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THE MEDIATING EFFECTS OF PERCEIVED FAMILY SUPPORT IN THE RELATIONSHIP BETWEEN ANXIETY AND PROBLEMATIC SMARTPHONE USE: A CROSS-CULTURAL VALIDATION

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KEYWORDS: Problematic smartphone use, smartphone addiction, cross-cultural study, stress-coping, negative emotion

ABSTRACT[1]

Problematic smartphone use (PSU) is frequently considered a public health issue, especially in East Asia and Europe. Yet, there is a paucity of research focusing on cultural and familial determinants of PSU. This cross-cultural study aimed to investigate smartphone usage patterns and possible mediating effects of perceived family support (PFS) from a stress-coping perspective. Convenience samples of 790 Chinese and 439 Belgian undergraduates completed an online survey that focused on sociodemographics and psychological variables (i.e., anxiety, depression, PFS, and PSU). In both samples, PSU was positively associated with anxiety and depression, and negatively associated with PFS. However, after controlling for sex and age in structural equation models, the consistent mediating effects of PFS were only found between anxiety and PSU in both cultural settings. These findings suggest that psychological interventions that take into account familial factors could be helpful for young people presenting with anxiety and PSU.

Smartphones have become a daily necessity in the modern world. Although associated with many improvements in daily functioning, smartphone use is also associated in certain cases with patterns of problematic usage involving negative outcomes (Elhai et al., 2017; Oviedo-Trespalacios et al., 2019; Roser et al., 2016; Sohn et al., 2019; Yang et al., 2020). The literature shows that problematic smartphone use (PSU) is a prevalent problematic behavioral pattern, especially among younger demographic groups in many countries (De-Sola et al., 2017; Long et al., 2016; Oviedo-Trespalacios et al., 2019; Sahu et al., 2019; Sohn et al., 2019). In 2015, the World Health Organization (WHO) convened an international expert group and systematically discussed the public health implications of excessive use of smartphones and similar electronic devices (WHO, 2015). This expert group concluded that health and

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psychological consequences associated with the constant increase in usage patterns of the Internet and electronic devices, including smartphones, is a relevant concern from a public health perspective (WHO, 2015).

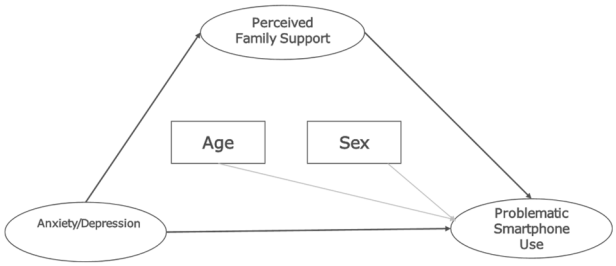
The etiology and underlying processes of PSU remain unclear. The stress-coping framework has been influential in the field of problematic and addictive online behaviors (Billieux, 2012; Kardefelt-Winther, 2014; Maroney et al., 2019; Plante et al., 2019). According to this framework, these problematic behaviors are displayed to cope with stressors and adverse emotional states (e.g., stressful events and/ or aversive emotions) through temporary cognitive and/or behavioral escape. In this regard, stressors or psychopathological symptoms constitute pivotal elements in the development and maintenance of PSU. Among the identified factors, anxiety and depression have been most consistently reported (Elhai et al., 2017; Kim et al., 2015; Kuss et al., 2018; Yang et al., 2020).

According to the stress-coping framework, perceived family support (PFS), as a critical coping source, is another crucial factor in the development of PSU. PFS refers to the self-perception that one is cared for and has assistance available from one's family (Zimet et al., 1990). Essentially, PFS reflects individuals' evaluation and subjective judgment of the quality of family support, which does not necessarily correspond to the actual family support available (Norris and Kaniasty, 1996). Evidence in the literature strongly supports that PFS is linked to well-being and constitutes a protective factor in the development of psychopathological symptoms when individuals are confronted with stressful events (e.g., symptoms of anxiety and depression) (Brannan et al., 2013; Christensen et al., 1989; Klink et al., 2008; Poulin et al., 2012; Thompson and Heller, 1990). It has been reported that family therapy, in which optimization of familial and social support is central, has proved efficient in mitigating substance abuse (Rowe, 2012; Slesnick and Prestopnik, 2009), as well as problematic use of the Internet and video games (Han et al., 2012; Liu et al., 2015).

However, only few studies have specifically focused on the correlation between PFS and PSU. A study conducted in Türkiye found that PFS had a mediating rather than a moderating effect in the relationship between stressful events (i.e., social exclusion experiences) and

psychological well-being among adolescents (Arslan, 2018). From the available evidence that parental factors are critical in the management of adolescents' problematic online behaviors (Long et al., 2018; Nielsen et al., 2019; Nielsen et al., 2020), and given the crucial role of PFS in mental well-being (Hoagwood et al., 2010; Kuhn and Laird, 2014; Pernice-Duca, 2010), we hypothesize that PFS might mediate the known relationship between psychopathological symptoms and PSU (shown in Fig. 1).

FIGURE 1*. Illustration of mediating models of PFS in PSU.*



Smartphones are today a major channel for social interactions in most societies, and PSU is generally viewed as highly culture-dependent (Baron and af Segerstad, 2010; Campbell, 2007). For example, evidence gathered in various European countries suggests that usage patterns and perceived dependence on mobile phone use vary considerably in different regional contexts (e.g., Northern vs. Southern European countries) and could, in particular, be influenced by country-specific usage preferences (e.g., type of applications used) or demographic factors (LopezFernandez et al., 2017). Panova et al. (2020) reported that the associations between smartphone use and affective states (anxiety and depression) are dissimilar in American and Spanish students.

To date, however, almost no studies have directly compared PSU manifestations in European and East Asian countries, although the larger part of PSU-related research comes from these two regions (De-Sola Gutiérrez et al., 2016). Yang et al. (2019), in one of the few available studies, showed that Chinese undergraduates tend to have higher levels of PSU than do British undergraduates. In another study outside of the European context, Kang and Jung (2014) reported that both American and Korean college students reported using their smartphones to fulfill their needs for safety (i.e., basic needs of security and protection) and

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self-actualization (i.e., the feeling that one's personal potential is fully realized), in accordance with Maslow's hierarchy of basic needs theory. Notably, cross-cultural studies are lacking that have compared the influence of familial support on PSU in European versus East Asian countries. This is clearly a research gap that warrants further investigation, as 1) preliminary evidence suggests that East Asian adolescents present with more elevated perceived dependence on mobile phone use (Shin, 2014; Yang et al. 2019), and 2) familial structures and support tend to differ in European versus East Asian countries (Brannan et al., 2013; Soenens et al., 2012).

Against this background, in the present study, we had three specific aims: 1) to identify potential cross-cultural differences in smartphone usage patterns and PSU in Chinese and Belgian undergraduates; 2) to reproduce the previously established associations between PSU and psychopathological symptoms (i.e., anxiety and depression) in these two different cultural contexts; and 3) to explore, separately in Chinese and Belgian undergraduates, the potential mediating effect of PFS in the relationship between psychopathological symptoms and PSU.

METHODS

PARTICIPANTS

A convenience sampling strategy was performed simultaneously in the capital city of Hunan province, Changsha, Central China, and in the French-speaking region of Belgium (Brussels and Wallonia). An online survey in either Chinese or French was distributed at the two sites to university students who were studying at multiple educational levels (e.g., associate degree, bachelor's degree, master's degree, and doctoral degree). In total, 3381 students properly completed the survey, 2380 of them from China (answered in Chinese) and 1001 from Belgium (answered in French). To ensure comparability between the Chinese and Belgium educational systems, we used the data only from undergraduates who were pursuing their bachelor's degree and using smartphones. A final sample of 790 Chinese undergraduates and 439 Belgian undergraduates was considered for the analyses.

PROCEDURE

This cross-sectional research was conducted between May and November 2017. The online survey was developed and distributed on the Qualtrics platform (Qualtrics Corp, Provo, UT). It was disseminated through multiple channels such as university group e-mails and SNS platforms (*e.g.,* Facebook in Belgium and WeChat in China). The study was conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards. The protocol was reviewed and approved by the ethics committee of the Second Xiangya Hospital, Central South University in China and approved by the ethical committee of the Psychological Science Research Institute, Université catholique de Louvain in Belgium. The anonymous survey explicitly stated the purposes of the study, and participants had to provide informed consent before completing it.

MEASURES

Besides questions about sociodemographics and smartphone usage patterns, the online survey consisted of five separate psychometric tools that were validated in both Chinese and French. Only three tools were selected and retained for the aim of this study, which focuses on smartphone use features and psychological factors related to PSU among Chinese and Belgian undergraduates. No other study has been published using the current dataset. Specifically, the three tools included were the Problematic Mobile Phone Use Questionnaire–Short Version (PMPUQ-SV), the Multidimensional Scale of Perceived Social Support (MSPSS), and the Depression Anxiety Stress Scale (DASS-21).

SOCIODEMOGRAPHICS AND SMARTPHONE USAGE FEATURE

Several items were designed to collect participants' basic sociodemographic data, such as sex and age. Specific information regarding smartphone usage patterns was also collected, including self-reported daily smartphone usage time on workdays and weekends (“Please estimate and fill out daily average time of your smartphone use during weekdays/weekends.”) and the most often used functions (mobile gaming, e-book reading, office work, social networking, nonprofessional video watching, online shopping, etc.).

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PROBLEMATIC MOBILE PHONE USE QUESTIONNAIRE–SHORT VERSION

The PMPUQ-SV is a self-administered questionnaire comprising 15 items, developed based on a longer scale by Billieux et al. (2008, see also Lopez-Fernandez et al., 2018). It was adapted and validated in Chinese by Wang et al. (2020). It comprises three 5-item subscales: dangerous mobile phone use, prohibited mobile phone use, and dependent mobile phone use. All items are answered on a 4-point Likert scale ranging from 1 ("I strongly agree") to 4 ("I strongly disagree"). In our study, we used the perceived dependence on mobile phone use subscale (five items; example of item: "It is hard for me not to use my mobile phone when I feel like it.") to assess PSU (for a similar approach, see Lopez-Fernandez et al., 2017). Overall scores of the subscale ranged from 5 to 20, with higher scores indicating higher PSU. In this study, Cronbach's alpha of the Chinese version of the subscale was 0.74, whereas it was 0.80 for the French version of the subscale.

MULTIDIMENSIONAL SCALE OF PERCEIVED SOCIAL SUPPORT

The MSPSS is a 12-item self-reported measure of perceived social support, originally developed by Zimet and Dahlem (1988). It was translated into and validated in Chinese (Chou, 2000) and in French (Denis et al., 2015). It comprises three 4-item subscales: perceived support from family, perceived support from friends, and perceived support from other significant people. All items are answered on a 7-point Likert scale ranging from 1 ("I strongly agree") to 7 ("I strongly disagree"). Our study relied on the family support subscale (4 items) to reflect the level of responders' PFS. Overall scores of the subscale ranged from 4 to 28, with higher scores indicating higher levels of PFS. In our study, Cronbach's alpha of the Chinese subscale was 0.84, whereas it was 0.89 for the French version of the subscale.

DEPRESSION ANXIETY STRESS SCALE

The DASS-21 is a 21-item self-reported measure of three negative emotional states, originally developed by Lovibond and Lovibond (1995). It was translated into and validated in Chinese (Wang et al., 2016) and in French (Ramasawmy, 2015). It comprises three 7-item subscales: the depression, anxiety, and stress subscales. All items are answered on a 4-point

Likert scale ranging from 0 (“did not apply to me at all”) to 3 (“applied to me very much, or most of the time”) according to responders' experience of negative states over the past week. Previous research with this scale showed that it is a reliable and valid instrument for discriminating the constructs of depression, anxiety, and stress and assessing the core symptoms of these constructs (Crawford and Henry, 2003). In our study, we used the depression and anxiety subscales. One item in each subscale was omitted because of significant differences in the wording between the Chinese and French versions. Cronbach's alpha of the Chinese subscales (depression and anxiety, both six items) were 0.86 and 0.72, respectively, whereas they were 0.87 and 0.74 for the French subscales.

STATISTICAL ANALYSES

Data analysis was performed with SPSS version 19.0 (IBM Corp, Armonk, NY), and AMOS version 26.0 (IBM Corp, Armonk, NY). Cronbach's alpha coefficients were calculated for reliability analysis. To validate the general measurement structure and ensure the psychometric compatibility between the Chinese and Belgium sample, we further performed a test of measurement invariance for the scales used. The final measurement structures achieved an acceptable level of scalar invariance (shown in Supplementary 1, http://links.lww.com/JNMD/A177).

We mainly computed nonparametric tests in our analyses for observed variables because of the nonnormality of the data distribution. Spearman correlation coefficients were computed for correlation analysis. Sociodemographic characteristics, smartphone usage patterns, and scores on psychometric scales were compared between undergraduates in China and those in Belgium by using chi-square tests, Mann-Whitney *U*-tests, and Wilcoxon tests, depending on the nature of the variables. A *p*-value of less than 0.05 was considered statistically significant. All computed tests were two-tailed.

Structural equation modeling (bootstrap method, multigroup) was used to determine the potential mediating effect of PFS in the relationships between psychopathological symptoms (*i.e.*, anxiety and depression) and PSU and to identify potential cultural differences between the Chinese and Belgian samples. Anxiety, depression, PFS, and PSU were considered as latent variables in the modeling. We tested two separate models for both

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psychopathological symptoms (*i.e.*, anxiety and depression). Each separate model was composed of two observed variables (*i.e.*, age and sex) and three latent factors (*i.e.*, PSU, PFS, and one type of psychopathological symptoms).

Regarding model fitting evaluation, we computed relative chi-square values (χ^2/df) to test the goodness of fit for each model. A relative χ^2 of 3 or less indicates a reasonable fit (Byrne, 2001). Moreover, in addition to χ^2, two other indices that depended on conventional cutoffs were computed: the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR) (Hu and Bentler, 1999). Their combination was adopted because the RMSEA is sensitive to misspecification of the factor loadings, and the SRMR is sensitive to misspecification of the factor covariances. An RMSEA between 0 and 0.05 indicates a good fit, and that between 0.05 and 0.08 represents an acceptable fit. An SRMR between 0 and 0.05 indicates a good fit, and that between 0.05 and 0.10 represents an acceptable fit (Schermelleh-Engel et al., 2003). We also reported the adjusted goodness-of-fit index (AGFI) and comparative fit index (CFI). An AGFI higher than 0.80 and a CFI higher than 0.90 are considered to indicate an acceptable fit (Hooper et al., 2008).

RESULTS

SOCIODEMOGRAPHICS

The final sample included 1229 undergraduates (790 Chinese undergraduates and 439 Belgian undergraduates). The Chinese sample comprised younger participants and a higher proportion of females (shown in Table 1).

TABLE 1. *Comparisons of Sociodemographics and Smartphone Usage Features Between Chinese and Belgian Undergraduates*

	China (n = 790), M ± SD/n (%)	Belgium (n = 439), M ± SD/n (%)	Test Value, U; χ^2
Age	19.19 ± 1.52	19.78 ± 1.55	5.93*
Sex			207.80*
Female	599 (75.8%)	290 (66.1%)	
Male	191 (24.2%)	149 (33.9%)	
Self-reported daily use time (weekdays, hours)	4.97 ± 4.01	2.21 ± 1.70	−18.44*
Self-reported daily use time (weekend, hours)	7.03 ± 3.65	2.47 ± 2.00	−22.93*
Most often used functions			147.81*
Texting (including WeChat, WhatsApp, Messenger) (1)	506 (64.1%)	163 (37.1%)	118.86* (1–2)
Social networking services (Weibo, Facebook) (2)	136 (17.2%)	199 (45.3%)	
Video watching (nonprofessional)	54 (6.8%)	42 (9.6%)	
Leisure reading	54 (6.8%)	3 (0.7%)	
Mobile gaming	20 (2.5%)	18 (4.1%)	
Other	20 (2.5%)	14 (3.2%)	

*p < 0.01.

TABLE 2*. Comparisons of Psychological Variables Between Chinese and Belgian Undergraduates*

	China (n = 790), M ± SD/n (%)	Belgium (n = 439), M ± SD/n (%)	Test Value, U
PSU	11.76 ± 2.23	11.22 ± 3.30	−3.69*
PFS	20.16 ± 4.93	21.78 ± 5.34	6.41*
Anxiety	10.16 ± 2.98	8.73 ± 2.70	−9.07*
Depression	9.30 ± 3.25	10.85 ± 3.75	7.87*

*p < 0.01.

SMARTPHONE USAGE PATTERNS

A comparison of smartphone usage patterns between Chinese and Belgian undergraduates is also shown in Table 1. Chinese undergraduates reported spending a longer time using their smartphones than did Belgian undergraduates and had different preferences in terms of the most often used functions. The undergraduates from both regions reported spending more time on smartphone use on weekends than on weekdays (Wilcoxon test: W_{CN} = 17.99, $p < 0.001$; W_{BE} = 5.39, $p < 0.001$), but Chinese undergraduates reported spending more time overall on smartphones than did their Belgian counterparts. In terms of the most often used smartphone functionalities, there were significant

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differences between the Chinese and the Belgian undergraduates. Texting, including via apps such as WeChat, was the most frequently used functionality among Chinese undergraduates, whereas social networking services (e.g., Instagram, Facebook) were the most used functionality for Belgian undergraduates.

PSU, PFS, AND PSYCHOPATHOLOGICAL SYMPTOMS

Comparisons between Chinese and Belgian undergraduates are shown in Table 2. Chinese undergraduates reported higher levels of PSU and anxiety than did Belgian undergraduates, whereas Belgian undergraduates reported higher levels of PFS and depression than did Chinese undergraduates.

CORRELATIONS AMONG PSYCHOLOGICAL VARIABLES

The results of the Spearman correlation analysis among target variables for both Chinese and Belgian undergraduates are shown in Table 3. In both cultural contexts, PSU was positively associated with anxiety and depression, and it was negatively associated with PFS.

TABLE 3. *Correlation Coefficient Matrix of Psychological Variables*

	PSU	PFS	Anxiety	Depression
	China (n = 790)/Belgium (n = 439)			
PSU	1			
PFS	−0.15*/−0.12*	1		
Anxiety	0.18*/0.21*	−0.18*/−0.15*	1	
Depression	0.29*/0.30*	−0.26*/−0.29*	0.60*/0.48*	1

*$p < 0.01$.

MULTIGROUP MEDIATION ANALYSES

The results of the fitting analyses of the two mediating models to be tested are shown in Figure 2 and Figure 3. Relative χ^2, RMSEA, SRMR, AGFI, and CFI of all two models presented a good fit. The two models were thus considered for mediation analyses. Results of the mediating effect analyses are shown in Table 4. After controlling for sex and age, we found

that PFS partially mediated the relationship between anxiety and PSU in both Chinese and Belgian undergraduates.

In contrast, PFS did not show a consistent mediating effect in the relationship between depression and PSU in the two groups. Our study found that PFS can partially mediate the relationship between depression and PSU in Chinese undergraduates, but the mediating effect was not found among European undergraduates. However, the difference in the mediating effect between the groups was not significant.

DISCUSSION

As PSU has emerged as an internationally relevant public health issue, cross-cultural studies on this topic are required (WHO, 2015). Nevertheless, such studies are scarce, this being especially the case for comparisons between European and East Asian countries. In our study, we aimed to fill this gap in the literature by investigating the cross-cultural differences in smartphone usage patterns and PSU in Belgian and Chinese undergraduates and to test, from a stress-coping framework, whether PFS mediates the relationships between experiences of the two most common psychopathological symptoms (i.e., anxiety and depression) and PSU.

SMARTPHONE USAGE PATTERN

This study suggests that Chinese undergraduates spent significantly more time on smartphone use on weekdays and on weekends than did Belgian undergraduates. Our results also showed that Chinese undergraduates displayed more marked PSU than did Belgian undergraduates, which is consistent with previous findings that compared Chinese and European undergraduates (Yang et al., 2019). We also found that Chinese undergraduates tended to use texting functionalities more than Belgian undergraduates did (64.1% *vs*. 37.1%, respectively, $p < 0.01$), whereas Belgian undergraduates more often preferred to use social networking services on their smartphones than Chinese undergraduates did (45.3% *vs*. 17.2%, respectively, $p < 0.01$), which highlights different smartphone usage patterns among undergraduates between the two countries.

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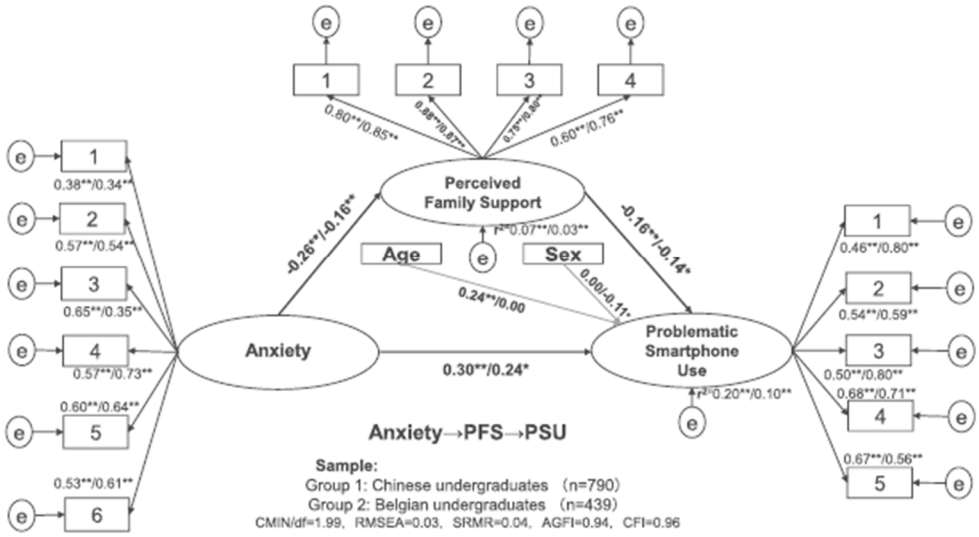
RELATIONSHIPS BETWEEN PSYCHOPATHOLOGICAL SYMPTOMS AND PSU

The study showed that PSU is positively correlated with psychopathological symptoms, namely, anxiety and depression. These findings are in line with previous research that linked these symptoms to PSU (Long et al., 2016; Yang et al., 2020), and they support the view that some individuals engage in excessive smartphone use to deal with negative emotional states (Billieux, 2012; Elhai et al., 2017). From this perspective, addictive-like behaviors such as PSU can be conceptualized as distraction- and avoidance-based strategies displayed to manage chronic stressors and aversive emotions. From a cross-cultural perspective, this study shows that the relationships between psychopathological symptoms and PSU are comparable in Chinese and Belgian undergraduates.

***FIGURE 2**. Multigroup analysis on mediating model of PFS in the relationship between anxiety and PSU.*

*Note: *p < 0.05; **p < 0.01. PSU, problematic smartphone use; PFS, perceived family support; all estimates were standardized; CMIN/DF: X^2/df; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; AGFI, adjusted goodness-of-fit index; CFI, comparative fit index; sex: female = 0, male = 1.*



MEDIATING EFFECT OF PERCEIVED FAMILIAL SUPPORT

Social support, with family support included as a key component, can act as an external coping resource to address stressful life events and psychopathological symptoms (Brannan et al., 2013; Christensen et al., 1989; Klink et al., 2008; Poulin et al., 2012; Thompson and Heller, 1990). It has been reported that efficient social support might act as a protective factor in the development of PSU or online addictive behaviors (Al-Kandari and Al-Sejari, 2021; Karaer and Akdemir 2019), as well as constituting a crucial component of recovery treatment programs for substance use and addictive disorders (Chen, 2006; Liu et al., 2015). Because we identified a negative association between PFS and PSU, we tested the possible mediation effect of PFS in the relationship between psychopathological symptoms and PSU.

We found that, when sex and age were controlled for, PFS partially mediates the direct relationship between anxiety and PSU in both Chinese and Belgian undergraduates. These findings suggest that perceived familial support is one of the factors accounting for the relationships between these psychopathological symptoms and PSU. Indeed, it might be that anxious undergraduates compensate for a lack of perceived familial support through intensive and sometimes excessive smartphone use. Our findings may have implications for the prevention of and intervention in PSU in both Eastern and Western cultural contexts. As has been reported, family therapy, in which optimizing familial and social support is central, has proved efficient to mitigate problematic use of the Internet and problematic gaming (Han et al., 2012; Liu et al., 2015). Our study further suggests that such psychological interventions could potentially be applied to young people with PSU associated with symptoms of anxiety.

In contrast, we did not find a consistent mediating effect of PFS in the relationship between depression and PSU in the cross-cultural analysis. The results suggest that distinctive variables explain relationships between PSU and depression versus anxiety.

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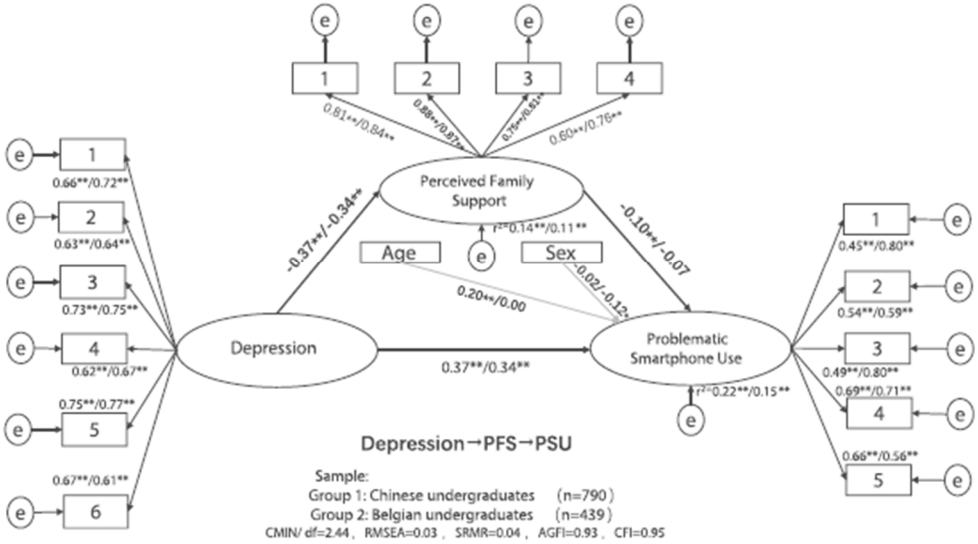
***FIGURE 3**. Multigroup analysis on mediating model of PFS in the relationship between depression and PSU. Note: *p < 0.05; **p < 0.01. PSU, problematic smartphone use; PFS, perceived family support; all estimates were standardized; CMIN/DF: X^2/df; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; AGFI, adjusted goodness-of-fit index; CFI, comparative fit index; sex: female = 0, male = 1.*



Our study also suggests that perceived lack of efficient familial support may only explain the relationship between depression and PSU among Chinese undergraduates. However, as the difference in the mediating effect is not significant between the two groups, the mediating effect cannot be confirmed. Further investigations are warranted to clarify these issues.

***TABLE 4**. Parameter Estimates of Mediating Models and Evaluation of Mediating Effects*

	a (95% CI)	b (95% CI)	c'/ Direct Effect (95% CI)	Indirect Effect (95% CI)	Total Effect (95% CI)	△ Indirect Effect
			Anxiety →PFS →PSU			
China (n = 790)	−0.258** (−0.349 ~ −0.160)	−0.160** (−0.254 ~ −0.064)	0.304** (0.202 ~ 0.405)	0.041** (0.017 ~ 0.076)	0.345** (0.244 ~ 0.442)	0.016 (−0.080 ~ 0.062)
Belgium (n = 439)	−0.163** (−0.272 ~ −0.049)	−0.144* (−0.247 ~ −0.025)	0.242** (0.101 ~ 0.369)	0.025* (0.005 ~ 0.360)	0.266** (0.131 ~ 0.390)	
			Depression →PFS →PSU			
China (n = 790)	−0.373** (−0.460 ~ −0.280)	−1.03* (−0.204 ~ 0.002)	0.371** (0.251 ~ 0.480)	0.038* (0.002 ~ 0.080)	0.409** (0.302 ~ 0.507)	0.018 (−0.035 ~ 0.060)
Belgium (n = 439)	−0.336** (−0.441 ~ −0.234)	−0.072 (−0.187 ~ 0.044)	0.336** (0.217 ~ 0.447)	0.020 (−0.015 ~ 0.065)	0.360** (0.248 ~ 0.462)	

All estimates were standardized; 95% CIs were calculated by using the bias-corrected percentile method.

**p < 0.05. **p < 0.01. CI, confidence interval.*

LIMITATIONS

Several limitations of this study should be acknowledged. First, the cross-sectional design hinders causal interpretations of the relationships shown in the models. Second, data collection was based exclusively on self-reports; therefore, the findings are potentially influenced by response/recall bias or errors. For example, PFS is a subjective evaluation of actual family support, which might be influenced by various factors, including experiences of aversive emotions (Barr-Anderson et al., 2010; Norris and Kaniasty, 1996). Similarly, previous research showed that self-reported time spent using smartphones generally does not correlate with actual usage, implying that this is not necessarily a valid indicator (Sally et al., 2015). However, in the current study, this variable was used for cross-cultural comparison purposes, and the details regarding time spent using the smartphone were not central to the study. Third, the study was conducted through a convenience sampling strategy among university students, which may limit the generalizability of the findings. Accordingly, large-scale studies with representative samples from more general populations are recommended for future studies.

CONCLUSIONS

In this study, we explored cross-cultural differences in PSU between Chinese and Belgian undergraduates. Relying on a stress-coping framework, we confirmed the associations between psychopathological symptoms (i.e., anxiety and depression) and PSU, and we further identified that PFS mediates the relationship between anxiety and PSU across cultural settings. Our findings may facilitate the prevention of and intervention in PSU. Psychological interventions that take into account familial factors and themes could be helpful for young people presenting with anxiety and PSU.

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DISCLOSURES

All authors of this article have read and approved the final version submitted. J. Lo, J.B., and T.L. conceptualized and designed the study. J. Lo, Y.L., Y.W., A.P., A.C., and J.D. developed and conducted the survey. J. Lo, J.B., Y.L., J. Lu, and Y.W. analyzed and interpreted the data. J. Lo, J.B., and T.L. obtained funding. J. Lo wrote the first draft of the manuscript. All authors revised, contributed to, and approved the final manuscript.

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The study was conducted ethically in accordance with the Declaration of Helsinki. The protocol was reviewed and approved by the ethics committee of the Second Xiangya Hospital, Central South University in China and approved by the ethical committee of the Psychological Science Research Institute, Université catholique de Louvain in Belgium. All participants provided informed consent before completing the anonymous online survey.

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