# Mobile phone addiction and social anxiety among Chinese adolescents: Mediating role of interpersonal problems

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**Título**: Adicción al teléfono móvil y ansiedad social entre adolescentes chinos: papel mediador de los problemas interpersonales.
**Resumen:** *Objetivos:* Con frecuencia se ha informado que la adicción al teléfono móvil (MPA) está correlacionada con trastornos psicológicos como la depresión, el estrés y la ansiedad entre la población joven. Sin embargo, el grado en que estos factores se correlacionan con el AMP y el mecanismo potencial subyacente a esas relaciones son concluyentes. Este estudio tuvo como objetivo investigar la asociación entre el nivel de AMP y la ansiedad social entre adolescentes chinos y examinó el efecto de mediación de los problemas interpersonales entre ellos. *Métodos:* Una muestra de 1027 estudiantes escolares seleccionados mediante un método de muestreo aleatorio por conglomerados estratificados respondió a cuestionarios sobre el índice MPA, la escala de ansiedad por interacción social, el inventario de problemas interpersonales y variables demográficas. Se realizaron análisis de correlación de Spearman y de regresión lineal múltiple para investigar el alcance de la asociación entre la AMP y la ansiedad social, y la prueba de Sobel y el muestreo de arranque confirmaron el papel mediador de los problemas interpersonales. *Resultados:* De todos los estudiantes de nuestro estudio, el 5,9% tenían AMP, y la puntuación de AMP se correlacionó positivamente con la ansiedad social después de controlar las variables demográficas en el modelo ajustado. El análisis de regresión de mediación múltiple reveló que el problema interpersonal era un mediador parcial significativo entre la AMP y la ansiedad social. *Conclusión:* Los adolescentes del AMP fueron un subgrupo de población que necesita prestar más atención para prevenir la ansiedad social. Mejorar los problemas interpersonales podría ser un enfoque eficaz para abordar la ansiedad social inducida por el AMP en los adolescentes.
**Palabras clave:** Adicción al teléfono móvil. Ansiedad social. Problemas interpersonales. Mediación.

**Abstract:** *Objectives:* Mobile phone addiction (MPA) has frequently reported to be correlated with psychological disorders such as depression, stress and anxiety among young population. However, the extent to which these factors are correlated with MPA and the potential mechanism underlying those relationships are conclusive. This study aimed to investigate the association between MPA level and social anxiety among Chinese adolescents, and examined the mediation effect of interpersonal problems between them. *Methods:* A sample of 1027 school-based students selected by a stratified-cluster random sampling method responded to questionnaires regarding MPA Index, Social Interaction Anxiousness Scale, Interpersonal Problems Inventory, and demographic variables. Spearman correlation and multiple linear regression analyses were performed to investigate the extent of the association between MPA and social anxiety, and Sobel test and bootstrapping sampling confirmed the mediating role of interpersonal problems. *Results:* Of all students in our study, 5.9% were MPA, and MPA score was positively correlated with social anxiety after controlled for demographic variables in the adjusted model. Multiple mediation regression analysis revealed that the interpersonal problem was a significant partial mediator between MPA and social anxiety. *Conclusion:* The MPA adolescents were a subgroup population who need to pay more attention to prevent social anxiety. Improving interpersonal problems might be an effective approach to deal with MPA-induced social anxiety in adolescents.
**Keywords**: Mobile phone addiction. Social anxiety. Interpersonal problems. Mediation.

## Introduction

The use of digital technology has grown rapidly during the last couple of decades and the advent of mobile phone has remarkably changed people's life to make our life convenient. Given the versatility and convenience that mobile phone provide to our daily lives, the number of mobile phones owners is dramatically increasing worldwide in recent years (Burchell, 2015; Elhai et al., 2017). The number of mobile phone users was approximately 7.33 billion in 2023 worldwide, which accounts for approximately 91.04% of the global population (BankMyCell, 2023). According to the latest official statistics, the number of mobile internet users in China has reached 1.047 billion up to August 2022, which accounts for 99.6% of the China's netizens (*China Internet Network Information Center (CNNIC),* 2022). However, excessive use of mobile phones could result in problems such as mobile phone addiction (MPA) (Choi et al., 2015). MPA is defined as excessive dependence or inability to regulate to control the impulse to use mobile phones, which is broadly deemed as a subset of behavioral or technological addition and would eventually lead to negative consequences in daily life (Billieux 2012). MPA has several synonyms in literature such as "problematic mobile phone use", "mobile phone dependence", and "smartphone addiction". Adolescents and colleges students are particularly at high risk of developing MPA (Bai et al., 2020), as they are usually mentally immature and have less self-regulatory ability (Li et al., 2018). Adolescents and young adults are the largest and fastest growing groups of mobile phone users, and MPA among children and adolescents has become a concern for all(Sahu et al. 2019). A meta-analysis showed the average prevalence of MPA among Chinese college students was approximately 23% (Tao, 2018). MPA is closely related to many psychological and behavioral problems such as depression, stress, anxiety, poor sleep quality, and maladaptive behavioral difficul-

ties (Cui et al., 2021; Liu et al., 2019; Thomee, 2018; Visnjic et al., 2018). The adverse effects of excessive and improper mobile phone usage can block the face-to-face communication and even lead to poor psychological health (Pierce, 2009; Tayama, 2011). Previous studies showed that there was a partial effect between mobile phone use and social anxiety(Bai et al., 2022; X. Li et al., 2022; You et al., 2019). These studies highlight the need to evaluate the link between mobile phone use and psychological impairment in the young population.

Social anxiety refers to an individual's experience of negative emotions such as worries, fears, and nervousness under social situation (Li et al., 2003). Previous study reported that anxiety disorders are the most frequent conditions in children and adolescents (Merikangas et al., 2009). Subjects with social anxiety prefer communications through mobile technology devices rather than face-to face communication (Ren et al., 2017). Generally, social anxiety persists from childhood to adolescence and social anxiety in college students was reported as high as 45.7% (Li et al., 2019). An increasing amount of evidence showed that the mobile phone addiction level was linked to interpersonal problems and negative emotions such as anxiety (Beranuy et al., 2009). In addition, people with high anxiety are often uncomfortable with personal communication, thereby experiencing some extensive interpersonal difficulties (Nepon et al., 2011). Thus, an underlying association among mobile phone addiction, social anxiety, and interpersonal problems is suspected. However, the extent of influence of the mobile phone addiction level on the undesirable emotion is yet to be elucidated. Does interpersonal relationship play a role in the relationship between mobile phone addiction and negative emotion such as social anxiety?.

In order to address the above concerns, this study recruited high school students and low-grade college students, who are typical groups of adolescent and young mobile users. We aimed to: 1) assess the prevalence of MPA among adolescents and young adults; 2) estimate the effects of mobile phone addiction levels on social anxiety among; 3) examine the mediating role of interpersonal problems between MPA levels and social anxiety.

## Methods

### Study population

A stratified random sample was used to selected students in senior high school and university from three different regions (Shannan, Guanzhong, and Shanbei) according to the district distribution in the Shaanxi province, China. The participants were asked to complete a 20-min questionnaire packet independently. A total of 1249 participants filled out the questionnaires, and 42 were excluded due to failure of competition. Finally, the sample consisted of 1207 adolescents from 16 junior high schools and high schools were recruited and analyzed. This study was reviewed and approved by the Academic Ethics Committee of Xian Jiao Tong University Health Science Center and was conducted in accordance with the Declaration of Helsinki.

### Measurements

#### *Mobile phone addiction levels*

Adolescents Mobile phone addiction level was assessed by the Mobile Phone Addiction Index (MPAI) that developed by Leung in 2008 (Leung, 2008). The MPAI has been confirmed to have good reliability and validity in Chinese samples (Yang et al., 2020). This measurement tool is consisted of 17 items that assessed four aspects of mobile phone addictions: (1) inability to control craving (7 items, such as "I am obsessed with my mobile phone" ; (2) feeling anxiety and lost (5 items, such as "I feel anxious if I have not checked for messages or switched on my mobile phone for some time"; (3) withdrawal/escape (3 items, such as "I feel lost when I do not have my mobile phone with me" ; (4) loss of productivity (2 items, such as "I prefer to play with my mobile phone rather than deal with urgent tasks" . Each of the 17-item MPAI scale is rated on a five-point Likert scale (1 = "not at all", 2 = "rarely", 3 = "occasionally", 4 = "often", 5 = "always"). The total score ranged from 17–85. High scores indicated a high level of mobile phone addiction/dependence. According to the classification criteria reported by Young, 1998 (Young, 1998), the score of 17–31 was classified as "non-addiction", 32–56 represented "possible MPA", and > 57 indicated "mobile phone addiction". In the current sample, MPAI scores showed good internal consistency (Cronbach's alpha = 0.881) which showed good validity of scale.

#### *Mobile phone use*

Mobile phone usage was examined by asking three questions to the participants: "How much time do you spend on your mobile phone per day on average?", "how long have you been using the mobile phone?", and "how much do you spend average monthly on your mobile phone?"

#### *Social anxiety*

Social anxiety is one of the most prevalent mental health disorders, which is characterized by excessive fear of social networking (Hoff et al., 2017). The 18 items on the social anxiety scale for adolescents (SAS-A) have been validated and were used for assessing the social anxiety (Zhou et al., 2008). The SAS-A includes three subscales, including fear of Negative Evaluation (FNE) (8 items), Social Avoidance and Distress in New Situations (SAD-New) (6 items), and Social Avoidance and Distress-General (SAD-General) (4 items). Each item was rated on a 5-point Likert scale according to how much the item "is true for you", ranging from 1 = "not at all" to 5 = "extremely agree". The items from each of the

three subscales were summed to obtain a total score. A high score for adolescent student indicates a high level of subjective social anxiety. The validity study documented good internal consistency coefficient. The Cronbach's alpha for social anxiety was 0.84 in the present study.

*Interpersonal problems*

The interpersonal problems was assessed by the Chinese version of Inventory of Interpersonal Problems (IIP-32) (Horowitz et al., 1988). The has been demonstrated to exhibit a good test-retest reliability (Wu et al., 2015) and a valid measure of interpersonal difficulties for adults and adolescents (Zhang et al. 2015). It is a 32-item self-reporting tool, on which, the respondents rate the severity of interpersonal difficulties on a scale of 1 (not at all) to 5 (extremely). The higher scores indicate greater interpersonal difficulties. A previous study assessed the Chinese version of IIP-32 and displayed its good test-retest reliability ($r = .94$) and strong internal consistency (coefficient = 0.90) (Sun et al., 2012). We detected a Cronbach's α coefficient of 0.85 for interpersonal problems in the present study.

**Statistical analysis**

Descriptive analysis was performed to examine the prevalence of MPA and participants' demographic characteristics according to mobile phone addiction levels. Chi-square test was used for categorical variables, and Kruskal-Wallis test were conducted for non-normal distributed continuous variables to make comparisons between MPA level groups. Spearman correlation analyses were performed to examine the correlations between MPA and social anxiety and interpersonal problems. Multivariate linear regression analyses were used to assess associations between MPA and social anxiety and interpersonal problems. The unadjusted model was tested for bivariate association for the two explanatory variables. The adjusted model then controlled all covariates including age, sex, residence, child numbers, SES, and family status. All data analyses were performed using Stata 15.0. P values < .05 were considered to be statistically significant (2-sided tests).

According to Baron and Kenny (Baron & Kenny 1986), four steps should be presented to establish a mediation by conduction series of Pearson/Spearman correlations and regression analyses: 1) the independent variable (IV) is significantly related to the dependent variable (DV), 2) the IV is significantly related to the mediator (M), 3) the M is significantly related to the dependent variable (DV), and 4) the effect of IV on DV controlling for M should be changed as compared to that without adding M in the model; this value is zero (Figure 1). If all the four steps are fulfilled, then variable M completely mediates the IV-DV relationship, while if only the first three steps are fulfilled, then partial mediation is indicated. Furthermore, the Sobel test and bootstrap resampling procedure were also used to assess the mediation effect.

**Figure 1**
*Illustration of a mediation design*
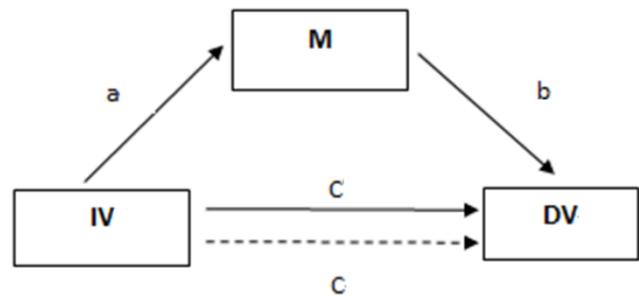


*Note*: Dotted line denotes the effect of the mobile phone addiction level on social anxiety when the interpersonal problem is not included as a mediator.

## Results

**Descriptive and correlation analysis**

The average age of the participants was 15.36 years ($SD$=2.50, ranging from 11 to 26). In total, 58.3% of participants were girls and 40.2% were the only-child in the family. All of the participants owned and used mobile phones and 5.6% of them were classified as Mobile Phone Addiction, half of them were possible

MPA and the rest 44.4% were categorized as non-MPA (Table 1). Up to 56.9% non-MPA spent < 2 h/day on the mobile phone, followed by 25.2% possible-MPA, and 16.2% MPA (Table 2). Conversely, up to 29.4% of the MPA spent > 6 h/day on mobile phone, followed by 13.4% of possible-MPAs, and only 3.2% of the non-MPAs. These results indicated that the higher the mobile phone addiction level, the more time an individual spent on the mobile phones. Also, a significant difference was found in the average monthly mobile phone bill among MPAs, possible-MPAs, and non-MPAs (P<0.001), suggesting a trend that higher the mobile phone addiction level, the more money an individual spent on the mobile phone. Furthermore, the percentage of the cumulative duration (years) of the mobile phone usage among MPAs, possible MPAs, and non-MPAs was 5.9%, 12.3%, and 7.8%, respectively.

**Table 1**
*Socio-demographical characteristics of the study population according to MPA status*

|  | Total | MPAs | Possible-MPAs | Non-MPAs |  |
|---|---|---|---|---|---|
|  | N (%) | n (%) | n (%) | n (%) | p-value |
|  | 1207 (100) | 68 (5.6) | 603 (50) | 536 (44.4) |  |
| Age | 15 (14-6) | 15 (14-16) | 15 (14-17) | 14 (13-16) | < .001 |
| Gender |  |  |  |  | .913 |
| Female | 704 (58.3) | 38 (3.1) | 251 (20.8) | 314 (26.0) |  |
| Male | 503 (41.7) | 30 2.5 | 352 (29.2) | 222 (18.4) |  |
| Location |  |  |  |  | .053 |
| Urban | 720 (59.7) | 37 (3.1) | 343 (28.4) | 340 (28.2) |  |
| Rural | 487 (40.3) | 31 (2.6) | 260 (21.5) | 196 (16.2) |  |
| Single child |  |  |  |  | .121 |
| Yes | 485 (40.2) | 32 (2.7) | 226 18.7 | 227 (18.8) |  |
| No | 722 (59.8) | 36 (3.0) | 377 (31.2) | 309 (25.6) |  |
| Family status (divorce) |  |  |  |  | .107 |
| Yes | 98 (8.1) | 10 (0.8) | 49 (4.1) | 39 (3.2) |  |
| No | 1109 (91.9) | 58 (4.8) | 554 (45.9) | 497 (41.2) |  |
| Family social economic status (SES) |  |  |  |  | .731 |
| Low | 766 (63.5) | 44 (3.6) | 386 (32) | 336 (27.8) |  |
| Middle | 341 (28.3) | 17 (1.4) | 164 (13.6) | 160 (13.3) |  |
| High | 100 (8.3) | 7 (0.6) | 53 (4.4) | 40 (3.3) |  |

**Table 2**
*Mobile phone use, social anxiety and interpersonal problems according to MPA status*

|  | MPAs | Possible-MPAs | Non-MPAs |  |
|---|---|---|---|---|
|  | n = 68 | n = 603 | n = 536 | p-value |
| Duration of daily mobile phone use [n (%)] |  |  |  | < .001 |
| <2 h | 11 (16.2) | 152 (25.2) | 305 (56.9) |  |
| 2–6 h | 37 (54.4) | 370 (61.4) | 214 (39.9) |  |
| >6 h | 20 (29.4) | 81 (13.4) | 17 (3.2) |  |
| Average mobile phone monthly bill [n (%)] |  |  |  | < .001 |
| <¥20 | 11 (16.2) | 127 (21.1) | 227 (42.4) |  |
| ¥20–¥50 | 24 (35.3) | 272 (45.1) | 220 (41.0) |  |
| ¥51–¥100 | 22 (32.4) | 157 (26.0) | 62 (11.6) |  |
| >¥100 | 11 (16.2) | 47 (7.8) | 27 (5.0) |  |
| Duration of mobile phone use [n (%)] |  |  |  | < .001 |
| <1 year | 24 (35.3) | 184 (30.5) | 222 (41.4) |  |
| 1-2 years | 28 (41.2) | 215 (35.7) | 186 (34.7) |  |
| 3-4 years | 12 (17.6) | 130 (21.6) | 86 (16.0) |  |
| >4 years | 4 (5.9) | 74 (12.3) | 42 (7.8) |  |
| Social anxiety score | 55 (47-63) | 48 (37-58) | 39 (28-51) | < .001 |
| Interpersonal problems | 71(53-86) | 56 (44-72) | 47 (36-62) | < .001 |

### Correlation analysis and multivariable regression analysis

Bivariate correlation analyses showed that social anxiety was related to mobile phone addiction ($r = .315$, $p < .001$), interpersonal problems ($r = .601$, $p < .001$); MPA was related to interpersonal problems ($r = .311$, $p < .001$). The multiple linear regression analysis models were summarized in Table 3. There were significant associations between MPA, social anxiety, and interpersonal problems ($p < .001$) (model 1). After controlled for the covariates, MPA and interpersonal problems were still positively associated with social anxiety (model 2).

**Table 3**
*Multivariable regression analysis of social anxiety*

| Variable | Model 1 |  |  |  |  | Model 2 |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  | β | t | p | 95% CI |  | β | t | p | 95% CI |  |
|  |  |  |  | Lower | Upper |  |  |  | Lower | Upper |
| MPA score | 0.197 | 6.05 | < .001 | 0.133 | 0.261 | 0.189 | 5.680 | < .001 | 0.1245 | 0.254 |
| Interpersonal problems | 0.422 | 10.550 | < .001 | 0.385 | 0.459 | 0.439 | 22.930 | < .001 | 0.402 | 0.477 |

**Table 4**
*Hierarchical regression result of the mediation effects of interpersonal problems between MPA and social anxiety*

| | Social anxiety | | | | | | |
|---|---|---|---|---|---|---|---|
| | B | β | $R^2$ | Adjust $R^2$ | $F$ | $\triangle R^2$ | $\triangle F$ |
| The possible-MPAs addiction level→social anxiety (path c) | 0.32(0.09) | 0.15 | 0.019 | 0.017 | 11.3 | 0.019 | 11.3 |
| The possible-MPAs addiction level→Interpersonal problems (path c) | 0.32(0.13) | 0.10 | 0.01 | 0.008 | 5.9 | 0.01 | 5.9 |
| Step1: Interpersonal problems→Social anxiety (path b) | 0.38(0.03) | 0.53 | 0.28 | 0.28 | 121.2 | 0.28 | 323.6 |
| Step2: the possible-MPA addiction level→Social anxiety (path c') | 0.18(0.08) | 0.08 | 0.29 | 0.29 | 176.3 | 0.06 | 5.08 |

## Mediating effects of interpersonal problems

The mobile phone addiction was positively and significantly correlated with interpersonal problems ($r = .13$, $p = .001$) and social anxiety ($r = .16$, $p < .001$). Moreover, the interpersonal problem also was significantly and positively correlated with the social anxiety ($r = .53$, $p < .001$). These results satisfied the primary conditions of the mediation test. In order to determine whether the interpersonal problem acts as a mediator of the association between the mobile phone addiction and social anxiety, further mediation analyses were conducted. As shown in Table 4, the first two regression analyses showed that the MPAs was a significant predictor of social anxiety ($β =.14$, $t = 3.36$, $p = .001$) and interpersonal problems ($β =.10$, $t = 2.44$, $p = .015$). When the interpersonal problem was added into the final model, the values of the MPA level dropped from .14 to .08, which remained significant, indicating that the MPA was an independent predictor of social anxiety.

The effect of the MPA on interpersonal problems and social anxiety, and the final controlling model for interpersonal problems were rated as .10, .14, .53, and .08, respectively. Moreover, the results from the Sobel test ($Z = 2.77$, $p = .03$) and those of the bootstrap resampling procedures were based on 1000 samples. The standardized indirect effect $= 0.14$ ($SE = .05$ bias-corrected bootstrap 95% CI $= .045–.242$), indicated that the interpersonal problem is a partial mediator of the link between MPA and social anxiety (Figure 2).

**Figure 2**
*Mediation model of social anxiety and MPA*
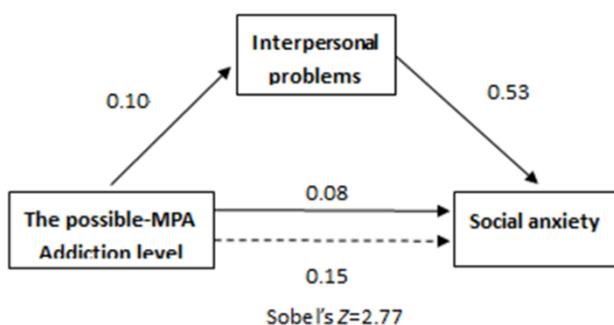


*Note.* The dotted line denotes the effect of the addiction level of MPA on social anxiety when the interpersonal problem is not included as a mediator.

## Discussion

This study investigated the association between mobile phone addiction and social anxiety among adolescents and young adults in a large random sample obtained from the northwest province of China. Furthermore, the mediation effects of interpersonal problems in the link between the mobile phone addiction and social anxiety were examined. Our results showed that 5.6% of students were MPA, and MPA was associated with greater social anxiety and poor interpersonal relationships. We also found that interpersonal problems mediated the relationship between MPA and social anxiety.

The prevalence of MPA in this study is different with result from previous studies, but still within the estimated range of mobile phone addiction as compared to the findings of other Asian studies(Li Chen ZY 2016; Wang et al. 2014). These discrepancies could be explained by various categorized scales, different samples selected, and data analysis performed in the study. Along with previous studies (Aktepe et al. 2013; Ghassemzadeh et al. 2008), the present study implied that possible-MPAs had various problems and could convert to MPAs if the mobile phone usage was out of control. Thus, this groups required additional attention needs in future studies.

The current study found significant differences in the mobile phone use with respect to the time of daily mobile phone use, average mobile phone monthly bill, and duration of the use. We found that higher the MPA level, the longer time is the mobile phone use daily and larger are the phone bills, which endorse the theory of technology addiction. Moreover, it could also be inferred that as compared to the non-MPAs, adolescents and young adults with high MPA level would prefer to use a mobile phone for interaction rather than face-to-face communication that can could lead them to a new form of social contact (Kamibeppu & Sugiura 2005).

The second finding of this study was that the MPA level had a significant impact on social anxiety, which might be accounted by a high proportion of males among MPAs. More than half of the MPAs were males, and they displayed a stable and less negative emotion as compared to the females (Kivikangas et al. 2014). This finding was in agreement with a previous study (Hong et al. 2012) that referred to MPA level as a positive predictor of negative emotion such as social anxiety. The total, indirect, and direct effects of the MPA level on social anxiety was 0.15, 0.14, and 0.08, respec-

tively. Thus, MPA necessitate intensive attention and effective intervention programs.

The current study also spotted the mediation effect of interpersonal problems in the association between the mobile phone addiction level and social anxiety among possible-MPAs, which was consistent with the findings of the other technology addiction study (Chiu 2014). The proportion of the interpersonal problems mediation was 65.21% for social anxiety of MPA; also, it was a partial and not a full mediator of the link between the MPA level and social anxiety. This indicated a partial direct effect of MPA level on social anxiety through the mediation role of interpersonal problems, which was not similar to the findings of the study based on 361 college students (Yao & Zhong 2014). This phenomenon might be attributed to the different study populations and sample sizes. Furthermore, the emotions of an individual not only affect their behavior but also could be affected by their behaviors (Haagsma et al. 2013). Thus, the MPA is a maladaptive behavior with distinct effects on an individual's emotions with or without the mediating effect of other variables.

Several limitations of the present study should be considered. First, the casual relationships among the variables could not be established due to the cross-sectional nature of the data, although it was based on the theoretical and prior research. Thus, a longitudinal research design is desirable to address the causal assumption indicated in this study. Second, some recall-based bias might occur by means of analysis of the self-reported data. For instance, due to social desirability, our results might underestimate the effect of mobile phone addiction level on social anxiety. Third, the social anxiety was evaluated only at one time point, while adolescents are a fast-growing group and may change their preferences swiftly.

## Conclusion

To summarize, this study found that MPA spend more money and time on mobile phone use, and they were also had a higher risk of social anxiety. The relationship between MPA and social anxiety was found to be independently and mediated by interpersonal problems. This study, for the first time, attempted to reveal the mediating role of interpersonal problems between MPA and social anxiety, and the results call for more attention to be paid towards social anxiety in MPA adolescents.

**Declare of competing Interest**: None.

## References

Aktepe, E., Olgac-Dundar, N., Soyoz, O., & Sonmez, Y. (2013). Possible internet addiction in high school students in the city center of Isparta and associated factors: a cross-sectional study. *Turk J Pediatr, 55*(4), 417-425.

Bai, C., Chen, X., Liu, H., & Yu, K. (2022). Parental Expectation and Mobile Phone Addiction in Adolescents from Chinese Low-Income Families: The Mediating Effects of Self-Esteem and Social Anxiety. *Cyberpsychol Behav Soc Netw, 25*(9), 589-596. https://doi.org/10.1089/cyber.20,22.0069

Bai C, Chen, X., Han, K. (2020). Mobile phone addiction and school performance among Chinese adolescents from low-income families: A moderated mediation model. *Children and Youth Services Review, 118*, 1-11.

BankMyCell. (2023). How many smartphones are in the world? Retrieved from https://www.bankmycell.com/blog/how-many-phonesare-in-the-world.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol, 51*(6), 1173-1182.

Beranuy, M., Oberst, U., Carbonell, X., & Chamarro, A. (2009). Problematic Internet and mobile phone use and clinical symptoms in college students: The role of emotional intelligence. *Computers in Human Behavior, 25*(5), 1182-1187.

Billieux, J. (2012). Problematic use of the mobile phone: A literature review and a pathways model. *Current Psychiatry Reviews, 8*(4), 299–307.

Burchell, K. (2015). Tasking the everyday: Where mobile and online communication take time. *Mob. Media. Commun, 3*, 36–52.

*China Internet Network Infomation Center (CNNIC). The 50th Statistical Report on China's Internet Development*. (2022). Retrieved from https://www.cnnic.com.cn/IDR/ReportDownloads/202212/P020221209344717199824.pdf

Chiu, S. I. (2014). The relationship between life stress and smartphone addiction on taiwanese university student: A mediation model of learning self-Efficacy and social self-Efficacy. *Computers in Human Behavior, 34*(4), 49-57.

Choi, S. W., Kim, D. J., Choi, J. S., Ahn, H., Choi, E. J., Song, W. Y., . . . Youn, H. (2015). Comparison of risk and protective factors associated with smartphone addiction and Internet addiction. *J Behav Addict, 4*(4), 308-314. https://doi.org/10.1556/2006.4.2015.043

Cui, G., Yin, Y., Li, S., Chen, L., Liu, X., Tang, K., & Li, Y. (2021). Longitudinal relationships among problematic mobile phone use, bedtime procrastination, sleep quality and depressive symptoms in Chinese college students: a cross-lagged panel analysis. *BMC Psychiatry, 21*(1), 449. https://doi.org/10.1186/s12888-021-03451-4

Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders, 207*, 251-259. https://doi.org/10.1016/j.jad.2016.08.030

Ghassemzadeh, L., Shahraray, M., & Moradi, A. (2008). Prevalence of internet addiction and comparison of internet addicts and non-addicts in Iranian high schools. *Cyberpsychol Behav, 11*(6), 731-733. https://doi.org/10.1089/cpb.2007.0243

Haagsma, M. C., Caplan, S. E., Peters, O., & Pieterse, M. E. (2013). A cognitive-behavioral model of problematic online gaming in adolescents aged 12–22 years. *Computers in Human Behavior, 29*(1), 202-209.

Hoff, A. L., Kendall, P. C., Langley, A., Ginsburg, G., Keeton, C., Compton, S., . . . Piacentini, J. (2017). Developmental Differences in Functioning in Youth With Social Phobia. *J Clin Child Adolesc Psychol, 46*(5), 686-694. https://doi.org/10.1080/15374416.2015.1079779

Hong, F. Y., Chiu, S. I., & Huang, D. H. (2012). A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students. *Computers in Human Behavior, 28*(6), 2152-2159. https://doi.org/10.1016/j.chb.2012.06.020

Horowitz, L. M., Rosenberg, S. E., Baer, B. A., Ureno, G., & Villasenor, V. S. (1988). Inventory of interpersonal problems: psychometric properties and clinical applications. *J Consult Clin Psychol, 56*(6), 885-892.

Kamibeppu, K., & Sugiura, H. (2005). Impact of the mobile phone on junior high-school students' friendships in the Tokyo metropolitan area. *Cyberpsychol Behav, 8*(2), 121-130. https://doi.org/10.1089/cpb.2005.8.121

Kivikangas, J. M., Katsyri, J., Jarvela, S., & Ravaja, N. (2014). Gender differences in emotional responses to cooperative and competitive game play. *PLoS One, 9*(7), e100318. https://doi.org/10.1371/journal.pone.0100318

Leung, L. (2008). Linking psychological attributes to addiction and improper use of the mobile phone among adolescents in Hong Kong. *Journal of Children & Media, 2*(2), 93-113.

Li, B., Zhong, J., and Qian, M. Y. (2003). Regression analysis on social anxiety proneness among college students. *Chin. Ment. Health J., 17*, 109–112.

Li, C., Xu, K. Y., Huang, X. Y., Chen, N. N., Li, J. Q., Wang, J., et al. (2019). The Mediating role of negative body self in emotion regulation strategies and social anxiety. *China J. Health Psychol., 27*, 1564–1567.

Li, C., Zheng, Y., Wenjie,. T., Fuyin, Y., Xiaodan, X., Jincai, H. (2016). Mobile phone addiction levels and negative emotions among Chinese young adults: The mediating role of interpersonal problems. *Computers in Human Behavior, 55*, 856-866.

Li, L., Xu, D. D., Chai, J. X., Wang, D., Li, L., Zhang, L., . . . Xiang, Y. T. (2018). Prevalence of Internet addiction disorder in Chinese university students: A comprehensive meta-analysis of observational studies. *J Behav Addict, 7*(3), 610-623. https://doi.org/10.1556/2006.7.2018.53

Li, X., Li, W., Liu, M., Xiao, W., & Zhou, H. (2022). How Does Shyness Affect Chinese College Students' Tendency to Mobile Phone Addiction? Testing the Mediating Roles of Social Anxiety and Self-Control. *Front Public Health, 10*, 902425. https://doi.org/10.3389/fpubh.2022.902425

Liu, J., Liu, C. X., Wu, T., Liu, B. P., Jia, C. X., & Liu, X. (2019). Prolonged mobile phone use is associated with depressive symptoms in Chinese adolescents. *J Affect Disord, 259*, 128-134. https://doi.org/10.1016/j.jad.2019.08.017

Liu, Q. X., Wu, J. Y., Zhou, Z. K., and Wang, W. J. (2020). Parental technoference and smartphone addiction in chinese adolescents: the mediating role of social sensitivity and loneliness. *Child. Youth. Serv. Rev., 118*, 1–9.

Long, J., Liu, T. Q., Liao, Y. H., Qi, C., He, H. Y., Chen, S. B., & Billieux, J. (2016). Prevalence and correlates of problematic smartphone use in a large random sample of Chinese undergraduates. *BMC Psychiatry, 16*(1), 408. https://doi.org/10.1186/s12888-016-1083-3

Merikangas, K. R., Nakamura, E. F., & Kessler, R. C. (2009). Epidemiology of mental disorders in children and adolescents. *Dialogues Clin Neurosci, 11*(1), 7-20. https://doi.org/10.31887/DCNS.2009.11.1/krmerikangas

Nepon, T., Flett, G. L., Hewitt, P. L., & Molnar, D. S. (2011). Perfectionism, negative social feedback, and interpersonal rumination in depression and social anxiety. *Canadian Journal of Behavioural Science, 43*(4), 297-308.

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

Ren, Y., Yang, J., & Liu, L. (2017). Social Anxiety and Internet Addiction among Rural Left-behind Children: The Mediating Effect of Loneliness. *Iran J Public Health, 46*(12), 1659-1668.

Sahu, M., Gandhi, S., & Sharma, M. K. (2019). Mobile Phone Addiction Among Children and Adolescents: A Systematic Review. *J Addict Nurs, 30*(4), 261-268. https://doi.org/10.1097/JAN.0000000000000309

Sun, Q. W., Jiang, G. R., Zhang, Q. J. (2012). A report on the application of inventory of interpersonal problems (IIP-32) to 1498 college students. *Chinese Journal of Clinical Psychology, 4*(18), 466-568.

Sun, R., Gao, Q., Xiang, Y., Chen, T., Liu, T., and Chen, Q. (2020). Parent–child relationships and mobile phone addiction tendency among Chinese adolescents: the mediating role of psychological needs satisfaction and the moderating role of peer relationships. *Child. Youth Serv. Rev., 116*, 1-35.

Tao, J., Luo, C., Huang, J., & Liang, L. (2018). Meta-analysis of the current situation of mobile phone dependence among college students in China. *Chinese Journal of School Health, 39*(9), 1391–1394.

Tayama, J. (2011). The Relationship between Mobile Phone Addiction and Psycho-Behavioral Factors among High School Students. *Japanese Journal of Psychosomatic Medicine, 51.*

Thomee, S. (2018). Mobile Phone Use and Mental Health. A Review of the Research That Takes a Psychological Perspective on Exposure. *Int J Environ Res Public Health, 15*(12). https://doi.org/10.3390/ijerph15122692

Visnjic, A., Velickovic, V., Sokolovic, D., Stankovic, M., Mijatovic, K., Stojanovic, M., . . . Radulovic, O. (2018). Relationship between the Manner of Mobile Phone Use and Depression, Anxiety, and Stress in University Students. *Int J Environ Res Public Health, 15*(4). https://doi.org/10.3390/ijerph15040697

Wang, P. W., Liu, T. L., Ko, C. H., Lin, H. C., Huang, M. F., Yeh, Y. C., & Yen, C. F. (2014). Association between problematic cellular phone use and suicide: the moderating effect of family function and depression. *Compr Psychiatry, 55*(2), 342-348. https://doi.org/10.1016/j.comppsych.2013.09.006

Wu, L. Z., Roche, M. J., Dowgwillo, E. A., Wang, S., & Pincus, A. L. (2015). A Chinese translation of the inventory of interpersonal problems-short circumplex. *J Pers Assess, 97*(2), 153-162. https://doi.org/10.1080/00223891.2014.971461

Yang, X. J., Liu, Q. Q., Lian, S. L., & Zhou, Z. K. (2020). Are bored minds more likely to be addicted? The relationship between boredom proneness and problematic mobile phone use. *Addict Behav, 108*, 106426. https://doi.org/10.1016/j.addbeh.2020.106426

Yao, M. Z., & Zhong, Z. J. (2014). Loneliness, social contacts and Internet addiction: A cross-lagged panel study. *Computers in Human Behavior, 30*(30), 164-170.

You, Z., Zhang, Y., Zhang, L., Xu, Y., & Chen, X. (2019). How does self-esteem affect mobile phone addiction? The mediating role of social anxiety and interpersonal sensitivity. *Psychiatry Res, 271*, 526-531. https://doi.org/10.1016/j.psychres.2018.12.040

Young, K. S. (1998). Internet addiction: the emergence of a new clinical disorder. *CyberPschology & Behavior, 1*(3), 237-244.

Zhang, J., Lanza, S., Zhang, M., & Su, B. (2015). Structure of the University Personality Inventory for Chinese College Students. *Psychol Rep, 116*(3), 821-839. https://doi.org/10.2466/08.02.PR0.116k26w3

Zhou, X., Xu, Q., Ingles, C. J., Hidalgo, M. D., & La Greca, A. M. (2008). Reliability and validity of the Chinese version of the Social Anxiety Scale for Adolescents. *Child Psychiatry Hum Dev, 39*(2), 185-200. https://doi.org/10.1007/s10578-007-0079-0