (95% CI, (0.0546, 0.1075)].
Niu et al. (2018, China)	746 (12–18 years)	SNS intensity, depression, negative social comparison, self-esteem	Facebook Intensity Scale (Ellison et al., 2007)	Positive and significant association with depression	Depression $r = 0.206$	Indirect effect of negative social comparison in the relationships between SNS use and depression (Mediating effect = 0.050, $SE = 0.009$ Bootstrap 95% CI: 0.032/0.086)
Tian et al. (2018, China)	5,215 (10–23 years)	SNS intensity, depression, loneliness, life satisfaction, Internet gaming, online pornography	Facebook Intensity Scale (Ellison et al., 2007)	Negative and significant association with depression	Depression $r = -0.08$	3% of the variance of depression was explained by social networking site use ($\beta = -0.06, p < 0.01$)

(Continued)

TABLE 1 | Continued

Authors (year and country of study)	Sample size (age range)	Study variables	Scale used to assess SNUD	Results with SNUD	Effect sizes: bivariate results	Effect sizes: multivariate results
Wang et al. (2018, China)	365 (14–18 years)	SNUD, depression, rumination, self-esteem	Facebook Intrusion Questionnaire (Elphinston and Noller, 2011)	Positive and significant association with depression	Depression $r = 0.18$	SNUD positively predicted depression, $\beta = 0.18, p < 0.001$
Yam et al. (2019, Hong Kong)	307 (17–30 years)	SNUD, gaming disorder, depression, anxiety	Bergen Social Media Addiction Scale (Andreassen et al., 2012)	Positive and significant associations with depression and anxiety	Depression $r = 0.18$ Anxiety $r = 0.19$	n/a

Effect sizes are factor results reported with SNUD unless otherwise stated; β , standardized regression coefficient; B, Unstandardized regression coefficient; AOR, Adjusted odds ratio; CI, Confidence interval.

et al., 2007) to assess SNS use intensity. Although not a direct measure of SNUD, research has reported that SNS intensity is related to addiction, therefore it appears to be a valid measure of SNUD (Müller et al., 2016). The measures for assessing SNUD varied, some studies had different measurement criteria. **Table 1** provides details of measurement instruments used by the studies to assess SNUD.

Social Networks Use Disorder and Depression Symptoms

Eight studies examined the associations between SNUD and depression (i.e., Hong et al., 2014; Li et al., 2017, 2018a,b; Niu et al., 2018; Tian et al., 2018; Wang et al., 2018; Hou et al., 2019; Yam et al., 2019). A significant and positive association between SNUD and depression was reported in seven studies (i.e., Hong et al., 2014; Li et al., 2017, 2018a,b; Niu et al., 2018; Wang et al., 2018; Hou et al., 2019; Yam et al., 2019). Tian et al. (2018) reported a significant negative association between SNUD and depression. Bivariate correlations were typically in the range from -0.08 to 0.259 . Two studies (Li et al., 2017, 2018a,b) reported odds ratios, which were in the range of 1.65 – 3.27 . Multivariate associations showed betas ranging from -0.06 (Tian et al., 2018) to 0.211 (Hong et al., 2014). Li et al. (2017) reported that insomnia partially mediated 44.8% of the effect of SNUD on depression (Sobel $Z = 3.919, p < 0.001$). One study reported that the odds of developing SNUD was 3.45 times (95% CI: 2.51–4.75) higher among those who were persistently depressed, and 4.47 times (95% CI: 3.33–5.99) higher among those who were emerging depressed (Li et al., 2018a,b). Several scales were used to assess depression in the studies. Most of the studies (Li et al., 2017, 2018a,b; Niu et al., 2018; Tian et al., 2018; Wang et al., 2018) made use of the Chinese version of the Center for Epidemiological Studies Depression Scale (CES-D; Chen et al., 2009). Hong et al. (2014) used the depressive character sub-scale of Lai's Personality Scale (Lai and Lai, 2003). Yam et al. (2019) used the Hospital Anxiety and Depression Scale (HADS; Chan et al., 2010).

Social Networks Use Disorder and Anxiety Symptoms

Four studies examined the associations between SNUD and anxiety (i.e., Liu and Ma, 2018a; Chen et al., 2019; Hou et al.,

2019; Yam et al., 2019). A significant, positive association between SNUD and anxiety was reported in four studies (i.e., Liu and Ma, 2018a; Chen et al., 2019; Hou et al., 2019; Yam et al., 2019). Bivariate correlations were typically in the range of 0.19 – 0.56 . Three of the studies reported inferential statistical results (i.e., Chen et al., 2019—high anxiety was associated with high levels of SNUD (β simple slope $= .32, p < 0.001$); (Liu and Ma, 2018a)—SNUD was a significant predictor of anxiety, anxiety was a mediator between SNUD and burnout (mediation effect $= 0.0795$ (95% CI, [0.0546, 0.1075])); (Hou et al., 2019)—anxiety was positively associated with SNUD ($\beta = 0.14, 0.12, p < 0.05$). Several scales were used to measure anxiety in the studies. Chen et al. (2019) used the Chinese version of the Social Phobia Scale (Ye et al., 2007). Hou et al. (2019) used the State-Trait Anxiety Inventory (Spielberger et al., 1970). Liu and Ma (2018a) used the Social Anxiety Scale for Social Media Users (SAS-SMU; Alkis et al., 2017). Yam et al. (2019) used the Hospital Anxiety and Depression Scale (HADS; Chan et al., 2010).

Social Networks Use Disorder and Further Predisposing Variables in Chinese Samples (Not Meeting the Inclusion Criteria)

In line with the I-PACE model (Brand et al., 2016, 2019), further predisposing variables have been identified as risk factors that are associated with SNUD. Thus, during the initial literature search, seven studies were found that examined SNUD among Chinese SNS users but did not meet the inclusion criteria (other predisposing variables were found to be associated with SNUD). We briefly describe these studies here. Lian et al. (2018) examined associations between SNUD, irrational procrastination, SNS fatigue, and effortful control. Results indicated that SNUD, irrational procrastination, and SNS fatigue were positively correlated with each other, and negatively correlated with effortful control. Further analysis revealed that SNUD had a direct effect on irrational procrastination. Montag et al. (2015) reported correlations between SNUD and unspecified Internet-use disorder amongst Chinese and Taiwanese samples. Hou et al. (2018) assessed how personality traits and psychological factors relate to excessive use of

WeChat[®] and Weibo[®]. The results showed that addictive use of Weibo[®] and WeChat[®] correlated positively with neuroticism, loneliness, and external locus of control and negatively with agreeableness, social support, and social interaction. Li et al. (2018a,b) examined influences of stressful life events and problematic use of WeChat[®] on life satisfaction. The results showed that stressful life events were positively associated with addictive use of WeChat[®]. Zhou and Wang (2017) explored the relationships between addictive use of WeChat[®] and self-control. The results outlined a significant negative correlation between addictive use of WeChat[®] and self-control. Liu and Ma (2018b) reported that SNUD symptoms were positively correlated with the pathological use of the smartphone, pathological Internet use, and narcissism, but negatively correlated with self-esteem. Wang et al. (2015) reported that SNUD was significantly associated with neuroticism and extraversion.

DISCUSSION

The present systematic review investigated SNUD and its associations with depression and anxiety symptoms in ten studies examining Chinese SNS use that met the inclusion criteria. A review of SNUD in Eastern cultures was much needed as there is a lack of research focusing on this topic as well as on possible convergent and divergent mechanisms between Eastern and Western cultures. The current review emphasizes that SNUD co-occurs with psychopathological symptoms. Most associations were found between SNUD and depression symptoms (Yu et al., 2018), but effect sizes were higher between SNUD and anxiety. Considering SNUD and comparisons between Western and Eastern cultures, the results are comparable to the review by Hussain and Griffiths (2018) who found that SNUD was associated with depression and anxiety symptomology in several European studies. More specifically, several Western studies (Andreassen et al., 2016; Pontes, 2017; Shensa et al., 2017; Van Rooij et al., 2017; Kircaburun et al., 2018; Worsley et al., 2018) have reported associations between SNUD and depression symptoms with small to moderate effect sizes. These effect sizes are similar to the Chinese SNUD studies reported in this review. Several Western studies (Andreassen et al., 2016; Pontes, 2017; Van Rooij et al., 2017; Atroszko et al., 2018; Worsley et al., 2018) have reported associations between SNUD and anxiety symptoms with small effect sizes. These effect sizes are similar to the Chinese SNUD studies reported in this review (although these were higher compared to associations with depression). A recent meta-analysis by Marino et al. (2018) examining the associations between SNUD and psychological distress reported a medium bivariate effect size. These findings are similar to the effect sizes reported in the present review. Other meta-analyses (Huang, 2012; Song et al., 2014) have reported small effect sizes, which differs to the effect sizes reported for Chinese SNS use, which were higher. In sum, the present review evidenced statistically significant associations between SNUD and depression and anxiety symptoms. However, the effect sizes reported were higher than a recent meta-analysis examining

Internet use and well-being (Çikrikci, 2016) and consistent with a meta-analysis investigating problematic Internet use and social anxiety (Prizant-Passal et al., 2016). Nevertheless, please note that (a) we did not conduct a meta-analysis and (b) well-being in terms of life satisfaction or positive emotionality was not the focus of the present review work, and there are few related studies (Zhou et al., 2017).

The results outline that overall the associations between SNUD and psychopathological symptoms seem to be comparable in Western as well as Eastern cultures. Nevertheless, research on SNUD and the addictive use of the Internet in general should go a step further. Investigating the relationship between psychopathology and SNUD is important for gaining an initial understanding of this potential disorder. However, bivariate correlations do not allow conclusions about underlying mechanisms or the process of the development and maintenance of addictive Internet use or SNUD. Moreover, it gives no answers to what negative consequence appeared first. Therefore, the question remains if psychopathological symptoms present a prerequisite to develop SNUD and/or if they represent a consequence of an addictive behavior. Consistent with the theoretical considerations of the I-PACE model (Brand et al., 2016, 2019), the interaction of predisposing variables such as depression, anxiety, and interpersonal sensitivity with further affective and cognitive mechanisms should be investigated in Eastern cultures as well. For example, the empirical study by Wegmann and Brand (2016) already outlined that aside from bivariate correlations the effect of psychopathological symptoms on tendencies toward SNUD is mediated by use expectancies, and similar studies have yielded the same conclusions (Niu et al., 2016a). The expectancies to escape from negative emotions and to experience pleasure by using SNSs seem to represent a reinforcement mechanism, which enhances the risk of individuals developing problematic use of SNSs or other communication applications. The interactive effect of predisposing variables and cognitive and affective mechanisms is discussed in several studies as well as in theoretical models (e.g., Niu et al., 2016b; Wegmann and Brand, 2016; Brand et al., 2019). Understanding these reinforcement mechanisms are relevant for the definition of convergent and divergent mechanisms in different specific forms of Internet-use disorders as well as in different cultures (Yao et al., 2014). This could also affect preventive mechanisms and treatment programs in Western and Eastern cultures.

Stodt et al. (2018) showed that the relevance of Internet-literacy capabilities as a preventive and protective role for the development and maintenance of addictive use of the Internet in general seem to differ in Germany and China. Additionally, Lachmann et al. (2018) outline comparable associations between symptom severity of addictive use of the Internet and life satisfaction and empathy. However, taking a closer look, the results also emphasize that there are differences in Chinese and German students. It could be speculated that the effect of protective factors such as high empathy or life satisfaction differ in both cultures, although works such as by Lachmann et al. (2018) or older work by Melchers et al. (2015) rather hint at the comparability of mechanisms. In

general, the present review results are in line with the study by Yang et al. (2019) comparing British and Chinese students; our findings emphasize differences regarding prevalence rates between cultures.

Further research is needed which especially examines the reinforcement mechanisms of the development and maintenance of SNUD as well as other types of Internet-use disorders in both cultures. SNUD is likely to influence the health and well-being of SNS users; it may also be the case that people with high levels of depression and anxiety may end up displaying maladaptive technology behaviors. However, this is currently a speculative assumption; the reviewed studies cannot answer these assumptions due to the cross-sectional nature of the studies. Future longitudinal studies will help to establish causal relationships. Distinguishing between Eastern and Western cultures and SNUD for future research questions is one way forward as the online applications are different in these cultures. The specific uses of SNSs may be different between cultures. Furthermore, Asian users have been shown to display more SNUD symptoms than Western users (Kuss et al., 2014; Stodt et al., 2018; Yang et al., 2019). This shows that further research examining SNUD in Asian countries is warranted. In addition, future research should consider other risk factors that may be associated with SNUD, such as impulsivity, and neuroticism (see recent works by Elhai et al., 2019; Peterka-Bonetta et al., 2019; Sha et al., 2019). Examining specific uses of SNSs (e.g., social interaction, posting photo's, viewing the profiles of other users) and its impact on psychological well-being is an important area for future research (see Rothen et al., 2018; Twenge et al., 2018).

Limitations and Future Research

Most of the reviewed studies used self-report methods and were cross-sectional, which makes it difficult to identify causal associations. Furthermore, specific activities engaged in by SNS users were not recorded making it difficult to ascertain the causes of SNUD, depression, and anxiety. The reviewed studies consisted of adolescent samples who tend to be the main users of this technological medium. This said, older people use SNSs and therefore studies examining SNS use among older users is warranted as this is an under-studied age-group. The current review did not investigate other relevant variables such as obsessive-compulsive disorders and loneliness; future research could investigate these variables. It is important to note that different measures were used to assess SNUD in the

reviewed studies and therefore researchers had different criteria for assessing SNUD. Currently, no diagnostic standard exists to assess and diagnose SNUD, even if it is seen to be mandatory to increase consistency of measurement in this field of research. However, there are unanswered questions regarding causality and underlying factors regarding the occurrence of symptoms (of both SNUD and psychiatric disorders). Prospective studies will help to answer these questions (Starcevic and Khazaal, 2017). Information on SNS use among individuals diagnosed with depression or anxiety disorders are limited (Prizant-Passal et al., 2016), future studies that utilize clinical samples to examine the SNUD-psychopathology relationship is much needed. Beyond that, it will be of large importance to also study the design of social media/messenger platforms both in the Western and Asian world in order to understand which in-built elements, such as Likes or retweets, actually foster addictive behaviors (Montag et al., 2019b). Finally, the low number of studies in the review means that additional reviews are warranted when significantly more studies have been published. Nevertheless, for the moment we believe our work to be comprehensive and it addressed an important gap in the research literature.

CONCLUSIONS

The present review revealed associations between SNUD and psychopathological symptoms among Chinese SNS users. A review of SNUD in Eastern cultures was warranted due to a lack of knowledge about SNS use in China. The findings were insightful and have the potential to inform prevention and interventions on SNUD in Eastern cultures and will be of benefit to researchers studying the impact of SNUD.

AUTHOR CONTRIBUTIONS

ZH, EW, and CM designed the present study. ZH wrote the first draft of the present work and carried out the systematic review. HY reviewed the scientific literature written in Mandarin. All authors worked over the first draft and approved the final version.

FUNDING

The position of CM was funded by a Heisenberg grant awarded to him by the German Research Foundation (DFG, MO2363/3-2).

REFERENCES

- Alkis, Y., Kadirhan, Z., and Sat, M. (2017). Development and validation of social anxiety scale for social media users. *Comput. Human Behav.* 72, 296–303. doi: 10.1016/j.chb.2017.03.011
- Allen, K. A., Ryan, T., Gray, D. L., McInerney, D. M., and Waters, L. (2014). Social media use and social connectedness in adolescents: the positives and the potential pitfalls. *Educ. Develop. Psychol.* 31, 18–31. doi: 10.1017/edp.2014.2
- Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., et al. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: a large-scale cross-sectional study. *Psychol. Addict. Behav.* 30, 252–262. doi: 10.1037/adb0000160
- Andreassen, C. S., and Pallesen, S. (2014). Social network site addiction—an overview. *Curr. Pharm. Des.* 20, 4053–4061. doi: 10.2174/13816128113199990616
- Andreassen, C. S., Torsheim, T., Brunborg, G. S., and Pallesen, S. (2012). Development of a facebook addiction scale. *Psychol. Rep.* 110, 501–517. doi: 10.2466/02.09.18.PR0.110.2.501-517
- Apaolaza, V., He, J., and Hartmann, P. (2014). The effect of gratifications derived from use of the social networking site Qzone on Chinese adolescents' positive mood. *Comput. Human Behav.* 41, 203–211. doi: 10.1016/j.chb.2014.09.029

- Appel, H., Crusius, J., and Gerlach, A. L. (2015). Social comparison, envy, and depression on facebook: a study looking at the effects of high comparison standards on depressed individuals. *J. Soc. Clin. Psychol.* 34, 277–289. doi: 10.1521/jscp.2015.34.4.277
- Atroszko, P. A., Balcerowska, J. M., Bereznowski, P., Biernatowska, A., Pallesen, S., and Andreassen, C. S. (2018). Facebook addiction among Polish undergraduate students: validity of measurement and relationship with personality and well-being. *Comput. Human Behav.* 85, 329–338. doi: 10.1016/j.chb.2018.04.001
- Balci, S., and Gölcü, A. (2013). Facebook addiction among university students in Turkey: Selcuk University example. *J. Turk. Stud.* 34, 255–278.
- Billieux, J., Schimmenti, A., Khazaal, Y., Maurage, P., and Heeren, A. (2015). Are we overpathologizing everyday life? a tenable blueprint for behavioral addiction research. *J. Behav. Addict.* 4, 119–123. doi: 10.1556/2006.4.2015.009
- Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., et al. (2019). The interaction of person-affect-cognition-execution (I-PACE) model for addictive behaviors: update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors. *Neurosci. Biobehav. Rev.* 104, 1–10. doi: 10.1016/j.neubiorev.2019.06.032
- Brand, M., Young, K. S., Laier, C., Wölfling, K., and Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific internet-use disorders: an interaction of person-affect-cognition-execution (I-PACE) model. *Neurosci. Biobehav. Rev.* 71, 252–266. doi: 10.1016/j.neubiorev.2016.08.033
- Chan, Y. F., Leung, D. Y., Fong, D. Y., Leung, C. M., and Lee, A. M. (2010). Psychometric evaluation of the hospital anxiety and depression scale in a large community sample of adolescents in Hong Kong. *Qual. Life Res.* 19, 865–873. doi: 10.1007/s11136-010-9645-1
- Chen, Y., Li, R., Zhang, P., and Liu, X. (2019). The moderating role of state attachment anxiety and avoidance between social anxiety and social networking sites addiction. *Psychol. Rep.* 6:33294118823178. doi: 10.1177/0033294118823178
- Chen, Z. Y., Yang, X. D., and Li, X. Y. (2009). Psychometric features of CES-D in Chinese adolescents. *Chin. J. Clin. Psychol.* 17, 443–448
- China Internet Network Information Center (2019). *The 43rd Statistical Report on the Development of Internet in China*. Available online at: http://www.cnnic.net.cn/hlwfzyj/hlwzxbg/hlwtjbg/201902/t20190228_70645.htm (accessed July 22, 2019).
- Chiu, C., Ip, C., and Silverman, A. (2012). Understanding social media in China. *McKinsey Quart.* 2, 78–81.
- Çikrikci, Ö. (2016). The effect of internet use on well-being: meta-analysis. *Comput. Human Behav.* 65, 560–566. doi: 10.1016/j.chb.2016.09.021
- Donnelly, E., and Kuss, D. J. (2016). Depression among users of social networking sites (SNSs): the role of SNS addiction and increased usage. *J. Addict. Prev. Med.* 1:107. doi: 10.19104/japm.2016.107
- Elhai, J. D., Yang, H., and Montag, C. (2019). Cognitive-and emotion-related dysfunctional coping processes: transdiagnostic mechanisms explaining depression and anxiety's relations with problematic smartphone use. *Curr. Addict. Rep.* 6, 410–417. doi: 10.1007/s40429-019-00260-4
- Ellison, N. B., Steinfield, C., and Lampe, C. (2007). The benefits of facebook “friends”: social capital and college students’ use of online social network sites. *J. Comp. Mediat. Commun.* 12, 1143–1168. doi: 10.1111/j.1083-6101.2007.00367.x
- Elphinston, R. A., and Noller, P. (2011). Time to face it! Facebook intrusion and the implications for romantic jealousy and relationship satisfaction. *Cyberpsychol. Behav. Soc. Netw.* 14, 631–635. doi: 10.1089/cyber.2010.0318
- Escobar-Viera, C. G., Shensa, A., Bowman, N. D., Sidani, J. E., Knight, J., James, A. E., et al. (2018). Passive and active social media use and depressive symptoms among United States adults. *Cyberpsychol. Behav. Soc. Netw.* 21, 437–443. doi: 10.1089/cyber.2017.0668
- Gao, F., and Zhang, Y. (2013). “Analysis of WeChat on iPhone,” in *Proceedings of the 2nd International Symposium on Computer, Communication, Control, and Automation* (Beijing). doi: 10.2991/3ca-13.2013.69
- Guedes, E., Sancassiani, F., Carta, M. G., Campos, C., Machado, S., King, A. L. S., et al. (2016). Internet addiction and excessive social networks use: what about facebook? *Clin. Pract. Epidemiol. Ment. Health* 12, 43–48. doi: 10.2174/1745017901612010043
- Hong, F. Y., Huang, D. H., Lin, H. Y., and Chiu, S. L. (2014). Analysis of the psychological traits, facebook usage, and facebook addiction model of Taiwanese university students. *Telemat. Inform.* 31, 597–606. doi: 10.1016/j.tele.2014.01.001
- Hou, J., Ndasauka, Y., Jiang, Y., Chen, S., Xu, F., and Zhang, X. (2018). Weibo or WeChat? assessing preference for social networking sites and role of personality traits and psychological factors. *Front. Psychol.* 9:545. doi: 10.3389/fpsyg.2018.00545
- Hou, J., Ndasauka, Y., Jiang, Y., Ye, Z., Wang, Y., Yang, L., et al. (2017). Excessive use of WeChat, social interaction and locus of control among college students in China. *PLoS ONE* 12:e0183633. doi: 10.1371/journal.pone.0183633
- Hou, X. L., Wang, H. Z., Hu, T. Q., Gentile, D. A., Gaskin, J., and Wang, J. L. (2019). The relationship between perceived stress and problematic social networking site use among Chinese college students. *J. Behav. Addict.* 8, 306–317. doi: 10.1556/2006.8.2019.26
- Huang, C. (2012). “Internet use and psychological wellbeing,” in *Encyclopedia of cyber behavior*, ed Z. Yan, (Hershey, PA: IGI Global), 301–313.
- Huang, R., Kim, H., and Kim, J. (2013). Social capital in QQ China: impacts on virtual engagement of information seeking, interaction sharing, knowledge creating, and purchasing intention. *J. Mark. Manag.* 29, 292–316. doi: 10.1080/0267257X.2013.766630
- Hussain, Z., and Griffiths, M. D. (2018). Problematic social networking site use and comorbid psychiatric disorders: a systematic review of recent large-scale studies. *Front. Psychiatry* 9:686. doi: 10.3389/fpsyg.2018.00686
- Khumsri, J., Yingyeun, R., Mereerat, M., Hanprathet, N., and Phanasathit, M. (2015). Prevalence of facebook addiction and related factors among Thai high school students. *J. Med. Assoc. Thai.* 98(Suppl.3), 51–60.
- Kircaburun, K., Kokkinos, C. M., Demetrotics, Z., Király, O., Griffiths, M. D., and Çolak, T. S. (2018). Problematic online behaviors among adolescents and emerging adults: associations between cyberbullying perpetration, problematic social media use, and psychosocial factors. *Int. J. Ment. Health Addict.* 17, 891–908. doi: 10.1007/s11469-018-9894-8
- Koc, M., and Gulyagci, S. (2013). Facebook addiction among Turkish college students: the role of psychological health, demographic, and usage characteristics. *Cyberpsychol. Behav. Soc. Netw.* 16, 279–284. doi: 10.1089/cyber.2012.0249
- Kuss, D. J., Griffiths, M. D., Karila, L., and Billieux, J. (2014). Internet addiction: a systematic review of epidemiological research for the last decade. *Curr. Pharm. Des.* 20, 4026–4052. doi: 10.2174/13816128113199990617
- Lachmann, B., Sindermann, C., Sariyska, R. Y., Luo, R., Melchers, M. C., Becker, B., et al. (2018). The role of empathy and life satisfaction in internet and smartphone use disorder. *Front. Psychol.* 9:398. doi: 10.3389/fpsyg.2018.00398
- Lai, B. Z., and Lai, M. L. (2003). *New Lai's Personality Scale Guide Handbook*. Taipei: Chian Hua.
- Li, B., Wu, Y., Jiang, S., and Zhai, H. (2018a). WeChat addiction suppresses the impact of stressful life events on life satisfaction. *Cyberpsychol. Behav. Soc. Netw.* 21, 194–198. doi: 10.1089/cyber.2017.0544
- Li, J.-B., Lau, J. T. F., Mo, P. K. H., Su, X., Wu, A. M. S., Tang, J., et al. (2016). Validation of the social networking activity intensity scale among junior middle school students in China. *PLoS ONE* 11:e0165695. doi: 10.1371/journal.pone.0165695
- Li, J.-B., Lau, J. T. F., Mo, P. K. H., Su, X.-F., Tang, J., Qin, Z.-G., et al. (2017). Insomnia partially mediated the association between problematic internet use and depression among secondary school students in China. *J. Behav. Addict.* 6, 554–563. doi: 10.1556/2006.6.2017.085
- Li, J.-B., Mo, P. K. H., Lau, J. T. F., Su, X. F., Zhang, X., Wu, A. M. S., et al. (2018b). Online social networking addiction and depression: the results from a large-scale prospective cohort study in Chinese adolescents. *J. Behav. Addict.* 7, 686–696. doi: 10.1556/2006.7.2018.69
- Lian, S., Tia, Y., Sun, X., and Zhang, C. (2017). The effect of adolescents’ active social network sites use on friendship quality: the chain mediating role of positive feedback and uncertainty. *Stud. Psychol. Behav.* 15, 197–204.
- Lian, S. L., Sun, X. J., Zhou, Z. K., Fan, C. Y., Niu, G. F., and Liu, Q. Q. (2018). Social networking site addiction and undergraduate students’ irrational procrastination: the mediating role of social networking site fatigue and the moderating role of effortful control. *PLoS ONE* 13:e0208162. doi: 10.1371/journal.pone.0208162

- Lien, C. H., and Cao, Y. (2014). Examining WeChat users' motivations, trust, attitudes, and positive word-of-mouth: evidence from China. *Comput. Human Behav.* 41, 104–111. doi: 10.1016/j.chb.2014.08.013
- Liu, C., and Ma, J. (2018a). Social media addiction and burnout: the mediating roles of envy and social media use anxiety. *Curr. Psychol.* 1–9. doi: 10.1007/s12144-018-9998-0
- Liu, C., and Ma, J. (2018b). Development and validation of the Chinese social media addiction scale. *Pers. Individ. Dif.* 134, 55–59. doi: 10.1016/j.paid.2018.05.046
- Liu, Q., Sun, X., Zhou, Z., Niu, G., Kong, F., and Lian, S. (2016). The effect of honest self-presentation in online social network sites on life satisfaction: the chain mediating role of online positive feedback and general self-concept. *J. Psychol. Sci.* 39,406–411.
- Liu, T. C., Desai, R. A., Krishnan-Sarin, S., Cavallo, D. A., and Potenza, M. N. (2011). Problematic internet use and health in adolescents: data from a high school survey in connecticut. *J. Clin. Psychiatry* 72, 836–845. doi: 10.4088/JCP.10m06057
- Mak, K. K., Lai, C. M., Watanabe, H., Kim, D. I., Bahar, N., Ramos, M., et al. (2014). Epidemiology of internet behaviors and addiction among adolescents in six Asian countries. *Cyberpsychol. Behav. Soc. Netw.* 17, 720–728. doi: 10.1089/cyber.2014.0139
- Marino, C., Gini, G., Vieno, A., and Spada, M. M. (2018). The associations between problematic facebook use, psychological distress and well-being among adolescents and young adults: a systematic review and meta-analysis. *J. Affect. Disord.* 226, 274–281. doi: 10.1016/j.jad.2017.10.007
- Melchers, M., Li, M., Chen, Y., Zhang, W., and Montag, C. (2015). Low empathy is associated with problematic use of the internet: empirical evidence from China and Germany. *Asian J. Psychiatr.* 17, 56–60. doi: 10.1016/j.ajp.2015.06.019
- Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int. J. Surg.* 8, 336–341. doi: 10.1016/j.ijsu.2010.02.007
- Montag, C., and Becker, B. (2018). China statt USA? warum die deutsche psychologie das reich der mitte im auge behalten sollte. *Wirtschaftspsychologie aktuell*, 3, 17–20.
- Montag, C., Becker, B., and Gan, C. (2018a). The multi-purpose application WeChat: a review on recent research. *Front. Psychol.* 9:2247. doi: 10.3389/fpsyg.2018.02247
- Montag, C., Bey, K., Sha, P., Li, M., Chen, Y. F., Liu, W. Y., et al. (2015). Is it meaningful to distinguish between generalized and specific Internet addiction? evidence from a cross-cultural study from Germany, Sweden, Taiwan and China. *Asia Pac. Psychiatry* 7, 20–26. doi: 10.1111/appy.12122
- Montag, C., and Diefenbach, S. (2018). Towards homo digitalis: important research issues for psychology and the neurosciences at the dawn of the internet of things and the digital society. *Sustainability* 10:415. doi: 10.3390/su10020415
- Montag, C., Lachmann, B., Herrlich, M., and Zweig, K. (2019a). Addictive features of social media/messenger platforms and freemium games against the background of psychological and economic theories. *Int. J. Environ. Res. Public Health* 16:2612. doi: 10.3390/ijerph16142612
- Montag, C., Markowitz, A., Blaszkiewicz, K., Andone, I., Lachmann, B., Sariyska, R., et al. (2017). Facebook usage on smartphones and gray matter volume of the nucleus accumbens. *Behav. Brain Res.* 329, 221–228. doi: 10.1016/j.bbr.2017.04.035
- Montag, C., Wegmann, E., Sariyska, R., Demetrovics, Z., and Brand, M. (2019b). How to overcome taxonomical problems in the study of internet use disorders and what to do with “smartphone addiction”? *J. Behav. Addict.* 31, 1–7. doi: 10.1556/2006.8.2019.59
- Montag, C., Zhao, Z., Sindermann, C., Xu, L., Fu, M., Li, J., et al. (2018b). Internet communication disorder and the structure of the human brain: initial insights on WeChat addiction. *Sci. Rep.* 8:2155. doi: 10.1038/s41598-018-19904-y
- Müller, K. W., Dreier, M., Beutel, M. E., Duven, E., Giral, S., and Wölfling, K. (2016). A hidden type of internet addiction? Intense and addictive use of social networking sites in adolescents. *Comput. Human Behav.* 55, 172–177. doi: 10.1016/j.chb.2015.09.007
- Müller, M., Brand, M., Mies, J., Lachmann, B., Sariyska, R. Y., and Montag, C. (2017). The 2D: 4D marker and different forms of internet use disorder. *Front. Psychiatry* 8:213. doi: 10.3389/fpsyg.2017.00213
- Mythily, S., Qiu, S., and Winslow, M. (2008). Prevalence and correlates of excessive internet use among youth in Singapore. *Ann. Acad. Med. Singap.* 37, 9–14.
- Nadkarni, A., and Hofmann, S. G. (2012). Why do people use facebook? *Pers. Individ. Dif.* 52, 243–249. doi: 10.1016/j.paid.2011.11.007
- Niu, G., Luo, Y., Sun, X., Zhou, Z., Yu, F., Yang, S.-L., et al. (2018). Qzone use and depression among Chinese adolescents: a moderated mediation model. *J. Affect. Disord.* 231, 58–62. doi: 10.1016/j.jad.2018.01.013
- Niu, G., Sun, X., Zhou, Z., Kong, F., and Tian, Y. (2016a). The impact of social network site (Qzone) on adolescents' depression: the serial mediation of upward social comparison and self-esteem. *Acta Psychologica Sinica* 48, 1282–1291. doi: 10.3724/SP.J.1041.2016.01282
- Niu, G., Sun, X., Zhou, Z., Tian, Y., Liu, Q., and Lian, S. (2016b). The effect of adolescents' social networking site use on self-concept clarity: the mediating role of social comparison. *J. Psychol. Sci.* 39, 97–102.
- Oberst, U., Wegmann, E., Stodt, B., Brand, M., and Chamarro, A. (2017). Negative consequences from heavy social networking in adolescents: the mediating role of fear of missing out. *J. Adolesc.* 55, 51–60. doi: 10.1016/j.adolescence.2016.12.008
- Peterka-Bonetta, J., Sindermann, C., Elhai, J. D., and Montag, C. (2019). Personality associations with smartphone and internet use disorder: a comparison study including links to impulsivity and social anxiety. *Front. Public Health* 7:127. doi: 10.3389/fpubh.2019.00127
- Pontes, H. M. (2017). Investigating the differential effects of social networking site addiction and internet gaming disorder on psychological health. *J. Behav. Addict.* 6, 601–610. doi: 10.1556/2006.6.2017.075
- Pontes, H. M., Schivinski, B., Sindermann, C., Li, M., Becker, B., Zhou, M., et al. (2019). Measurement and conceptualization of gaming disorder according to the World Health Organization framework: the development of the gaming disorder test. *Int. J. Ment. Health Addict.* 1–21. doi: 10.1007/s11469-019-00088-z
- Potenza, M. N., Higuchi, S., and Brand, M. (2018). Call for research into a wider range of behavioural addictions. *Nature* 555:30. doi: 10.1038/d41586-018-02568-z
- Prizant-Passal, S., Shechner, T., and Aderka, I. M. (2016). Social anxiety and internet use—a meta-analysis: what do we know? what are we missing? *Comput. Human Behav.* 62, 221–229. doi: 10.1016/j.chb.2016.04.003
- Rothen, S., Briefer, J. F., Deleuze, J., Karila, L., Andreassen, C. S., Achab, S., et al. (2018). Disentangling the role of users' preferences and impulsivity traits in problematic facebook use. *PLoS ONE* 13:e0201971. doi: 10.1371/journal.pone.0201971
- Sampasa-Kanyinga, H., and Hamilton, H. A. (2015). Social networking sites and mental health problems in adolescents: the mediating role of cyberbullying victimization. *Eur. Psychiatry* 30, 1021–1027. doi: 10.1016/j.eurpsy.2015.09.011
- Sariyska, R., Reuter, M., Lachmann, B., and Montag, C. (2015). Attention deficit/hyperactivity disorder is a better predictor for problematic internet use than depression: evidence from Germany. *J. Addict. Res. Ther.* 6:209. doi: 10.4172/2155-6105.1000209
- Scholz, R., Bartelsman, E., Diefenbach, S., Franke, L., Grunwald, A., Helbing, D., et al. (2018). Unintended side effects of the digital transition: European scientists' messages from a proposition-based expert round table. *Sustainability* 10:2001. doi: 10.3390/su10062001
- Sha, P., Sariyska, R., Riedl, R., Lachmann, B., and Montag, C. (2019). Linking internet communication and smartphone use disorder by taking a closer look at the facebook and WhatsApp applications. *Addict. Behav. Rep.* 9:100148. doi: 10.1016/j.abrep.2018.100148
- Shensa, A., Escobar-Viera, C. G., Sidani, J. E., Bowman, N. D., Marshal, M. P., and Primack, B. A. (2017). Problematic social media use and depressive symptoms among US young adults: a nationally-representative study. *Soc. Sci. Med.* 182, 150–157. doi: 10.1016/j.socscimed.2017.03.061
- Siddiqui, S., and Singh, T. (2016). Social media its impact with positive and negative aspects. *Int. J. Comput. Appl. Technol. Res.* 5, 71–75. doi: 10.7753/IJCATR0502.1006
- Sindermann, C., Elhai, J. D., and Montag, C. (2020). Predicting tendencies towards the disordered use of facebook's social media platforms: on the role of personality, impulsivity, and social anxiety. *Psychiatry Res.* 285:112793. doi: 10.1016/j.psychres.2020.112793
- Socialmediatoday.com (2014). *Understanding Social Media in China in 2014*. Available online at: <https://www.socialmediatoday.com/content/understanding-social-media-china-2014> (accessed December 8, 2019).

- Song, H., Zmyslinski-Seelig, A., Kim, J., Drent, A., Victor, A., Omori, K., et al. (2014). Does facebook make you lonely?: a meta-analysis. *Comput. Human Behav.* 36, 446–452. doi: 10.1016/j.chb.2014.04.011
- Spielberger, C. D., Gorsuch, R. L., and Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Starcevic, V., and Khazaal, Y. (2017). Relationships between behavioural addictions and psychiatric disorders: what is known and what is yet to be learned? *Front. Psychiatry* 8:53. doi: 10.3389/fpsy.2017.00053
- Statista.com (2019). *Number of Monthly Active WeChat users From 4th Quarter 2011 to 4th Quarter 2018*. Available online at: <https://www.statista.com/statistics/255778/number-of-active-wechat-messenger-accounts/> (accessed May 14, 2019).
- Stodt, B., Brand, M., Sindermann, C., Wegmann, E., Li, M., Zhou, M., et al. (2018). Investigating the effect of personality, internet literacy, and use expectancies in internet-use disorder: a comparative study between China and Germany. *Int. J. Environ. Res. Public Health* 15:579. doi: 10.3390/ijerph15040579
- Sullivan, J. (2013). China's weibo: is faster different? *New Media Soc.* 16, 24–37. doi: 10.1177/1461444812472966
- Sun, X., Lian, S., Niu, G., Yan, J., and Tong, Y. (2016). Social network site use and depression in adolescents: mediating of upward social comparison. *Chi. J. Clin. Psychol.* 24, 32–35. doi: 10.1108/IntR-09-2017-0358
- Tang, C. S. K., Koh, Y. W., and Gan, Y. (2017). Addiction to internet use, online gaming, and online social networking among young adults in China, Singapore, and the United States. *Asia Pac. J. Public Health* 29, 673–682. doi: 10.1177/1010539517739558
- Tateno, M., Teo, A. R., and Kato, T. A. (2018). Does LINE addiction exist? potential concerns about Japan's most popular form of social media on smartphones. *Psychiatry Clin. Neurosci.* 72, 540–541. doi: 10.1111/pcn.12672
- Tian, Y., Zhang, S., Wu, R., Wang, P., Gao, F., and Chen, Y. (2018). Association between specific internet activities and life satisfaction: the mediating effects of loneliness and depression. *Front. Psychol.* 9:118. doi: 10.3389/fpsyg.2018.01181
- Tiggemann, M., and Polivy, J. (2010). Upward and downward: social comparison processing of thin idealized media images. *Psychol. Women Q.* 34, 356–364. doi: 10.1111/j.1471-6402.2010.01581.x
- Turel, O., and Serenko, A. (2012). The benefits and dangers of enjoyment with social networking websites. *Eur. J. Inf. Syst.* 21, 512–528. doi: 10.1057/ejis.2012.1
- Twenge, J. M., Martin, G. N., and Campbell, W. K. (2018). Decreases in psychological well-being among American adolescents after 2012 and links to screen time during the rise of smartphone technology. *Emotion* 18, 765–780. doi: 10.1037/emo0000403
- Van Rooij, A. J., Ferguson, C. J., Van de Mheen, D., and Schoenmakers, T. M. (2017). Time to abandon internet addiction? Predicting problematic internet, game, and social media use from psychosocial well-being and application use. *Clin. Neuropsychiatry* 14, 113–121.
- Vogel, E. A., Rose, J. P., Okdie, B. M., Eckles, K., and Franz, B. (2015). Who compares and despairs? The effect of social comparison orientation on social media use and its outcomes. *Pers. Individ. Dif.* 86, 249–256. doi: 10.1016/j.paid.2015.06.026
- Vogel, E. A., Rose, J. P., Roberts, L. R., and Eckles, K. (2014). Social comparison, social media, and self-esteem. *Psychol. Pop. Media Cult.* 3, 206–222. doi: 10.1037/ppm0000047
- Wang, C.-W., Ho, R. T. H., Chan, C. L. W., and Tse, S. (2015). Exploring personality characteristics of Chinese adolescents with internet-related addictive behaviors: trait differences for gaming addiction and social networking addiction. *Addict. Behav.* 42, 32–35. doi: 10.1016/j.addbeh.2014.10.039
- Wang, P., Wang, X., Wu, Y., Xie, X., Wang, X., Zhao, F., et al. (2018). Social networking sites addiction and adolescent depression: a moderated mediation model of rumination and self-esteem. *Pers. Individ. Dif.* 127, 162–167. doi: 10.1016/j.paid.2018.02.008
- Wegmann, E., and Brand, M. (2016). Internet-communication disorder: it's a matter of social aspects, coping, and internet-use expectancies. *Front. Psychol.* 7:1747. doi: 10.3389/fpsyg.2016.01747
- Wegmann, E., Mueller, S. M., Ostendorf, S., and Brand, M. (2018). Highlighting internet-communication disorder as further internet-use disorder when considering neuroimaging studies. *Curr. Behav. Neurosci. Rep.* 5, 295–301. doi: 10.1007/s40473-018-0164-7
- Weixin.qq.com. (2019). *WeChat is a Way of Life*. Available online at: <https://weixin.qq.com/> (accessed 15 July, 2019).
- Wilson, K., Fornasier, S., and White, K. M. (2010). Psychological predictors of young adults' use of social networking sites. *Cyberpsychol. Behav. Soc. Netw.* 13, 173–177. doi: 10.1089/cyber.2009.0094
- Wolniczak, I., Cáceres-DelAguila, J. A., Palma-Ardiles, G., Arroyo, K. J., Solís-Visscher, R., Paredes-Yauri, S., et al. (2013). Association between facebook dependence and poor sleep quality: a study in a sample of undergraduate students in Peru. *PLoS ONE* 8:e59087. doi: 10.1371/journal.pone.0059087
- World Health Organization (2019). ICD-11 Mortality and Morbidity Statistics. Mental, Behavioural or Neurodevelopmental Disorders. Available online at: <https://icd.who.int/dev11/l-m/en#/http%3a%2f%2fid.who.int%2f2fcd%2fentity%2f1630268048> (accessed December 20, 2019).
- Worsley, J. D., McIntyre, J. C., Bentall, R. P., and Corcoran, R. (2018). Childhood maltreatment and problematic social media use: the role of attachment and depression. *Psychiatry Res.* 267, 88–93. doi: 10.1016/j.psychres.2018.05.023
- Xanidis, N., and Brignell, C. M. (2016). The association between the use of social network sites, sleep quality, and cognitive function during the day. *Comput. Human Behav.* 55, 121–126. doi: 10.1016/j.chb.2015.09.004
- Yam, C. W., Pakpour, A. H., Griffiths, M. D., Yau, W. Y., Lo, C. M., Ng, J. M. T., et al. (2019). Psychometric testing of three Chinese online-related addictive behavior instruments among Hong Kong university students. *Psychiatr Q.* 90, 117–128. doi: 10.1007/s11126-018-9610-7
- Yang, Z., Asbury, K., and Griffiths, M. D. (2019). Do Chinese and British university students use smartphones differently? a cross-cultural mixed methods study. *Int. J. Ment. Health Addict.* 17, 644–657. doi: 10.1007/s11469-018-0024-4
- Yao, Q., Ma, H., Yan, H., and Chen, Q. (2014). Analysis of social network users' online behavior from the perspective of psychology. *Adv. Psychol. Sci.* 22, 1647–1659. doi: 10.3724/SP.J.1042.2014.01647
- Ye, D. M., Qian, M. Y., Liu, X. H., and Chen, X. (2007). Revision of social interaction anxiety scale and social phobia scale. *Chin. J. Clin. Psychol.* 15, 115–117.
- Young, K. S. (1996). Psychology of computer use: XL. addictive use of the internet: a case that breaks the stereotype. *Psychol. Rep.* 79, 899–902. doi: 10.2466/pr0.1996.79.3.899
- Yu, Y., Zhang, Y., Xiong, M., and Zhou, S. (2018). Passive following social network site and depression: the role of envy and mindfulness. *Chin. J. Clin. Psychol.* 26, 502–506.
- Zhou, X., and Wang, X. (2017). The relationship between self-control ability and WeChat addiction among university students. *Chin. J. Health Psychol.* 8, 037.
- Zhou, Z., Lian, S., Tian, Y., Niu, G., and Sun, X. (2017). The relationship between social network sites use and life satisfaction: a moderated mediation model. *Psychol. Dev. Educ.* 33, 297–305. doi: 10.16187/j.cnki.issn1001-4918.2017.03.06

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2020 Hussain, Wegmann, Yang and Montag. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.