

## Review Article

# Prevalence of mobile phone addiction among medical students: a systematic review

Anqi Song<sup>1</sup>, Guiling Song<sup>2</sup>, Huanyan Wang<sup>3</sup>, Qichao Niu<sup>1</sup>, Guisen Yin<sup>4</sup>, Hua Chen<sup>5</sup>, Faisal UL Rehman<sup>6</sup>

<sup>1</sup>Department of Student Affairs, The Second Affiliated Hospital of Harbin Medical University, Harbin 150086, Heilongjiang, China; <sup>2</sup>Department of Chemical Medicine, Yantai Center for Food and Drug Control, Yantai 264003, Shandong, China; <sup>3</sup>Personnel Department, Women's Hospital, Zhejiang University School of Medicine, Hangzhou 310030, Zhejiang, China; <sup>4</sup>Department of Pharmacy, Yantai Hospital of Traditional Chinese Medicine, Yantai 264001, Shandong, China; <sup>5</sup>Department of Research and Development, Qingdao Bioman Biomedical Technology Co., LTD, Qingdao 266031, Shandong, China; <sup>6</sup>The Affiliated Hospital of Qingdao University, Precision Medicine Center of Oncology, Qingdao University, Qingdao 266003, Shandong, China

Received February 9, 2023; Accepted April 11, 2023; Epub May 15, 2023; Published May 30, 2023

**Abstract:** The incidence and factors related to mobile phone addiction among Chinese medical students were analyzed through meta-analysis. Chinese literature databases (such as China Knowledge Network and VIP Information Resource System) and English literature databases (such as PubMed and Web of Science) were searched for cross-sectional studies on the incidence and factors related to mobile phone addiction, and the required data were extracted. Meta-analysis was performed using a random effects model with RevMan 5.3 statistical software, and publication bias was tested with Stata 12.0. A total of 20 studies were included, including 36,365 study subjects. Among them, there were 10,597 cases of mobile phone addiction with an incidence of 29.14%. The results of the meta-analysis showed that the combined OR values (95% CI) of the factors were: gender 1.070 (1.030-1.120), residence 1.118 (1.090-1.146), school type 1.280 (1.241-1.321), mobile phone use time 1.098 (1.068-1.129), sleep quality 1.280 (1.288-1.334), self-perception of learning 0.737 (0.710-0.767), and family relationship 0.821 (0.791-0.852). The study showed that being a male student from cities and towns, being at a vocational college, excessive use of mobile phones, and poor sleep quality were the risk factors for mobile phone addiction among medical students in China. Positive self-perception of learning and family relationships were protective factors, and more related factors are still controversial and need to be further explored and confirmed.

**Keywords:** Mobile phone addiction, medical students, China, influencing factors, meta-analysis

### Introduction

Mobile phone addiction, also known as mobile phone anxiety and mobile phone syndrome, is a behavioral addiction characterized by the compulsive and excessive use of smartphones that may result in decreased social functioning and psychological and behavioral disorders in patients [1]. According to a relevant study, there were 1.50978 billion mobile phone users in China as of June 2018, and smartphones have surpassed other Internet access devices in popularity [2]. The number of mobile phone users across the three primary telecommunications providers in China reached 1.67 billion in 2022, and the number of 5G mobile phone users reached 455 million, according to a re-

port of the Ministry of Industry and Information Technology on the economic performance of the communications industry in the first half of the year, and this report also found that the majority of mobile phone users were young and middle-aged, with the mobile phone ownership rate of college students exceeding 90% [3]. Medical schools should help students comprehend, in light of such facts and trends, that mobile phones serve primarily as productivity aids, with entertainment functions making up a relatively minor portion of their overall impact on study, work, and life.

Some medical students have gotten addicted to their phones because of their excessive usage in the last several years, which has been

increased by the pandemic, the demands of online courses, and the long hours spent at home away from the constraints of the group environment [4]. According to the findings, there is a strong correlation between medical students' mobile phone use and a variety of mental health issues (including but not limited to interpersonal sensitivity, paranoia, depression, anxiety, hostility, and compulsion), all of which have a chilling effect on their academic performance and have now emerged as a social public health concern [5]. As the future pillar of the healthcare industry, medical students have a heavy learning task, and their mobile phone addiction should receive closer attention. Therefore, it is of great significance for understand the current situation and risk factors of mobile phone addiction among medical students in China and take corresponding preventive measures to reduce the rate of mobile phone addiction. The meta-analysis method was used in this study to systematically and quantitatively evaluate the literature previously published related to mobile phone addiction and associated factors in medical students to explore the relationship between various factors and Chinese medical students' mobile phone addiction, and the risk ratio (OR) was used to assess the strength of the relationship between various factors and mobile phone addiction in order to provide a basis for prevention of phone addiction.

### Materials and methods

#### *Source of information/data*

The data related to Chinese medical students' mobile phone addiction published in official journals before June 2022 was searched in Chinese literature databases such as CNKI, Weipu Information Resources System, Wanfang Database, and a few others, along with English literature databases such as PubMed and Web of Sciences. At the same time, a further query was made through literature tracing.

Inclusion criteria: ① Full text of the literature was available; ② Medical students in the literature included junior college students, undergraduate and graduate students; ③ All medical students in the literature received a mobile phone addiction index scale assessment [6];

④ The literature should provide statistical index OR value and 95% CI; ⑤ The literature was evaluated by the relevant quality evaluation standard, including 11 parameters in total with a total score of 11 points; the higher the score, the better the literature quality; and literature with a score  $\geq 7$  points was included [7].

Exclusion criteria: ① Unpublished papers; ② Lack of complete data in the literature or poor text usability; ③ Statistical method errors in the literature.

#### *Data extraction*

Articles were chosen and rated based on the inclusion and exclusion criteria. From each piece of literature, the date of publication, the first author, region, total number of subjects, number of mobile phone addiction cases, average age of research subjects, OR value to evaluate the strength of the relationship between influencing factors, 95% CI, and other information used for quality evaluation were extracted.

#### *Statistical methods*

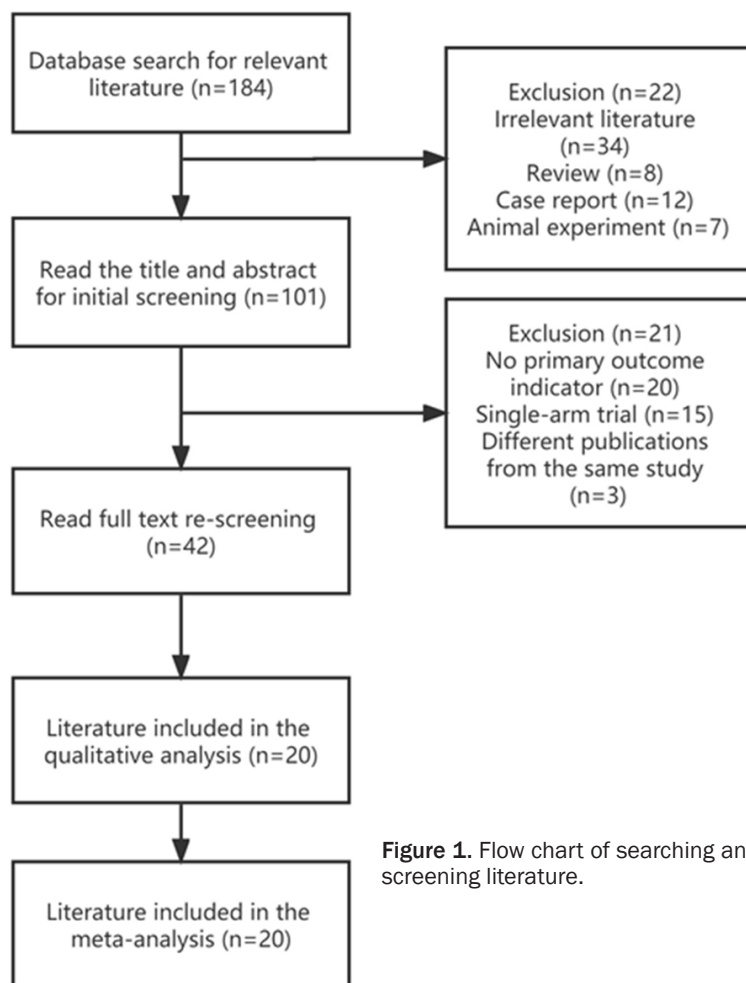
The data were organized, and a database was created in accordance with the criteria of this meta-analysis. With RevMan 5.3 statistical software, a meta-analysis was conducted to determine the correlation between each research component and Internet addiction. The effect size was represented by the odds ratio (OR) and its 95% confidence interval (CI). In the included literature, statistical heterogeneity was qualitatively analyzed using the Q-test. The combined statistics were calculated using the fixed-effects model if there was no significant variability ( $P > 0.05$ ) across studies and the random-effects model if there was significant variability ( $P < 0.05$ ). The published findings of the literature were assessed using the funnel plot, the Begg rank correlation method, and the Egger linear regression method in Stata 12.0, and there was no publication bias if  $P > 0.05$ .

### Results

#### *Basic characteristics of research literature*

Preliminary search yielded 184 potentially relevant papers, and finally 20 papers met the inclusion criteria and were included in the anal-

## Mobile phone addiction



**Figure 1.** Flow chart of searching and screening literature.

ysis (**Figure 1**) [8-27]. Of these, 15 (75.00%) were in Chinese, and the other 5 (25.00%) were in English. Eleven of these studies focused on the correlation between gender and cell phone addiction (47.83%), 10 on the correlation between residence and cell phone addiction (43.48%), 10 on the correlation between the amount of time spent on mobile phones and addiction (43.48%), 10 on the correlation between self-perception of learning and cell phone addiction in teaching (43.48%), 10 on the correlation between cell phone addiction and sleep quality (43.48%), and 10 on the correlation between family relationships and cell phone addiction (43.48%), as shown in **Table 1**.

### Meta analysis results of each research factor

A total of 36,365 research subjects from 20 studies were included in this analysis, and there were 10,597 cases of mobile phone

addiction overall, with an incidence of 29.14%. We first tested the heterogeneity of each study element included in the literature using  $I^2$  statistics; the findings revealed that  $I^2$  values were  $>50\%$  and  $P$  values were  $<0.05$ . Thus, we chose the random effect model for the meta-analysis. The findings revealed that among Chinese medical students, poor sleep quality, male gender, urban residence, vocational college type, and mobile phone usage time  $\geq 4$  hours were risk factors for mobile phone addiction ( $OR > 1$ ,  $P < 0.05$ ). Good family ties and a positive self-perception were protective factors against mobile phone addiction in Chinese medical students ( $OR < 1$ ,  $P < 0.05$ ), as shown in **Table 2** and **Figures 2-8**.

### Publication bias analysis

The publication bias was statistically assessed using funnel plots. The findings revealed that the funnel plots of the variables in **Table 2** were essentially symmetrical; the  $P$  value of the Begg test was  $>0.05$ ; the Egger test results revealed that the  $P$  values of gender, residence, school type, mobile phone use time, integration of classmates, family structure, family relationship, and sleep quality were all  $>0.05$ . The stated findings suggest that the included literature was free of any publication bias, as shown in **Table 3** and **Figures 9-15**.

### Discussion

Mobile phones are popular because they play a crucial role in modern society, including communication, payment, and online entertainment, thus resulting in an increase in mobile phone usage [28]. In recent years, as a result of the pandemic, mobile phones have become an essential entertainment tool for college students participating in outdoor activities. Simultaneously, due to the increased

## Mobile phone addiction

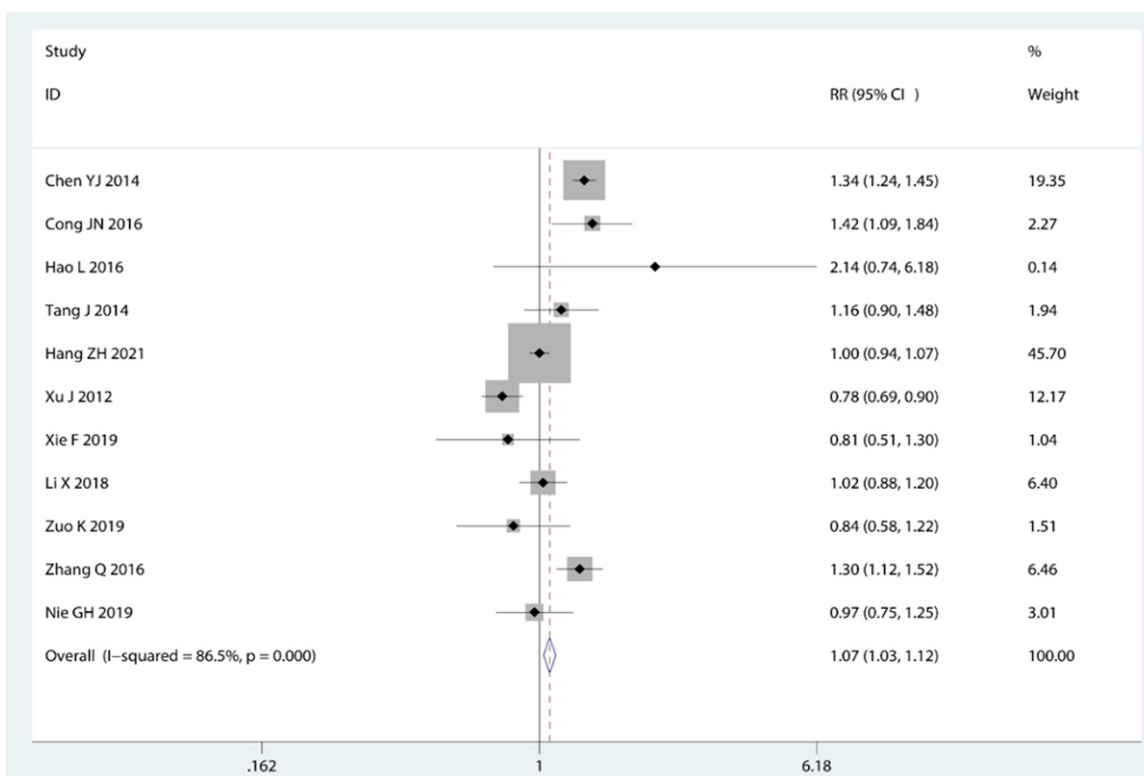
**Table 1.** Basic characteristics of research literature

| First author, Publication year | Area of study   | Age of subjects | Sample size | Mobile phone addiction cases | Incidence rate of mobile phone addiction | Adjustment factors  |
|--------------------------------|-----------------|-----------------|-------------|------------------------------|--|---|
| Liu H [8], 2022                | southwest China | 19.16±1.21      | 2182        | 866                          | 39.69                                    | Mental health, Occupational identity, Cell phone use before bed, Perceived research stress  |
| Ren LS [9], 2017               | South China     | 20.30±1.58      | 619         | 87                           | 14.05                                    | Origin, Total ULS-8 score of loneliness, daily mobile Internet access time, Monthly mobile phone expenses   |
| Xu J [10], 2012                | East China      | 19.24±1.74      | 5122        | 449                          | 8.77                                     | Gender, living expenses, time spent on the mobile Internet, purpose of Internet use   |
| HUANG ZH [11], 2021            | South China     | 19.84±1.36      | 10357       | 6154                         | 59.42                                    | Gender, school type, residence, age, major, type of residence, time spent on mobile phone, family relationship, sleep quality   |
| ZUO K [12], 2019               | Northwest China | 20.14±1.83      | 380         | 78                           | 20.53                                    | Gender, residence, grade, time spent on mobile phone, self-perception of learning, frequency of using mobile phone in class, integration with classmates, social comfort, school type, self-perception in learning, family relationship |
| XIE F [13], 2019               | Northwest China | 22.01±2.03      | 493         | 327                          | 66.33                                    | Residence, Recent exams, depression, self-perception in learning, family relationship, sleep quality  |
| LI X [14], 2018                | East China      | 20.25±1.33      | 1328        | 250                          | 18.83                                    | Gender, major, school type, residence, life satisfaction, interpersonal relationships, self-perception in learning  |
| Tang J [15], 2014              | Central China   | 20.03±1.79      | 755         | 45                           | 1.32                                     | Gender, Emotions, Family Situation, Stressful Life Events   |
| LI F J [16], 2018              | Central China   | 19.83±1.28      | 2687        | 160                          | 5.95                                     | Residence, time spent on mobile phones, self-perception in learning, school type, family relationship, sleep quality  |
| HAO L [17], 2016               | East China      | 20.16±1.73      | 680         | 92                           | 13.53                                    | Gender, Origin, school type, time spent on mobile phone, family relationship, self-perception in learning   |
| CONG JN [18], 2016             | East China      | 20.41±1.39      | 567         | 31                           | 5.46                                     | Gender, residence, school type, family structure, family relationship, mobile phone usage time, integration of classmates, self-perception in learning  |
| ZHOU XY [19], 2015             | Northwest China | 20.53±1.67      | 601         | 117                          | 19.47                                    | School type, integration of classmates, philosophy and pursuit of life, non-mobile recreational activities, anxiety, sleep quality  |
| CHEN YJ [20], 2014             | North China     | 19.06±1.28      | 5485        | 704                          | 12.84                                    | Gender, residence, family relationship, family structure, loneliness, professional satisfaction   |
| ZHANG Q [21], 2016             | East China      | 19.87±1.54      | 901         | 175                          | 19.42                                    | Gender, introversion and extroversion, popular culture effect, depression, neuroticism, self-perception in learning   |
| Feng Z [22], 2022              | East China      | 20.46±1.85      | 450         | 36                           | 8.00                                     | Depression, sleep quality, professional satisfaction  |
| LIU H [23], 2011               | Northwest China | 20.47±1.67      | 442         | 131                          | 29.84                                    | Loneliness, online entertainment, school type   |
| HOU J [24], 2021               | South China     | 19.61±1.72      | 545         | 173                          | 31.74                                    | Social anxiety, Negative emotional information, Attentional Bias, Internet use purpose  |
| JIANG XJ [25], 2019            | North China     | 20.38±18.42     | 475         | 264                          | 55.50                                    | Bad mood, sleep quality, generalized anxiety, professional satisfaction, mobile phone use time  |
| NIE GH [26], 2019              | East China      | 20.14±1.92      | 1198        | 195                          | 16.3                                     | Gender, residence, depression, sleep quality, school type, time spent on mobile phone, self-perception of learning, family relationship   |
| Lam LT [27], 2015              | Northeast China | 19.87±1.54      | 1098        | 263                          | 23.95                                    | Internet time, video game time, bad mood, stress  |

## Mobile phone addiction

**Table 2.** Meta-analysis results of each research factor

| Research factor             | Number of studies | Heterogeneity test results |          | Meta-analysis results |
|-----------------------------|-------------------|----------------------------|----------|-----------------------|
|                             |                   | I <sup>2</sup> Value       | PH value | Incidence (95% CI)    |
| Gender                      | 11                | 86.50%                     | <0.001   | 1.070 (1.030-1.120)   |
| Residence                   | 10                | 98.00%                     | <0.001   | 1.118 (1.090-1.146)   |
| School type                 | 10                | 98.90%                     | <0.001   | 1.280 (1.241-1.321)   |
| Phone usage time            | 10                | 96.00%                     | <0.001   | 1.098 (1.068-1.129)   |
| Self-perception in learning | 10                | 97.50%                     | <0.001   | 0.737 (0.710-0.767)   |
| Family relationship         | 10                | 96.60%                     | <0.001   | 0.821 (0.791-0.852)   |
| Sleep quality               | 10                | 95.20%                     | <0.001   | 1.280 (1.228-1.334)   |



**Figure 2.** Gender and mobile phone addiction.

demand for online courses, mobile phones have emerged as a significant learning tool [29]. A study from Hong Kong estimated that 38.5% of adults were addicted to their mobile phones [30]. In 2016, a study recruited 1,441 undergraduates at Wannan Medical College and assessed the phenomena of mobile phone addiction among medical students using the Smartphone Addiction Scale (SAS-SV) revealed that 29.8% of medical students (29.3% of females and 30.3% of males) had smartphone addiction [31]. In a study conducted by Long in

2015, which included 1062 college students who used smartphones, it was discovered that the prevalence of mobile phone addiction among these students was 21.3% [32]. A total of 36,365 subjects were included in this study, and there were 10,597 cases of mobile phone addiction with an incidence of 29.14%. Identifying risk factors and formulating prevention and control measures are particularly critical for preventing mobile phone addiction and ensuring the physical and mental health of medical students.

## Mobile phone addiction

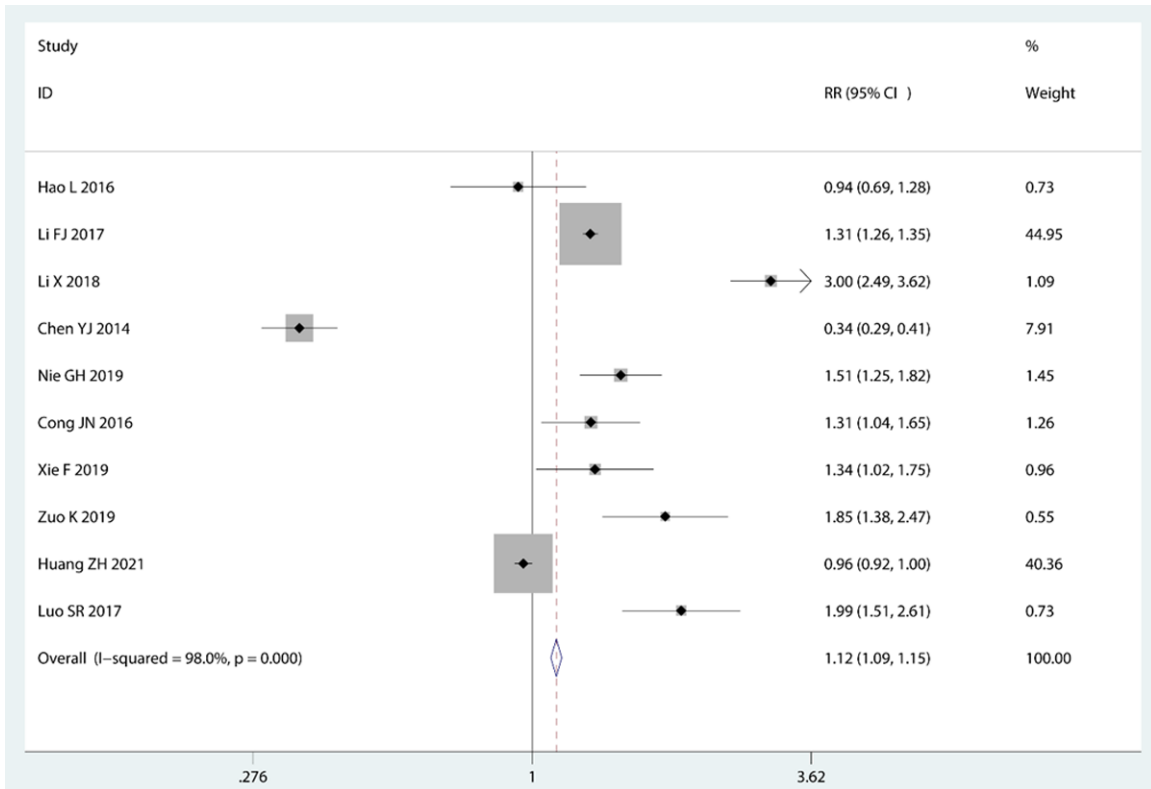


Figure 3. Residence and mobile phone addiction.

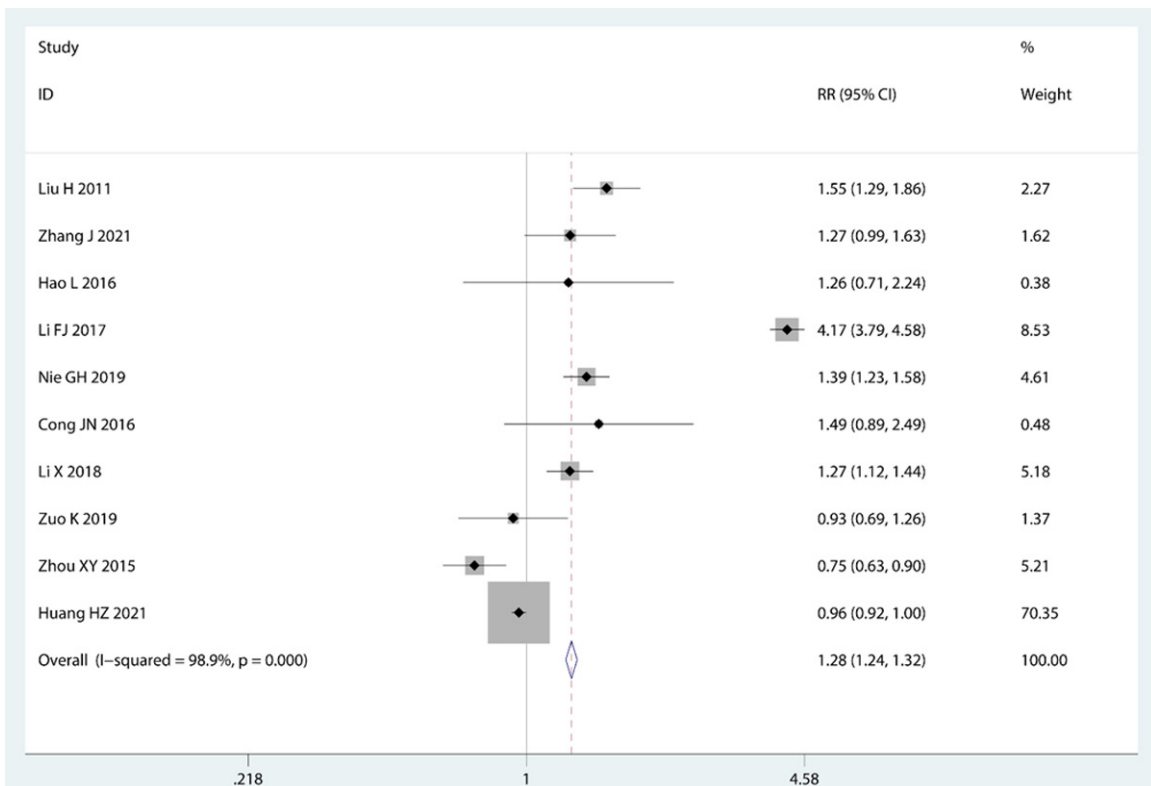


Figure 4. School types and mobile phone addiction.

# Mobile phone addiction

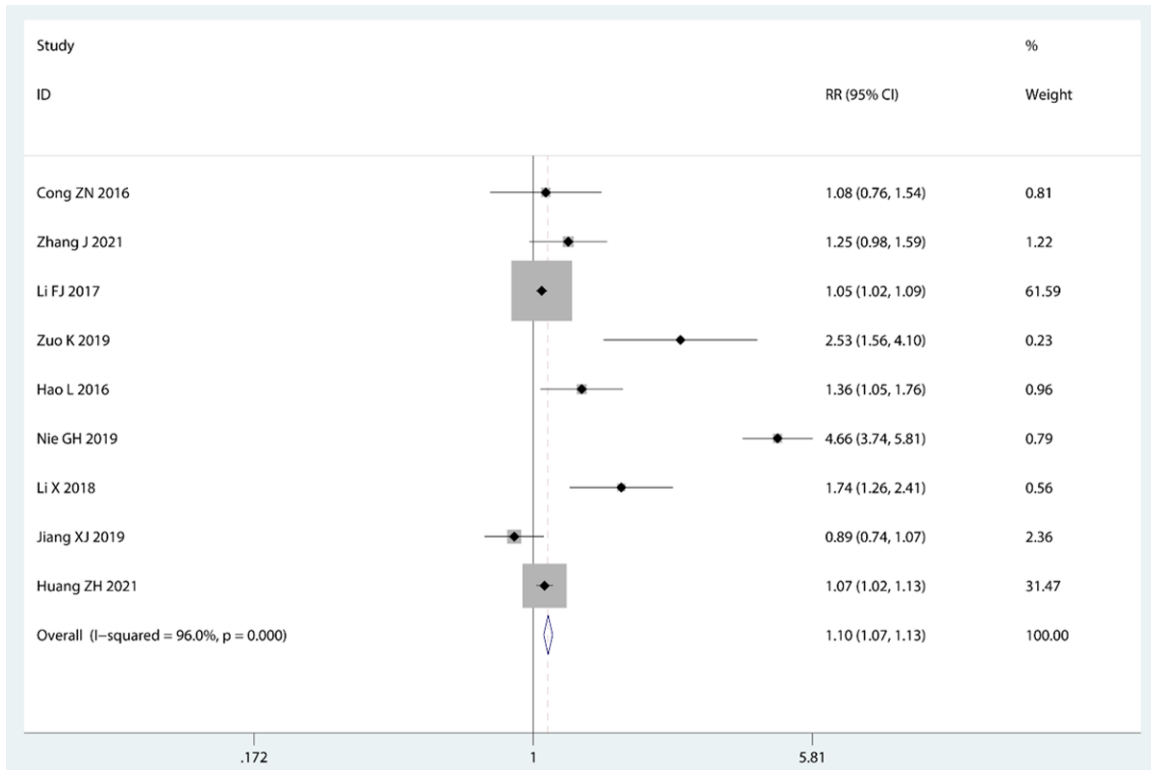


Figure 5. Phone use time and mobile phone addiction.

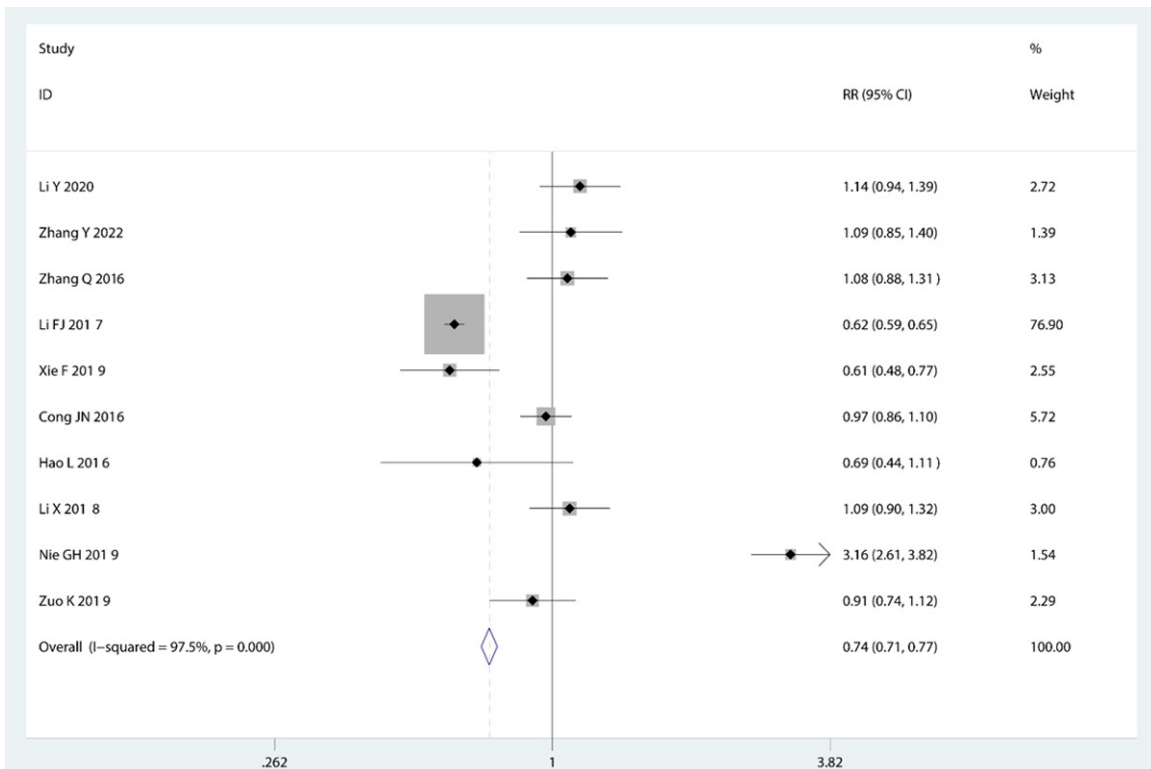
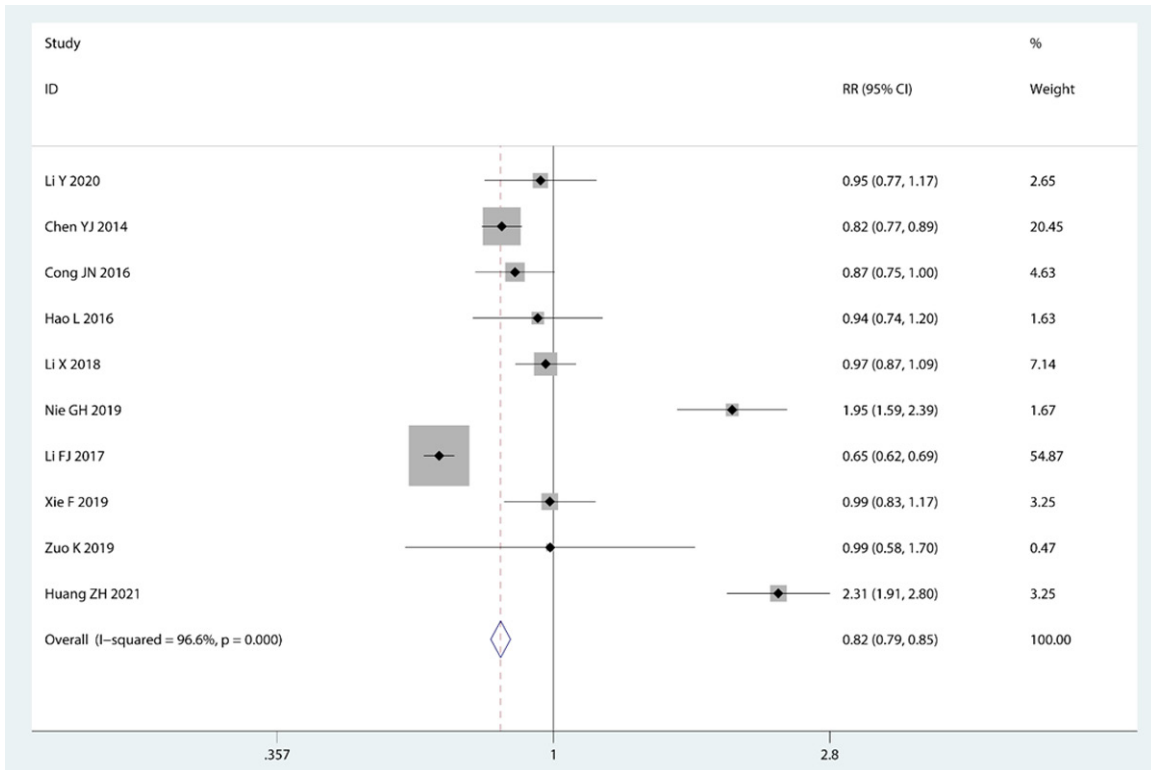
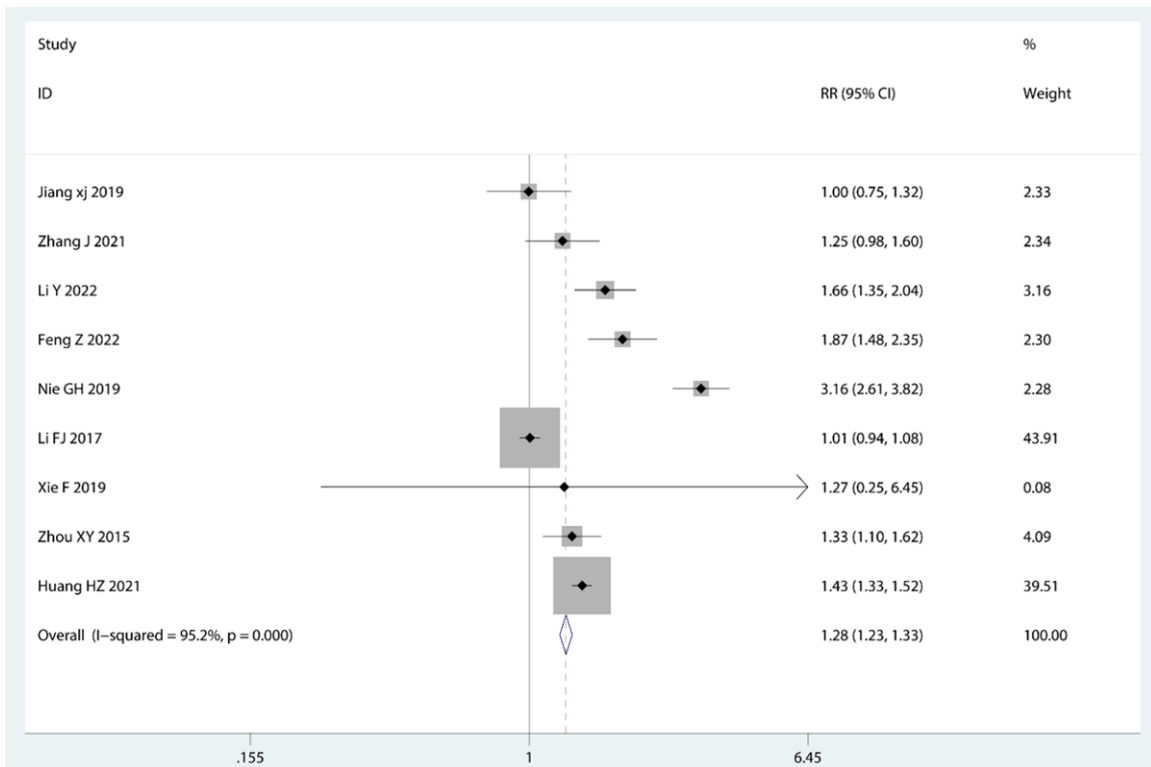


Figure 6. Self-perception in learning and mobile phone addiction.

## Mobile phone addiction



**Figure 7.** Family Relationships and mobile phone addiction.

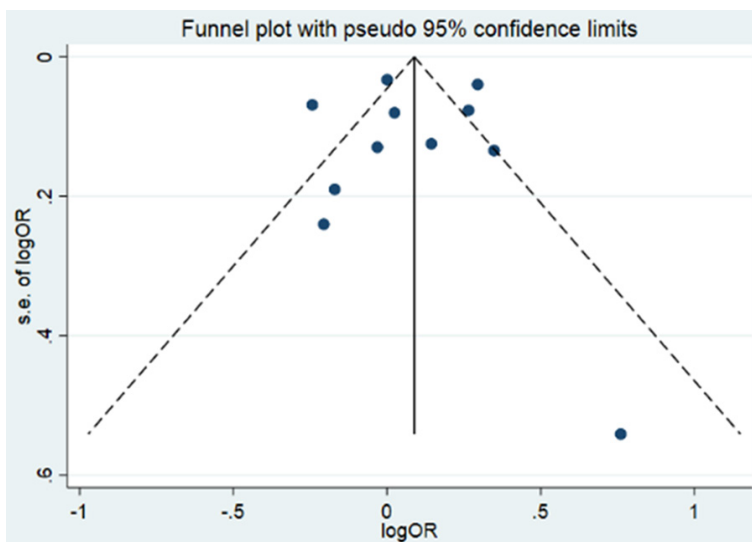


**Figure 8.** Sleep quality and mobile phone addiction.

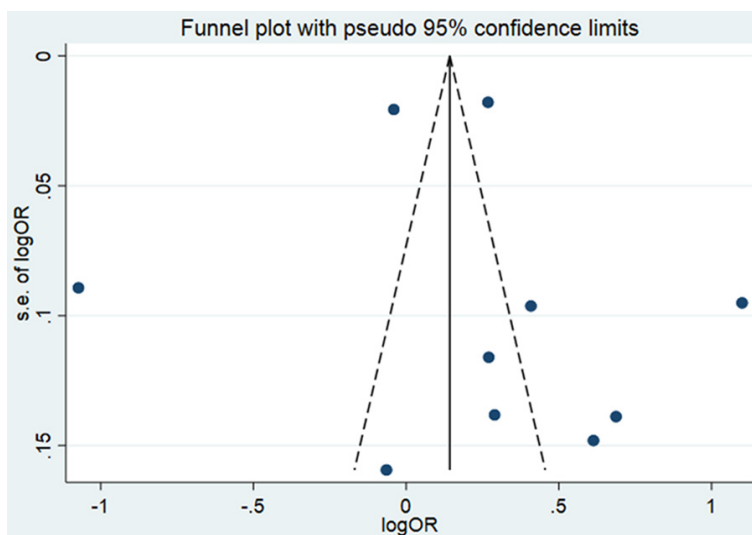


**Table 3.** Publication bias analysis

| Research factor             | Number of studies | Begg rank correlation test | Egger Linear Regression |
|-----------------------------|-------------------|----------------------------|-------------------------|
|                             |                   | $Z_B/P_B$                  | $t_E/P_E$               |
| Gender                      | 11                | 0.00/1.000                 | 0.13/0.900              |
| Residence                   | 10                | 0.72/0.474                 | 0.07/0.948              |
| School Type                 | 10                | 0.18/0.858                 | 0.33/0.749              |
| Phone usage time            | 10                | 1.77/0.076                 | 1.70/0.133              |
| Self-perception in learning | 10                | 1.25/0.210                 | 2.06/0.056              |
| Family relationship         | 10                | 0.72/0.474                 | 1.96/0.064              |
| Sleep quality               | 10                | 0.94/0.348                 | 0.99/0.353              |



**Figure 9.** Publication bias regarding gender.



**Figure 10.** Publication bias regarding residence.

There are many factors related to mobile phone addiction, and it is often difficult to include all factors in a single study. At the same time, there are certain differences between studies, which makes it difficult to apply the results of literature research to clinical practice. The results from a meta-analysis are more in line with the facts since they are the outcome of a quantitative combined analysis of several studies on the same scientific subject. A total of 20 studies on factors related to mobile phone addiction among Chinese medical students with different sample sizes, different regions, and different times were included in this study. The Meta results found that male gender, junior/vocational medical school, urban residence, and the use of mobile phones for  $\geq 4$  hours, and poor sleep quality were risk factors for mobile phone addiction in Chinese medical students. Good self-esteem in learning and harmonious family relationship were protective factors for mobile phone addiction in Chinese medical students, indicating that gender, residence, school type, mobile phone use time, sleep quality, self-perception in learning, and family relationship are closely related to mobile phone addiction in Chinese medical students.

Specific findings are as follows: (1) The incidence of mobile phone addiction in male medical students is higher than that in females, as men are more obsessed with mobile games. Smartphones have online game functions, which can meet the psychological needs

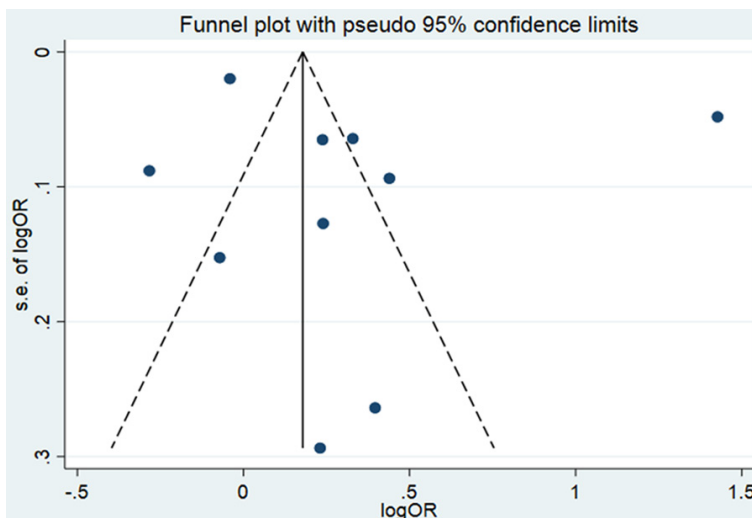


Figure 11. Publication bias regarding school type.

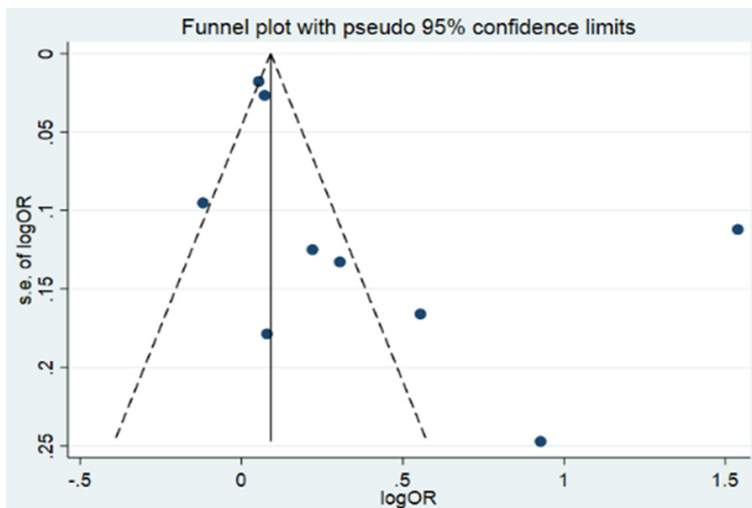


Figure 12. Publication bias regarding phone use time.

of some gamers, thereby increasing the risk of mobile phone addiction. Women, on the other hand, pay more attention to interpersonal relationships. Through social interaction, they can feel warm and positive emotions and thus get support from others. Therefore, the rate of mobile phone addiction is relatively low in females. (2) Medical students from cities and towns have earlier access to smartphones, a higher prevalence of smartphones, and more reliance on mobile phones in daily life, resulting in a higher frequency of use of mobile phones by urban students. At the same time, mobile phones are an important way for college students to engage in social interaction; however,

smartphones give medical students with convenient and novel information to achieve global connection, hence boosting the mobile phone addiction rate of urban medical students. (3) Compared to undergraduate and graduate medical students, junior/vocational medical students have different academic performances, may have worse study habits, and their self-control ability is relatively poor. Affected by the pandemic, online courses are an important learning method for many medical students, but online courses have also further created regulatory loopholes, inability to supervise students' learning in a timely and effective manner, and junior/vocational college students may be less able to effectively control mobile phone use, resulting in mobile phone addiction. (4) Mobile phone use time  $\geq 4$  h. Frequency and duration of mobile phone use are important indicators to evaluate phone addiction. Medical students who use mobile phones for a long time can increase their dependence on phones, indulge in the use of mobile phones, use up a lot of time, and harm their daily learning

and life. (5) Lee et al. used the longitudinal data of the Korean Children and Youth Group Survey of the National Youth Policy Institute (2011-2013) to study a total of 1125 students, and the generalized estimating equation analysis showed that high mobile phone addiction (mobile phone addiction score  $>20$  points) increases the risk of poor sleep quality, which is consistent with the conclusion of this study [33]. Sleep is an important life activity, and good sleep quality can help medical students regain sufficient energy to cope with the study and life of the next day. Medical students with poor sleep quality have difficulty falling asleep at night and may use mobile phones to pass

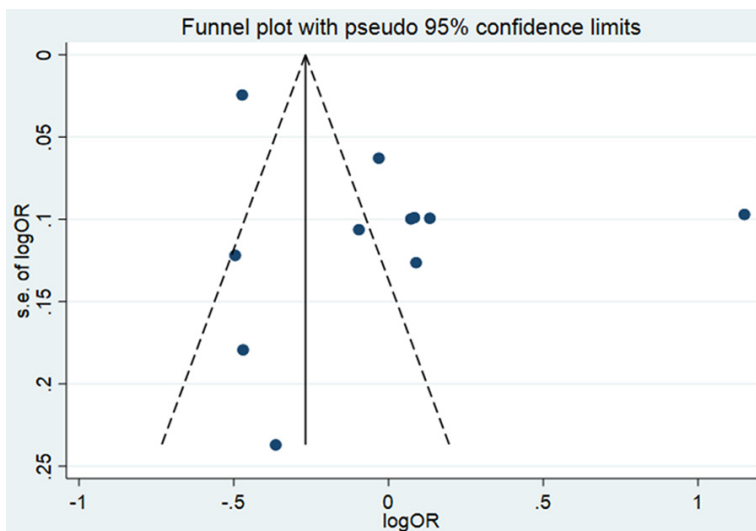


Figure 13. Publication bias regarding self-perception in learning.

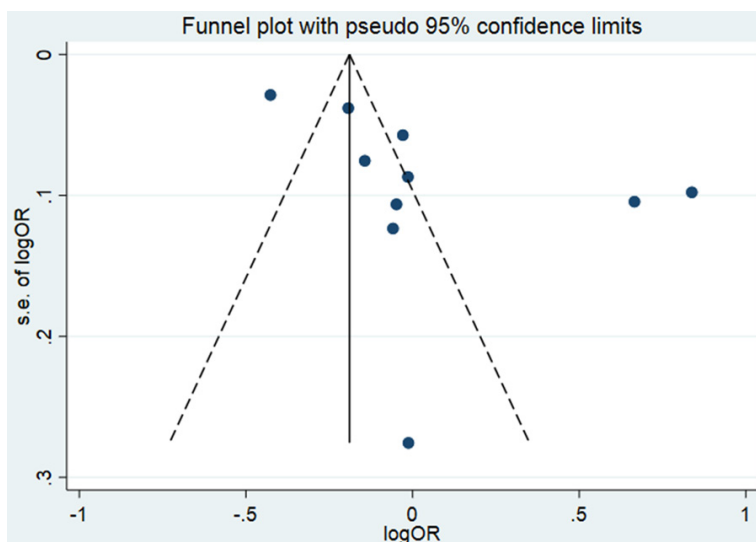


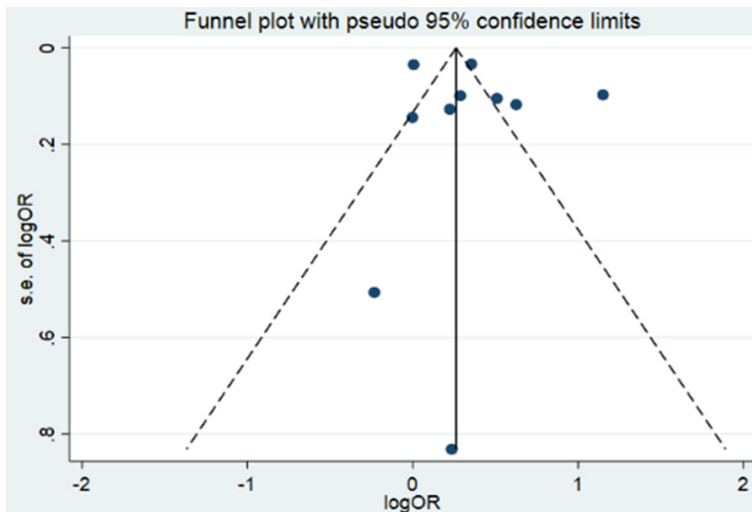
Figure 14. Publication bias regarding family relationship.

the time, thereby increasing the frequency of mobile phone use, prolonging the use of mobile phones, and causing addiction. At the same time, mobile phone addiction may impair medical students' sleep quality by squeezing out their sleep time, which is harmful to both physical and mental health. (6) Poor academic performance among medical students with low self-esteem may be due to their dissatisfaction with their majors and lack of motivation to work hard. Instead, they spend time using smartphones for entertainment, which lowers their grades and creates a vicious cycle of disinter-

est in studying and addiction to mobile phones. (7) The stability or harmony of family relationships has a significant impact on everyone's behavioral addiction. Parental conflict in marriage can directly result in individual psychological issues and unhappiness in family relationships. This can create a stable and negative evaluation system, which can result in adaptive issues like loneliness and low self-esteem. As a result, they turn to virtual friends on their mobile phones for emotional support to meet their psychological needs, which leads to mobile phone addiction. Therefore, mobile phone addiction is a social problem that cannot be ignored. It is closely related to the family, school and society, as well as the psychological, physiological and personality characteristics of medical students. Based on these preceding factors, social departments can implement focused interventions to lower the incidence of mobile phone addiction among Chinese medical students.

This study used funnel plot, Begg rank correlation test and Egger linear regression method to evaluate publication bias. The results found that the results of Begg rank correlation test and Egger test were all  $P > 0.05$ , and the funnel plots were basically symmetrical, which confirmed that the research results were relatively reliable. However, this study still has some limitations, such as: ① Some information cannot be obtained from the literature, such as the occurrence of mobile phone addiction among students at different schools and ages; ② All the included studies were cross-sectional studies, and the causal relationship between research factors and mobile phone addiction of Chinese medical students could not be determined.

## Mobile phone addiction



**Figure 15.** Publication bias regarding sleep quality.

To sum up, research shows that male gender, urban residence, vocational college study, mobile phone usage duration, and poor sleep quality were risk factors. At the same time, family harmony and positive self-esteem in education were protective factors against mobile phone addiction among Chinese medical students.

### Acknowledgements

I would like to thank all the classmates and colleagues who have helped me, as well as the 2nd Affiliated Hospital of Harbin Medical University, the Affiliated Hospital of Qingdao University, and Qingdao Bioman Biomedical Technology Co., LTD for their help. This is a short text to acknowledge the contributions of specific colleagues, institutions, or agencies that aided the efforts of the authors. The research was funded by the 2022 basic scientific research, business cost research project of Heilongjiang provincial colleges and universities research on the countermeasures of synergistic education of ideological and political courses and “The ideological and political curriculum” in medical colleges and universities to improve the professional ethics of medical students.

### Disclosure of conflict of interest

None.

**Address correspondence to:** Hua Chen, Department of Research and Development, Qingdao Bioman Biomedical Technology Co., LTD, Qingdao

266031, Shandong, China. Tel: +86-15020033646; E-mail: hua-chen9ivy@163.com; Faisal UL Rehman, The Affiliated Hospital of Qingdao University, Precision Medicine Center of Oncology, Qingdao University, Qingdao 266003, Shandong, China. Tel: +86-15318771397; E-mail: faisalr@163.com

### References

- [1] Ma H, He JQ, Zou JM and Zhong Y. Mobile phone addiction and its association with burnout in Chinese novice nurses: a cross-sectional survey. *Nurs Open* 2021; 8: 688-694.
- [2] Lian SL, Sun XJ, Niu GF, Yang XJ, Zhou ZK and Yang C. Mobile phone addiction and psychological distress among Chinese adolescents: The mediating role of rumination and moderating role of the capacity to be alone. *J Affect Disord* 2021; 279: 701-710.
- [3] Operation monitoring and coordination bureau of the ministry of industry and information technology (2022). “The economic operation of the communication industry from January to August 2022.” Retrieved 09-22, from [https://www.miit.gov.cn/jgsj/yxj/xxfb/art/2022/art\\_eaa15205ae3642c0b9415f2d26623b5b.html](https://www.miit.gov.cn/jgsj/yxj/xxfb/art/2022/art_eaa15205ae3642c0b9415f2d26623b5b.html).
- [4] Ivanova A, Gorbaniuk O, Blachnio A, Przepiorka A, Mraka N, Polishchuk V and Gorbaniuk J. Mobile phone addiction, phubbing, and depression among men and women: a moderated mediation analysis. *Psychiatr Q* 2020; 91: 655-668.
- [5] Dou K, Wang LX, Li JB, Wang GD, Li YY and Huang YT. Mobile phone addiction and risk-taking behavior among Chinese adolescents: a moderated mediation model. *Int J Environ Res Public Health* 2020; 17: 5472.
- [6] Ibrahim NK, Baharoon BS, Banjar WF, Jar AA, Ashor RM, Aman AA and Al-Ahmadi JR. Mobile phone addiction and its relationship to sleep quality and academic achievement of medical students at King Abdulaziz University, Jeddah, Saudi Arabia. *J Res Health Sci* 2018; 18: e00420.
- [7] Zeng X, Liu H, Chen X and Leng W. Meta analysis series IV: quality assessment tool for observational research. *Chinese Journal of Evidence-Based Cardiovascular Medicine* 2012; 4: 297-299.
- [8] Liu H, Zhou Z, Zhu E, Huang L and Zhang M. Smartphone addiction and its associated fac-

## Mobile phone addiction

- tors among freshmen medical students in China: a cross-sectional study. *BMC Psychiatry* 2022; 22: 308.
- [9] Luo SR, Li YN, Zhou SQ, Li ZM and Huang XM. Mobile phone addiction and its influencing factors in students from a university of Nanning City. *Guangxi Medical Journal* 2017; 39: 1050-1052, 1067.
- [10] Xu J, Shen LX, Yan CH, Hu H, Yang F, Wang L, Kotha SR, Zhang LN, Liao XP and Zhang J. Personal characteristics related to the risk of adolescent internet addiction: a survey in Shanghai, China. *BMC Public Health* 2012; 12: 1106.
- [11] Huang ZH, Tan JY, Xu HF, Huang BY, Chen QS, Li ZX, Zhuang WM, Zhang YB and Gao YH. Association of smartphone addiction with daily behaviors and mental health during the COVID-19 pandemic among medical college students. *Chinese Journal of School Health* 2021; 42: 713-718.
- [12] Zuo K, Zhang GW, Li Y, Huang XD, Zhou LJ, Zhao ZY and Men K. Investigation on current status of mobile phone addiction and influencing factors among students in a medical college. *Chinese Journal of School Doctor* 2019; 33: 721-723, 756.
- [13] Xie F and Song LP. Influence of emotional and cognitive appraisal orientation on smartphone addiction among medical students. *Journal of Nursing Science* 2019; 34: 62-64.
- [14] Li X, Fan YG, Zhang AR and Ye DQ. Mobile phone addiction and its influencing factors among college students in Anhui. *Chinese Journal of School Doctor* 2018; 39: 1236-1238.
- [15] Tang J, Yu Y, Du Y, Ma Y, Zhang D and Wang J. Prevalence of internet addiction and its association with stressful life events and psychological symptoms among adolescent internet users. *Addict Behav* 2014; 39: 744-747.
- [16] Li FJ, Sun J, He J, Yang BS and Wang X. Prevalence and influencing factors of risk behaviors related to addictive substance abuse among adolescents in Henan province. *Chinese Journal of Public Health* 2018; 4: 497-500.
- [17] Hao L, Gu CH and Xu Y. Internet addiction of higher vocational nursing students and analysis of influencing factors. *Health Related Vocational Education* 2016; 34: 125-127.
- [18] Cong JN, Huang XM and Zhao YJ. Analysis of internet addiction disorder and predictors among medical college students. *Primary Health Care in China* 2016; 30: 72-73.
- [19] Zhou XY, Chang JB, Guo XL, Han JM and Guo LP. Current situation of internet addiction disorder and mental health among students in Yan'an city. *Occupation and Health* 2015; 31: 3317-3320.
- [20] Chen YJ, Li L, Hu YH and Jia FC. Analysis of current situation and influencing factors of Internet addiction in college students of Shijiazhuang city. *Chinese Journal of School Health* 2014; 35: 1349-1352.
- [21] Zhang Q, Gong J, Li Y, Zhang XY and Shi BJ. Investigation on influencing factors of college students' smartphone addiction. *Chinese Journal of School Health* 2016; 37: 142-144.
- [22] Feng Z, Diao Y, Ma H, Liu M, Long M, Zhao S, Wu H and Wang Y. Mobile phone addiction and depression among Chinese medical students: the mediating role of sleep quality and the moderating role of peer relationships. *BMC Psychiatry* 2022; 22: 567.
- [23] Liu H and Wang HL. The relationship between college students' mobile phone addiction and loneliness, mobile phone use motivation. *Psychol Sci* 2011; 34: 1453-1457.
- [24] Hou J, Zhu YG and Fang XY. Mobile phone addiction and depression: Multiple mediating effects of social anxiety and attentional bias to negative emotional information. *Acta Psychologica Sinica* 2021; 53: 362.
- [25] Jiang XJ, He BY and Wang JM. Association between smartphone addiction and sleep quality and mediating role of generalized anxiety among students in a medical college of Nanjing City. *Occupation and Health* 2019; 35: 1851-1853.
- [26] Nie GH and Yang X. The relationship between mobile phone addiction, sleep quality and depression among medical college students in Guangxi. *Modern Preventive Medicine* 2019; 46: 2591-2593.
- [27] Lam LT and Wong EM. Stress moderates the relationship between problematic Internet use by parents and problematic Internet use by adolescents. *J Adolesc Health* 2015; 56: 300-306.
- [28] El-Sayed Desouky D and Abu-Zaid H. Mobile phone use pattern and addiction in relation to depression and anxiety. *East Mediterr Health J* 2020; 26: 692-699.
- [29] Yang X, Wang P and Hu P. Trait procrastination and Mobile phone addiction among Chinese college students: a moderated mediation model of stress and gender. *Front Psychol* 2020; 11: 614660.
- [30] Luk TT, Wang MP, Shen C, Wan A, Chau PH, Oliffe J, Viswanath K, Chan SS and Lam TH. Short version of the smartphone addiction scale in Chinese adults: psychometric properties, sociodemographic, and health behavioral correlates. *J Behav Addict* 2018; 7: 1157-1165.
- [31] Chen B, Liu F, Ding S, Ying X, Wang L and Wen Y. Gender differences in factors associated

## Mobile phone addiction

- with smartphone addiction: a cross-sectional study among medical college students. *BMC Psychiatry* 2017; 17: 341.
- [32] Long J, Liu TQ, Liao YH, Qi C, He HY, Chen SB and Billieux J. Prevalence and correlates of problematic smartphone use in a large random sample of Chinese undergraduates. *BMC Psychiatry* 2016; 16: 408.
- [33] Lee JE, Jang SI, Ju YJ, Kim W, Lee HJ and Park EC. Relationship between Mobile phone addiction and the incidence of poor and short sleep among Korean adolescents: a longitudinal study of the Korean Children & Youth Panel Survey. *J Korean Med Sci* 2017; 32: 1166-1172.