Prevalence of Internet addiction disorder in Chinese university students: A comprehensive meta-analysis of observational studies

LU LI¹, DAN-DAN XU², JING-XIN CHAI², DI WANG³, LIN LI¹, LING ZHANG⁴, LI LU², CHEE H. NG⁵, GABOR S. UNGVARI⁶, SONG-LI MEI⁴ and YU-TAO XIANG⁷

¹Department of Pharmacy, The Affiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huaiyi Hospital), Guangzhou, China
²Unit of Psychiatry, Faculty of Health Sciences, University of Macau, Macao SAR, China
³Faculty of Sciences, Harbin University, Harbin, China
⁴Department of Health Education, Beijing Centers for Disease Prevention and Control, Beijing, China
⁵Beijing Centers for Disease Prevention and Medical Research, Beijing, China
⁶The National Clinical Research Center for Mental Disorders and Beijing Key Laboratory of Mental Disorders, Beijing Anding Hospital, Capital Medical University, Beijing, China
⁷Department of Pharmacy, The First Affiliated Hospital of Zhejiang University, Hangzhou, China
⁸Department of Psychiatry, University of Melbourne, Melbourne, VIC, Australia
⁹Department of Psychiatry, University of Notre Dame Australia/Graylands Hospital, Perth, WA, Australia
¹⁰School of Public Health, Jilin University, Changchun, China

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Background and aims: Internet addiction disorder (IAD) is common in university students. A number of studies have examined the prevalence of IAD in Chinese university students, but the results have been inconsistent. This is a meta-analysis of the prevalence of IAD and its associated factors in Chinese university students. Methods: Both English (PubMed, PsycINFO, and Embase) and Chinese (Wan Fang Database and Chinese National Knowledge Infrastructure) databases were systematically and independently searched from their inception until January 16, 2017. Results: Altogether 70 studies covering 122,454 university students were included in the meta-analysis. Using the random-effects model, the pooled overall prevalence of IAD was 11.3% (95% CI: 10.1%–12.5%). When using the 8-item Young Diagnostic Questionnaire, the 10-item modified Young Diagnostic Questionnaire, the 20-item Internet Addiction Test, and the 26-item Chen Internet Addiction Scale, the pooled prevalence of IAD was 8.4% (95% CI: 6.7%–10.4%), 9.3% (95% CI: 7.6%–11.4%), 11.2% (95% CI: 8.8%–14.3%), and 14.0% (95% CI: 10.6%–18.4%), respectively. Subgroup analyses revealed that the pooled prevalence of IAD was significantly associated with the measurement instrument ($Q = 9.41, p = .024$). Male gender, higher grade, and urban abode were also significantly associated with IAD. The prevalence of IAD was also higher in eastern and central China than in its northern and western regions (10.7% vs. 8.1%, $Q = 4.90, p = .027$). Conclusions: IAD is common among Chinese university students. Appropriate strategies for the prevention and treatment of IAD in this population need greater attention.

Keywords: Internet addiction disorder, meta-analysis, university students, China

INTRODUCTION

Over the past decade, the number of Internet users has rapidly increased worldwide (Miniwatts Marketing Group, 2011). Young (1996) first called attention to the possibility that Internet users could become addicted to the Internet, and devised the first diagnostic criteria for Internet addiction disorder (IAD). The psychopathological foundation of IAD has been controversial. Young (1998a) proposed that IAD is essentially an impulse control disorder, similar to eating disorders, pathological gambling, and generic technological gaming, and other addictions. Others argued that IAD is a behavioral addiction (Beard, 2005).

It was proposed that IAD should be included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) as an official diagnosis (Block, 2008). However, IAD is not listed in the DSM-V as a separate diagnostic entity (American Psychiatric Association, 2013). In the past decades, different criteria for IAD have been proposed and a number of terms, such as “pathological Internet use,” “excessive Internet use,” “Internet addiction,” “problematic Internet use,” “psychopathological Internet use,” “Internet dependence,” and “compulsive computer use,” have been used. A few measurement tools for IAD, such as the

* Corresponding author: Dr. Yu-Tao Xiang, MD, PhD; Unit of Psychiatry, Faculty of Health Sciences, University of Macau, 3/F, Building E12, Avenida da Universidade, Taipa, Macau SAR, China; Phone: +853 8822 4223; Fax: +853 2288 2314; E-mail: xyutly@gmail.com

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Chen Internet Addiction Scale (CIAS; Chen, Weng, Su, Wu, & Yang, 2003), Young’s Diagnostic Questionnaire (YQD; Young, 1998b), and Internet Addiction Test (IAT; Young, 1998a), have been applied in clinical practice and research.

The negative effects of IAD on physical and mental health have been a public health concern. IAD could lead to poor concentration and academic performance, headache, musculoskeletal pain, and fatigue (Dol, 2016), as well as psychiatric comorbidities, such as mood and anxiety disorders (Spada, 2014), dysfunctional personality (Jiang & Leung, 2011), attention-deficit hyperactivity disorder (Yoo et al., 2004), impulsivity (De Berardis et al., 2009), and high levels of aggressiveness (Ko, Yen, Liu, Huang, & Yen, 2009). Examining the epidemiological patterns of IAD and its associations with demographic and clinical variables may help develop preventive and treatment strategies, and allocate appropriate health services to address the fast emerging problem of IAD.

A meta-analysis covering studies from 31 countries found that the pooled prevalence of IAD was 6.0% in the general population with the highest prevalence in the Middle East (10.9%) and the lowest in Northern and Western Europe (2.6%) in the general population (Cheng & Li, 2014). However, another study conducted in six Asian countries indicated that the prevalence of IAD among adolescents was higher in Asia than in Europe (Mak et al., 2014). The divergent prevalence rates could be explained by differences in assessment tools and cut-offs used in the surveys and the sociocultural and economic background of the participants.

Apart from geographical location, there is growing evidence that sociocultural factors, such as gender, age, and socioeconomic status, may greatly influence the development of IAD (Kuss, Griffiths, Karila, & Billieux, 2014). Male students were more prone to IAD in some (Ching et al., 2017; Çuhadar, 2012; Demetrovics, Szeredi, & Rozsa, 2008; Huang et al., 2009; Kheirkhah, Ghabeli, & Gouran, 2010), but not all (Fernandez et al., 2015; Ni, Yan, Chen, & Liu, 2009) studies. The association between age and IAD remains controversial. Higher prevalence of IAD was found those older than 21 years in one study (Fernandez et al., 2015), but younger age was associated with the higher prevalence of IAD in other European studies (Bakken et al., 2009; Morrison & Gere, 2010). On the contrary, no association was found between age and IAD in Chinese university students (Huang et al., 2009). Furthermore, the prevalence of IAD is higher in the general population in countries with heavier traffic, pollution, and overall dissatisfaction with life (Cheng & Li, 2014). Adolescents from families with high socioeconomic status use the Internet more frequently than their poorer counterparts (Xu, Li, & Ma., 2014). People in urban areas are more likely to have IAD than those in rural areas (Li, Yang, & Jiang, 2015). Apart from the above sociocultural factors, the impact of measurement instruments on the prevalence of IAD should also be considered. To date, more than 20 assessment instruments on IAD have been developed, which partly contributes to the inconsistency in the prevalence of IAD (Kuss et al., 2014). Due to the impact of sociocultural and economic factors on IAD, it is necessary to examine IAD in different populations.

Compared to adults, university students have less self-regulatory ability (Ahmet, Serhat, Nihan, Recep, & Ümit, 2015) and are more likely to use Internet excessively (Bakken et al., 2009; Kuss et al., 2014), which increases the risk of IAD in this population. University students have been called “digital natives,” since they use Internet frequently. For example, the prevalence of IAD in a cohort of medical students was 30.1% (Zhang, Lim, Lee, & Ho, 2017), which is approximately five times higher than figures reported from the general population (Cheng & Li, 2014). In 2015, the number of university students in China accounted for about 20% of the total students’ population worldwide (Zhao, 2016). According to the Chinese Internet Network Information Center, there were around 688 million Internet users in China, of which one fourth were students (China Internet Network Information Center, 2016).

IAD among the university students seems to be a big challenge and public health issue in China. The prevalence of IAD in university students in China ranges from 1.9% to 49.4% (Ding et al., 2016; Lin, 2007; Ni et al., 2009; Shen, Zhang, & Wang, 2013). The wide variation of these figures could be partly due to sociocultural factors, the varying level of economic development as well as the sampling methods and measures of IAD. For example, in the economically more advanced central and eastern areas of China, young people gain access easier to computer and Internet services at an early age. Mak et al. (2014) found that 51.1% adolescents in Hong Kong have their own computer, whereas the corresponding figure in mainland China was only 14.7%. The different socioeconomic development of these Chinese societies explains this gap between mainland China and Hong Kong and Macao, former colonies of the United Kingdom, and Portugal until 1997 and 1999, respectively.

The common limitations of the literature on the prevalence of IAD in student populations in China are small sample size, few study sites (i.e., 1–2 universities), and non-random sampling. Most studies on the prevalence of IAD in university students published in Chinese are generally not accessible to the international readership and have not been included in prior reviews. To date, no study has investigated IAD in Chinese university students nationwide in a nationwide sample, which gave the impetus to conduct a meta-analysis without language restrictions to examine the pooled prevalence of IAD in this population and its associated demographic and clinical factors.

METHODS

Search strategies

Both English (PubMed, EMBASE, and PsycINFO) and Chinese (Wan Fang and Chinese National Knowledge Infrastructure) databases were systematically and independently searched from their inception to January 16, 2017 by two reviewers (D-DX and J-XC). The following search terms were used: (“China” or “Chinese” or “Hong Kong” or “Macau” or “Taiwan”) and (“Internet addiction” or “problematic Internet use” or “pathological Internet use” or “Internet dependent” or “compulsive Internet use” or “excessive Internet use” or “Internet overuse” or “heavy Internet use”)

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and ("prevalence" or "survey" or "cross-sectional study" or "rate") and ("university students" or "college students" or "undergraduate students" or "adolescents" or "young adults"). Reference lists of the selected papers were manually searched to avoid missing relevant records.

**Study selection**

Original studies that met the following criteria were included in the meta-analysis: (a) cross-sectional epidemiological studies conducted in undergraduate students in mainland China, Hong Kong, Macau, or Taiwan; (b) report on the prevalence of IAD; (3) using the definition of IAD based on the YDQ-8, YDQ-10, IAT-20, or CIAS-26. Exclusion criteria were (a) case studies; (b) surveys based on convenience sampling or surveys with no sampling information; and (c) surveys with no information on response rate. Two reviewers (D-DX and J-XC) independently checked the titles, abstracts, and full-texts of the initial search results independently, and they discussed and resolved any discrepancies involving a third reviewer (LuL). The interrater agreement between the two reviewers on the included studies was satisfactory, with a $\kappa$ value of 0.843.

**Quality evaluation**

The two reviewers (D-DX and J-XC) independently assessed the methodological quality of the studies using an assessment tool reported previously (Loney, Chambers, Bennett, Roberts, & Stratford, 1998; Michael, 1998). The quality assessment tool consists of eight items covering sampling, measurement, and analysis (Supplementary Table 1). The score ranges between 0 and 8 with a score of 7–8 as high quality, 4–6 as moderate quality, and 0–3 as low quality (Yang, Zhang, Zhu, Zhu, & Guo, 2016). The reviewers resolved any disagreements during a discussion with a third reviewer (LuL).

**Data extraction**

Data were independently extracted by two reviewers (D-DX and J-XC) and were checked by a third reviewer (LuL). The following information was extracted and tabulated: place of survey, geographic region, the year of publication, age, sample size, proportion of males, sampling methods, assessment instruments and their cut-off, academic major (medical, science and engineering, and liberal arts) and grade, response rate, and the prevalence of IAD.

**Statistical analyses**

The streak software, version 12.0 (Stata Corporation, College Station, TX, USA) and the Comprehensive Meta-Analysis software (CMA), version 2 (Biostat Inc., Englewood, NJ, USA) were used to perform the meta-analysis. The $I^2$ statistic was used to evaluate heterogeneity of the studies, with $I^2$ values greater than 50% indicating heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003). The results of the included studies were combined using random-effects model and the prevalence with 95% confidence intervals (CIs) was calculated. In order to examine the impact of moderating factors (gender, academic major and grade, geographic region, and assessment tools) on the results, subgroup analyses were conducted using studies with available data. For example, if a study had provided the prevalence of IAD in both genders, the prevalence estimates were entered into the CMA separately for males and females. In this case, the CMA automatically generated the pooled prevalence in the whole sample and also by gender in the subgroup analyses according to the user options. According to the different levels of economic development, the geographic locations were classified into central, western, eastern, and northeast regions of China (National Bureau of Statistics of China, 2011). In addition, meta-regression analyses were conducted to examine the moderating effects of the year of publication, the proportion of males, the sample sizes, and response rate. Only studies reporting data on the aforementioned moderating factors were included in subgroup or meta-regression analyses. Publication bias was measured with both the Egger’s and Begg’s tests and a visual funnel plot for asymmetry was also presented (Figure 1). Sensitivity analysis was conducted by removing each study individually to evaluate the quality and consistency of the results. All analyses were two-tailed, with $\alpha$ set at .05.

**Ethics**

As this was a meta-analysis, approval by ethics committees were not required according to the local regulations in China.

**RESULTS**

**Search results, studies characteristics, and quality assessment**

Figure 2 shows the flow chart of literature search. In total, 4,876 records were collected in the initial search. After removing the duplicates, 2,871 papers were screened by title and abstract. Following a full-text review of the remaining 607 studies, 537 studies were excluded; thus, 70 studies (12 in English and 58 in Chinese) covering 122,454 university students were included in the analyses.
Fifty-seven studies were conducted in mainland China, one in Hong Kong and Macao, four in Taiwan, and eight studies were not reported.

Table 1 shows the basic characteristics of the studies. All studies were rated as “moderate quality” (Yang et al., 2016). The mean score of the quality assessment was 5 with a range from 4 to 6. All studies clearly defined the target population and used validated well-established criteria. Most studies had response rates more than 70% but only a few studies clearly described the characteristics of non-responders. The quality scores of the studies are shown in Table 1.

Prevalence of IAD

Figure 3 shows the forest plot of the prevalence of IAD, which varied from 1.9% to 49.4% in the 70 studies; the overall pooled prevalence was 11.3% (95% CI: 10.1%–12.5%).

Subgroup and meta-regression analyses

Table 2 presents the results of subgroup analyses. There was significant difference in IAD rates between studies using different instruments ($Q = 9.41, p = .024$); the pooled prevalence figures with YDQ-8, YDQ-10, IAT-20, and CIAS-26 were 8.4%, 9.3%, 11.2%, and 14.0%, respectively. There was significant difference in IAD rates between female and male students ($6.6\%$ vs. $13.7\%$; $Q = 64.04, p < .001$), between different grades ($8.4\%$ vs. $11.5\%$ vs. $11.1\%$ vs. $12.9\%$; $Q = 10.47, p = .015$), between higher (eastern and central) and lower (northeast and western) economic development level regions ($10.7\%$ vs. $8.1\%$; $Q = 4.90, p = .027$), and between urban and rural areas ($15.4\%$ vs. $11.4\%$; $Q = 7.09, p = .008$). On the contrary, there was no significant difference between different academic majors ($Q = 3.68, p = .15$) and between mainland China and Hong Kong/Macao/Taiwan ($Q = 0.072, p = .78$).

Meta-regression analyses revealed that sample size ($\beta = −0.00007, p < .001$; including all the 70 studies) was negatively, whereas the proportion of males ($\beta = 1.334, p < .001$; including 63 studies with available data) and higher grade ($\beta = 0.12, p < .001$; including 28 studies with available data) was positively associated with the prevalence of IAD. However, the response rate ($\beta = −0.1077, p = .40$) and the year of publication ($\beta = −0.00048, p = .87$) were not associated.

Publication bias and sensitivity analysis

All the visual funnel plots, the Egger’s ($t = 3.792, p < .001$) and Begg’s tests ($z = −0.3041, p < .001$) revealed
Table 1. Characteristics of the studies included in the meta-analysis

| No. | Author (publication year) | Place of survey | Region | Sampling method | Grade | Age (mean ± SD/range) | Proportion of male (%) | Effective sample | Response rate (%) | Instrument/ cut-off | Prevalence (%) | Quality score |
|-----|---------------------------|-----------------|--------|-----------------|-------|-----------------------|------------------------|-------------------|------------------|-----------------|---------------|--------------|
| 1   | Liu, Bao, and Wen (2010)  | Jiangsu (mainland China) | E, C, M | 1–3 | 20.1 ± 1.1 | 54.1 | 8,595 | 95.60 | IAT-20 ≥ 50 | 4.20 | 6 |
| 2   | Liu, Xiao, and Cao (2009) | Hunan (mainland China) | C, C, M | 1–4 | 19.5 ± 2.1 | 56.3 | 1,306 | 96.74 | IAT-20 ≥ 50 | 13.55 | 5 |
| 3   | Ni et al. (2009) | Shaxi (mainland China) | W, C | 1 | 18.7 ± 1.1 | 68.2 | 3,557 | 92.00 | IAT-20 ≥ 50 | 6.44 | 5 |
| 4   | Tang and Yu (2012) | Hebei (mainland China) | C, S | 1–3 | NR | 33.3 | 1,377 | 94.80 | IAT-20 ≥ 50 | 6.89 | 5 |
| 5   | Feng, Xiong, and Huang (2014) | Guizhou (mainland China) | W, C, S | 1–4 | NR | 45.1 | 1,497 | 100.00 | IAT-20 ≥ 50 | 8.40 | 5 |
| 6   | Yao, Li, and Tao (2011) | Anhui (mainland China) | C, S, R | 1–3 | 19.6 ± 1.4 | 44.9 | 3,320 | 100.00 | IAT-20 ≥ 50 | 9.30 | 5 |
| 7   | Yu and Ji (2010) | Jiangsu (mainland China) | C, S | 1–3 | NR | 61.9 | 1,189 | 99.10 | IAT-20 ≥ 50 | 10.60 | 5 |
| 8   | Xu et al. (2014) | NR | –, C, S | 1–4 | 20.4 ± 1.4 | 49.6 | 1,542 | 98.20 | IAT-20 ≥ 50 | 11.15 | 4 |
| 9   | Bao, Li, and Tao (2014) | Anhui (mainland China) | C, R, S | 1–3 | NR | 48.0 | 2,377 | 97.90 | IAT-20 ≥ 50 | 13.40 | 4 |
| 10  | Song, Xu, and Li (2014) | Anhui (mainland China) | C, C, S | 1–4 | NR | 50.1 | 2,675 | 97.00 | IAT-20 ≥ 50 | 17.53 | 6 |
| 11  | Li and Hu (2014) | Guangdong (mainland China) | E, R | 1–4 | 20.0 ± 1.2 | 41.5 | 1,056 | 94.70 | IAT-20 ≥ 50 | 18.80 | 4 |
| 12  | Ye et al. (2016) | Hubei (mainland China) | C, C, S | 1–4 | 19.7 ± 1.2 | 59.2 | 2,422 | 95.60 | IAT-20 ≥ 50 | 22.30 | 5 |
| 13  | Pan and Zhang (2006) | Guangdong (mainland China) | E, C, R | 3 | 21.5 ± 1.0 | 54.4 | 1,112 | 100.00 | IAT-20 ≥ 50 | 27.70 | 4 |
| 14  | Cao et al. (2011) | Zhejiang (mainland China) | C, M, R | 1–2 | NR | NR | 5,061 | 99.86 | IAT-20 ≥ 50 | 6.9 | 6 |
| 15  | Zeng and Chen (2014) | Sichuan (mainland China) | W, C, R | 17–25 | 49.8 | 434 | 97.50 | IAT-20 ≥ 50 | 5.80 | 4 |
| 16  | Li et al. (2014) | NR | –, C, S | 2–3 | NR | 46.0 | 947 | 98.90 | IAT-20 ≥ 50 | 13.73 | 5 |
| 17  | Li et al. (2015) | NR | –, R, S | 1–3 | 20.0 ± 1.1 | 50.7 | 938 | 98.74 | IAT-20 ≥ 50 | 18.23 | 5 |
| 18  | Liu and Xu (2014) | Fujian (mainland China) | C, E, S, R | 1–4 | NR | 36.7 | 678 | 98.40 | IAT-20 ≥ 50 | 10.18 | 4 |
| 19  | Liu and Hu (2014) | NR | –, C, R | 2–3 | 20.2 ± 1.4 | 48.9 | 730 | 97.33 | IAT-20 ≥ 50 | 5.75 | 4 |
| 20  | Shen and Xie (2011) | Jiangsu (mainland China) | C, E, R | NR | NR | 64.4 | 281 | 93.67 | IAT-20 ≥ 50 | 22.78 | 4 |
| 21  | Wang and Guo (2012) | Liaoning (mainland China) | N, R, S | 1–4 | NR | 48.3 | 720 | 97.75 | IAT-20 ≥ 50 | 18.20 | 4 |
| 22  | Yao and Zhang (2006) | Jiangsu (mainland China) | E, C, R, S | 1–4 | NR | 50.5 | 517 | 97.45 | IAT-20 ≥ 50 | 20.80 | 4 |
| 23  | Cong, Huang, and Zhao (2016) | Shandong (mainland China) | E, C, S, NR | 20.9 ± 0.9 | 30.3 | 567 | 97.76 | IAT-20 ≥ 60 | 5.46 | 5 |
| 24  | Hu and Wang (2011) | NR | –, C, S, R | 1– | NR | 56.6 | 1,517 | 97.20 | IAT-20 ≥ 60 | 3.00 | 4 |
| 25  | Ding et al. (2016) | Hong Kong/Macau | C, R, S | NR | NR | 42.8 | 1,510 | 81.00 | YDQ-8 ≥ 5 | 1.90 | 5 |
| 26  | Wang, You, and Huang (2012) | Hubei (mainland China) | C, C, R, S | 1–4 | NR | 48.6 | 1,986 | 86.30 | YDQ-8 ≥ 5 | 3.80 | 4 |
| 27  | Luo and Guo (2014) | Shandong (mainland China) | E, C, S | 1–5 | 21.2 ± 1.2 | 37.4 | 1,026 | 91.10 | YDQ-8 ≥ 5 | 4.48 | 4 |
| 28  | Feng, Mai, and Li (2006) | Jilin (mainland China) | N, C, S | 1–3 | NR | 34.5 | 1,784 | 89.20 | YDQ-8 ≥ 5 | 7.00 | 4 |
| 29  | Zhang, Tang, and Jian (2015) | Jilin (mainland China) | N, R, NR | 22.7 ± 2.5 | 38.9 | 1,068 | 69.50 | YDQ-8 ≥ 5 | 7.60 | 4 |
| 30  | Feng et al. (2006) | Jilin (mainland China) | N, C, S | 1–4 | 17–24 | 32.8 | 1,227 | 100.00 | YDQ-8 ≥ 5 | 7.80 | 4 |
| 31  | Deng and Fang (2012) | Hubei (mainland China) | C, C, S | 1–4 | 20.2 ± 1.4 | 57.8 | 1,183 | 92.30 | YDQ-8 ≥ 5 | 8.88 | 4 |
| 32  | Huang et al. (2009) | Hubei (mainland China) | C, C, S, R | 1–3 | 20.2 ± 1.3 | 54.3 | 3,496 | 79.50 | YDQ-8 ≥ 5 | 9.58 | 6 |
| 33  | Wu and Zhu (2004) | Hubei (mainland China) | C, C | 1–4 | NR | 1,617 | 94.50 | YDQ-8 ≥ 5 | 10.51 | 4 |
| 34  | Zhang and Shen (2009) | Zhejiang (mainland China) | E, M, R | 1–4 | 22.0 ± 1.0 | 58.9 | 1,014 | 92.20 | YDQ-8 ≥ 5 | 11.70 | 4 |
| No. | Author(s) (Year) | Location (mainland China) | Methodology | T Score | Median | Mean (± SD) | YDQ-10 ≥ 5 | YDQ-10 ≥ 6 |
|-----|------------------|---------------------------|-------------|---------|---------|-------------|-------------|------------|
| 35  | Deng (2013)      | Guangdong                | E           | R       | NR      | 51.6        | 2,161       | 96.80      |
| 36  | Liu, Zhao, and Shi (2015) | Guangdong              | E           | C, S    | NR      | 20.7 ± 1.5  | 1,193       | 91.80      |
| 37  | Xi, Zhang, and Cheng (2014) | NR                    | NR          |         | C, R    | 16.2 ± 3.4  | 43.6        | 4,866      |
| 38  | Tan and Li (2005) | Hunan                   | C           | C, S    | NR      | 48.1        | 1,040       | 86.70      |
| 39  | Li (2010)        | Zhejiang                | C           | C, S    | NR      | 21.8 ± 2.1  | 54.2        | 2,136      |
| 40  | Hou, Zhang, and Yang (2013) | Jilin                  | C           | C       | NR      | 20.9 ± 2.4  | 47.98       | 942        |
| 41  | Huang, Lin, and Xu (2013) | Fujian                 | E           | S, R    | NR      | 22.81       | 285         | 90.76      |
| 42  | Luo and Zhu (2015) | Jiangxi                 | C           | R       | NR      | 21.83       | 545         | 99.10      |
| 43  | Mei, Kou, Yu, and Yang (2007) | Jilin                  | N           | C       | NR      | 42.89       | 816         | 90.67      |
| 44  | Mei, Yang, Kou, and Yu (2009) | Jilin                  | N           | S       | NR      | 20.9 ± 1.4  | 46.41       | 1,310      |
| 45  | Shi and Zhang (2005) | Shanxi                  | C           | C       | NR      | 20.8 ± 2.8  | 56.23       | 546        |
| 46  | Wang, Chen, and Zuo (2011) | Hunan                 | C           | C       | 3       | 39.10       | 757         | 94.63      |
| 47  | Yang, Hou, and Jiang (2007) | Neimenggu             | W           | C, R    | NR      | 40.21       | 776         | 97.00      |
| 48  | Yao and Yang (2014) | Chongqing               | W           | C       | 1–4     | 20.5 ± 1.6  | 43.95       | 810        |
| 49  | Chi, Lin, and Zhang (2016) | Anhui                 | C           | C, S, R | NR      | 19.6 ± 1.1  | 62.1        | 1,172      |
| 50  | Luo, Shen, and Zhang (2009) | Hunan                 | C           | C       | 1–4     | 21.8 ± 2.1  | 54.2        | 2,136      |
| 51  | Wang and Wang (2012) | Hubei                  | C           | R       | 1–4     | 20.3 ± 1.1  | 36.4        | 3,256      |
| 52  | Zhang, Tang, et al. (2015) and Zhang, Mei, et al. (2015) | Jiangsu            | E           | C, S    | 1–3     | 20.3 ± 1.1  | 36.4        | 3,256      |
| 53  | Zhao and Dai (2009) | Guangdong               | E           | C, S, R | NR      | 47.6        | 1,766       | 95.20      |
| 54  | Peng, Zhu, and Feng (2007) | Shanghai              | E           | C, S    | NR      | 52.0        | 1,569       | 99.80      |
| 55  | Zhang and Wang (2011) | Gansu                  | W           | C, S    | 1–4     | 21.2 ± 1.6  | 53.8        | 2,052      |
| 56  | Zhao, Hu, Zhang, and Sun (2012) | Gansu          | W           | C, S    | NR      | 51.2        | 1,807       | 95.10      |
| 57  | Yao, Gao, and Zhou (2006) | Anhui                | C           | C, S    | NR      | 71.0        | 2,010       | 95.70      |
| 58  | Liang, He, and Yang (2008) | Henan                | C           | C, R    | NR      | 36.03       | 827         | 91.89      |
| 59  | Jia (2009)       | Jilin                   | E           | C, S    | NR      | 20.9 ± 1.5  | 37.82       | 735        |
| 60  | Li et al. (2011) | Zhejiang               | C           | C, R    | NR      | 18–24       | 49.75       | 597        |
| 61  | Lin (2007)       | Jiangsu                 | C           | S, R    | NR      | 18–24       | 49.75       | 597        |

(Continued)
To the best of our knowledge, this was the first study to estimate the pooled prevalence of IAD in Chinese university students. The meta-analysis found a pooled prevalence of 11.3% (95% CI: 10.1%–12.5%), which is similar to the figure in India (8.2%; 95% CI: 5.7%–10.5%) (Krishnamurthy & Chetlapalli, 2015), Turkey (9.7%; 95% CI: 8.0%–11.7%) (Canan, Ataoglu, Ozcetin, & Icmeli, 2012), Japan (15.0%; 95% CI: 10.3%–21.3%) (Hirao, 2015), United States (12.0%; 95% CI: 8.4%–16.9%) (Christakis, Moreno, Jelenchick, Myaing, & Zhou, 2011), but higher than those reported from Spain (6.08%; 95% CI: 5.3%–7.0%) (Fernandez et al., 2015), and lower than those found in Lebanon (16.8%; 95% CI: 13.8%–19.8%) (Younes et al., 2016), United Kingdom (18.3%; 95% CI: 14.7%–22.6%) (Niemi, Griffiths, & Banyard, 2005), Iran (34.6%; 95% CI: 23.9%–47.2%) (Bahrainian, Alizadeh, Raeisoon, Gorji, & Khazaee, 2014; Mohammadbeigi et al., 2016), Malaysia (36.9%; 95% CI: 32.4%–41.6%) (Ching et al., 2017), and Jordan (40.0%; 95% CI: 36.1%–44.0%) (Al-Gamal, Alzyayat, & Ahmad, 2016). However, it should be noted that due to the discrepancies in diagnostic criteria and sampling methods, direct comparisons between these results should be made with caution.

The result of the current meta-analysis is significantly higher than the figures in a meta-analysis in the general population pooled from 31 countries (6.0%; 95% CI: 5.1%–6.9%) (Cheng & Li, 2014) and in Chinese adolescents in a nationwide study (8.1%; 95% CI: 7.7%–8.5%) (Cao, Sun, Wan, Hao, & Tao, 2011), but similar to the figure in adolescents and college students in China (10.0%; 95% CI: 8.0%–12.0%) (Bian, Liu, Li, & Liu, 2016). Compared to adolescents, university students have generally more pressing psychological and social obligations and need to maintain regular communication with their peers, resulting in frequent Internet use (Kandel, 1998). Compared with other behavioral addictions, Internet addiction seems to be more common in Chinese university students. For example, the prevalence of Internet gaming disorder and compulsive buying behavior was 7.8% (Gao, Li, & Wan, 2008) and 5.99% (Jiang & Shi, 2016), respectively, in a cohort of Chinese university students.

There was significant difference in IAD rates between the studies using different instruments. The prevalence of IAD was relatively lower in studies using YDQ than those using IAT-20 and CIAS-26. The YDQ-8 comprises eight items (Young, 1998b), whereas YDQ-10 (Chi et al., 2016; Young, 1997) has 10 items with “yes/no” options. Both these instruments were adopted from the DSM-IV criteria for pathological gambling. On the contrary, IAT and CIAS are Likert scales that measure IAD with severity ratings from 1 (“not at all”) to 5 (“always”). Thus, IAT and CIAS may have better discriminating properties to measure IAD than YDQ (Lai et al., 2013), since dimensional measures are usually more accurate and valid than categorical measures.
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Table 2. Subgroup analyses of Internet addiction disorder in Chinese university students

| Subgroups       | Categories (number of studies) | Proportion (%) | 95% CI (%) | Events | Sample size | Standard error within subgroups (%) | Standard error across subgroups (%) | p values | I² (%) | Q (p) value (%) |
|-----------------|--------------------------------|----------------|------------|--------|-------------|-------------------------------------|-------------------------------------|----------|--------|----------------|
| Assessment tool | YDQ-8 (25)                     | 8.4            | 6.7–10.4   | 3,965  | 39,719      | 0.141                               | <.001                               | 97.8     |        | **9.41 (.024)** |
|                 | YDQ-10 (12)                    | 9.3            | 7.6–11.4   | 2,071  | 21,249      | 0.070                               | <.001                               | 95.5     |        |                |
|                 | IAT-20 (23)                    | 11.2           | 8.8–14.3   | 4,244  | 39,354      | 0.163                               | <.001                               | 98.5     |        |                |
|                 | CIAS-26 (10)                   | 14.0           | 10.6–18.4  | 2,302  | 22,132      | 0.156                               | <.001                               | 98.5     |        |                |
| Sex             | Male (53)                      | 13.7           | 12.2–15.4  | 5,240  | 37,434      | 0.061                               | <.001                               | 95.7     |        |                |
|                 | Female (53)                    | 6.6            | 5.7–7.5    | 2,737  | 37,640      | 0.072                               | <.001                               | 93.6     |        | **64.04 (.001)** |
| Major           | Medical (18)                   | 9.2            | 7.7–10.9   | 2,284  | 23,553      | 0.077                               | <.001                               | 94.1     |        | 3.68 (.15)    |
|                 | Science and engineering (11)   | 12.6           | 9.2–16.8   | 796    | 7,342       | 0.175                               | <.001                               | 94.9     |        |                |
| Grade           | Liberal arts (10)              | 8.4            | 5.6–12.3   | 545    | 7,141       | 0.254                               | <.001                               | 95.5     |        |                |
|                 | First (27)                     | 8.4            | 7.0–10.0   | 1,345  | 15,331      | 0.083                               | <.001                               | 90.4     |        | **10.47 (.015)** |
|                 | Second (28)                    | 11.5           | 9.3–14.2   | 2,021  | 16,021      | 0.138                               | <.001                               | 95.8     |        |                |
|                 | Third (28)                     | 11.1           | 9.0–13.7   | 1,750  | 14,601      | 0.141                               | <.001                               | 94.9     |        |                |
|                 | Fourth or fifth (18)           | 12.9           | 10.3–16.0  | 680    | 5,254       | 0.119                               | <.001                               | 88.5     |        |                |
| Mainland China  | Yes (57)                       | 10.0           | 8.7–11.4   | 9,419  | 93,780      | 0.082                               | <.001                               | 97.9     |        | 0.072 (.78)   |
|                 | No (5)                         | 10.4           | 7.6–14.3   | 1,846  | 13,543      | 0.132                               | <.001                               | 97.8     |        |                |
| Geographic locations | Eastern or central (42)  | 10.7           | 9.0–12.6   | 7,473  | 69,429      | 0.102                               | <.001                               | 98.1     |        | **4.90 (.027)** |
|                 | Western or outlying (13)       | 8.1            | 6.8–9.7    | 1,470  | 17,858      | 0.057                               | <.001                               | 92.0     |        |                |
| Rural/urban     | Rural (13)                     | 11.4           | 9.7–13.4   | 1,475  | 12,606      | 0.052                               | <.001                               | 89.8     |        | 7.09 (.008)   |
|                 | Urban (13)                     | 15.4           | 13.2–17.9  | 1,859  | 12,010      | 0.052                               | <.001                               | 91.2     |        |                |

Note. Bold values represent p < 0.05. IAT: Internet Addiction Test; YDQ: Young’s Diagnostic Questionnaire; CIAS: Chen Internet Addiction Scale; CI: confidence interval.

(Kuss et al., 2014). Furthermore, various cut-off values would probably lead to different findings.

The subgroup and meta-regression analyses both showed that IAD was more common in male than in female students, which was consistent with the results of most of other studies (Ching et al., 2017; Huang et al., 2009). Male predominance for IAD could be explained because male students are more likely to play internet games and spend more time online (Canan et al., 2011; Tsai et al., 2009). Similar to previous studies (Cao et al., 2011; Pawlowska et al., 2015), students in urban areas were more likely to have IAD than rural students (15.4% vs. 11.4%). In addition, the prevalence of IAD was significantly associated with geographic regions: the rate of IAD was higher in central and eastern China (10.7%) than in the western and northeast regions (8.1%). Since IAD is significantly associated with socioeconomic levels (Satan, 2013), the existing economic gap between different regions of China and between rural and urban areas may explain the divergent IAD rates. Students in high-income areas in the central and eastern regions and in urban areas have easier access to the Internet through smartphones and computers than those living in poor areas. Furthermore, students in poor economic regions often have part-time jobs to supplement their tuition fees leaving them with less leisure time for Internet use (Lin, Ko, & Wu, 2011).

The prevalence of IAD increased with advancing academic years in this study, which is similar to findings of some (Hu, 2014) but not all studies (Al-Gamal et al., 2016). Unlike in a previous study (Ni et al., 2009), no significant difference in IAD rates was found between different academic majors. Sample size was negatively associated with the prevalence of IAD. Although there was no known external factor that could lead to a systemic distortion in smaller studies, the results of these studies may be relatively unstable. However, this observation warrants confirmation.

The strengths of this meta-analysis include the following: all studies were rated as moderate quality; probability sampling was used in all studies; response rates in all except one study were larger than 70%; and 70 studies covered by this meta-analysis were conducted in different geographic areas of China including Taiwan, Hong Kong, and Macau, which makes the sample representative of Chinese university students. However, there are some limitations. First, most studies did not report non-responders’ demographic data. Second, there remains substantial heterogeneity in the subgroup analysis since heterogeneity is unavoidable in the meta-analysis of epidemiological surveys (Li et al., 2016; Long et al., 2014; Winsper et al., 2013). Third, factors that influence the prevalence of IAD, such as lifestyle, living conditions, university environments, and comorbidities, were not examined due to the paucity of such data. Fourth, the result of the Egger’s and Begg’s tests revealed publication bias. Studies with obvious methodological shortcomings, such as small sample size and non-random sampling, are usually difficult to get published, which may constitute publication bias (Angell, 1989; Light, 1987). Fifth, in the meta-regression analyses, only a single predictor could be entered using the CMA program. Therefore, the potential overlapping effects between moderators could not be controlled for.

In conclusion, IAD is common among Chinese university students, and is associated with male gender, higher academic grade, urban abode, and the economically more
Figure 3. Forest plot of the prevalence of IAD in Chinese university students
advanced eastern and central regions of China. Considering the negative effects of IAD, appropriate strategies for the prevention and treatment of IAD for Chinese university students need greater attention.

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**REFERENCES**

Ahmet, A., Serhat, A., Nihan, A., Reccep, U., & Ümit, S. (2015). Self-control management and Internet addiction. *International Online Journal of Educational Sciences, 7*(3), 95–100. doi:10.15345/ijoes.2015.03.016

Al-Gamal, E., Alzayyat, A., & Ahmad, M. M. (2016). Prevalence of Internet addiction and its association with psychological distress and coping strategies among university students in Jordan. *Perspectives in Psychiatric Care, 52*(1), 49–61. doi:10.1111/ppc.12102

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Association.

Angell, M. (1989). Negative studies. *The New England Journal of Medicine, 321*(7), 464–466. doi:10.1056/NEJM198908137210708

Bahrainian, S. A., Alizadeh, K. H., Raeisoon, M. R., Gorji, O. H., & Khazaee, A. (2014). Relationship of Internet addiction with self-esteem and depression in university students. *Journal of Preventive Medicine and Hygiene, 55*(3), 86–89.

Bakken, I. J., Wenzel, H. G., Gotestam, K. G., Johansson, A., & Oren, A. (2009). Internet addiction among Norwegian adults: A stratified probability sample study. *Scandinavian Journal of Psychology, 50*(2), 121–127. doi:10.1111/j.1467-9450.2008.00685.x

Bao, R. G., Li, Y. Y., & Tao, S. M. (2014). Correlations between Internet screen time and mental health among college students. *Chinese Journal of School Health, 35*(7), 1001–1004. doi:10.16835/j.cnki.1000-9817.2014.07.017

Beard, K. W. (2005). Internet addiction: A review of current assessment techniques and potential assessment questions. *CyberPsychology & Behavior, 8*(1), 7–14. doi:10.1089/cpb.2005.8.7

Bian, H. Y., Liu, Y. Y., Li, N., & Liu, T. W. (2016). Meta analysis for Internet addiction rate among adolescents. *Chinese Journal of School Health, 37*(1), 67–70. doi:10.16835/j.cnki.1000-9817.2016.01.020

Block, J. J. (2008). Issues for DSM-V: Internet addiction. *The American Journal of Psychiatry, 165*(3), 306–307. doi:10.1176/appi.ajp.2007.07101556

Canan, F., Ataoglu, A., Ozcetin, A., & Icmeli, C. (2012). The association between Internet addiction and dissociation among Turkish college students. *Comprehensive Psychiatry, 55*(5), 422–426. doi:10.1016/j.comppsych.2011.08.006

Cao, H., Sun, Y., Wan, Y., Hao, J., & Tao, F. (2011). Problematic Internet use in Chinese adolescents and its relation to psychosomatic symptoms and life satisfaction. *BMC Public Health, 11*(1), 802. doi:10.1186/1471-2458-11-802

Chen, S. H., Weng, L. C. J., Su, Y., Wu, H. M., & Yang, P. F. (2003). Development of Chinese Internet Addiction Scale and its psychometric study. *Chinese Journal of Psychology, 45*, 279–294. doi:10.1037/44491-000

Chen, Y. J., Li, L., & Hu, Y. H. (2014). Analysis of current situation and influencing factors of Internet addiction in college students of Shijiazhuang city. *Chinese Journal of School Health, 35*, 1349–1352. doi:10.16835/j.cnki.1000-9817.2014.09.025

Cheng, C., & Li, A. Y. (2014). Internet addiction prevalence and quality of (real) life: A meta-analysis of 31 nations across seven world regions. *Cyberpsychology, Behavior, and Social Networking, 17*(12), 755–760. doi:10.1089/cyber.2014.0317

Chi, X., Lin, L., & Zhang, P. (2016). Internet addiction among college students in China: Prevalence and psychosocial correlates. *Cyberpsychology, Behavior, and Social Networking, 19*(9), 567–573. doi:10.1089/cyber.2016.0234

China Internet Network Information Center. (2016). *Statistical report on Internet development in China* (p. 51). Beijing, China: CNNIC Steering Committee.

Ching, S. M., Hamidin, A., Vasudevan, R., Sazlyna, M. S., Wan Aliaa, W. S., Foo, Y. L., Yee, A., & Hoo, F. K. (2017). Prevalence and factors associated with Internet addiction among medical students – A cross-sectional study in Malaysia. *Medical Journal of Malaysia, 72*(1), 7–11.

Christakis, D. A., Moreno, M. M., Jelenchick, L., Myaing, M. T., & Zhou, C. (2011). Problematic Internet usage in US college students: A pilot study. *BMC Medicine, 9*(1), 77. doi:10.1186/1741-7015-9-77

Cong, J. N., Huang, X. M., & Zhao, Y. J. (2016). Prevalence of Internet addiction and its related predictors among medical college students. *Chinese Primary Health Care, 30*(8), 72–73. doi:10.3969/j.issn.1001-568X.2016.08.0030

Çuhadar, Cem. (2012). Exploration of problematic Internet use and social interaction anxiety among Turkish pre-service teachers. *Computers & Education, 59*(2), 173–181. doi:10.1016/j.compedu.2011.12.029

De Berardis, D., D’Albenzo, A., Gambi, F., Sepede, G., Valchera, A., Conti, C. M., Fulcheri, M., Cavuto, M., Ortolani, C., Salerno, R. M., Serroni, N., & Ferro, F. M. (2009). Alexithymia and its relationships with dissociative experiences and Internet addiction in a nonclinical sample. *CyberPsychology & Behavior, 12*(1), 67–69. doi:10.1089/cpb.2008.0108

Demetrovics, Z., Szeredi, B., & Rozsa, S. (2008). The three-factor model of Internet addiction: The development of the Problematic Internet Use Questionnaire. *Behavior Research Methods, 40*(2), 563–574. doi:10.3758/BRM.40.2.563
Hirao, K. (2015). Difference in mental state between Internet-addicted and non-addicted Japanese undergraduates. *Journal of Psychological Science, 35*(1), 123–128. doi:10.16719/j.cnki.1671-6981.2012.01.002

Deng, W. (2013). Investigation on Internet addiction of college students in Zhubai. *Journal of Campus Life & Mental Health, 11*(5), 311–312.

Ding, Y. J., Lau, C. H., Sou, K. L., Abraham, A. A., Griffiths, S. M., & Kim, J. H. (2016). Association between Internet addiction and high-risk sexual attitudes in Chinese university students from Hong Kong and Macau. *Public Health, 132*, 60–63. doi:10.1016/j.puhe.2015.11.009

Dol, K. S. (2016). Fatigue and pain related to Internet usage among university students. *Journal of Physical Therapy Science, 28*(4), 1233–1237. doi:10.1589/jpts.28.1233

Deng, W. (2013). Investigation on Internet addiction of college students in Zhuhai. *Journal of Campus Life & Mental Health, 11*(5), 311–312.

Ding, Y. J., Lau, C. H., Sou, K. L., Abraham, A. A., Griffiths, S. M., & Kim, J. H. (2016). Association between Internet addiction and high-risk sexual attitudes in Chinese university students from Hong Kong and Macau. *Public Health, 132*, 60–63. doi:10.1016/j.puhe.2015.11.009

Dol, K. S. (2016). Fatigue and pain related to Internet usage among university students. *Journal of Physical Therapy Science, 28*(4), 1233–1237. doi:10.1589/jpts.28.1233

Feng, C. L., Mei, S. L., & Li, Z. L. (2006). The influence of Internet addiction on the mental health of college students. *Chinese School Health, 27*(11), 951–952.

Feng, C. Y., Xiong, M., & Huang, Y. L. (2007). Prevalence of Internet addiction disorder and anxiety and depression among 1497 university students in Guizhou. *Chinese Journal of School Health, 28*(9), 801–802.

Fernandez, V. T., Alguacil, O. J., Almaraz, G. A., Cancela, C. J. M., Delgado, R. M., Garcia, M. M., Jiménez-Mejías, E., Llorca, J., Molina, A. J., Ortiz Moncada, R., Valero-Juan, L. F., & Martin, V. (2015). Problematic Internet use in university students: Associated factors and differences of gender. *Adicciones, 27*(4), 265–275.

Gao, Y., Li, Z. L., & Wan, B. H. (2008). Investigation on Internet addiction disorder in college students. *Chinese School Health, 29*(11), 1368–1369.

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ, 327*(7414), 557–560. doi:10.1136/bmj.327.7414.557

Hirao, K. (2015). Difference in mental state between Internet-addicted and non-addicted Japanese undergraduates. *International Journal of Adolescent Medicine and Health, 27*(3), 307–310. doi:10.1515/ijamb-2014-0030

Hou, Q. F., Zhang, Z., & Yang, G. (2013). Effects of different addiction states on activities, personalities and self-control ability among undergraduate Internet users. *Journal of Zhejiang University, 40*(1), 106–111. doi:10.3785/j.issn.1008-9497.2013.01.022

Hu, Y. W. (2014). Relationship between Internet addiction and psychological well-being of undergraduates. *Anhui Medical and Pharmaceutical Journal, 18*(4), 697–699. doi:10.3969/j.issn.1009-6469.2014.04.032

Hu, Y. W., & Wang, G. H. (2011). Relationship between Internet addiction and suicidal tendency in undergraduates. *Journal of Chinese Health Management, 5*(6), 384–386. doi:10.3760/cma.j.issn.1674-0815.2011.06.026

Huang, R. L., Lu, Z., Liu, J. J., You, Y. M., Pan, Z. Q., Wei, Z., He, Q., & Wang, Z. Z. (2009). Features and predictors of problematic Internet use in Chinese college students. *Behaviour & Information Technology, 28*(5), 485–490. doi:10.1080/01449290701485801

Huang, L. W., Lin, Z. H., & Xu, L. X. (2013). The influence of Internet addiction of college students on sub-health. *Journal of Mudanjiang University, 34*(1), 73–75.

Jia, L. Z. (2009). Comparative study of self-consistency and congruence achievement motivation and self-esteem between IAD and non-IAD. *Modern Preventive Medicine, 36*(23), 4479–4481.

Jiang, D., Zhu, S., Ye, M., & Lin, C. (2012). Cross-sectional survey of prevalence and personality characteristics of college students with Internet addiction in Wenzhou, China. *Shanghai Archives of Psychiatry, 24*(2), 99–107. doi:10.3969/j.issn.1002-0829.2012.02.005

Jiang, Q., & Leung, L. (2011). Effects of individual differences, awareness-knowledge, and acceptance of Internet addiction as a health risk on willingness to change Internet habits. *Social Science Computer Review, 30*(2), 170–183. doi:10.1177/0894439311398440

Jiang, Z., & Shi, M. (2016). Prevalence and co-occurrence of compulsive buying, problematic Internet and mobile phone use in college students in Yantai, China: Relevance of self-traits. *BMC Public Health, 16*(1), 1211. doi:10.1186/s12889-016-3884-1

Kandell, J. J. (1998). Internet addiction on campus: The vulnerability of college students. *CyberPsychology & Behavior, 1*(1), 11–17. doi:10.1089/cpb.1998.1.11

Kheirkhah, F., Ghabeli, J. A., & Gouran, A. (2010). Internet addiction, prevalence and epidemiological features in Mazandaran Province. *Iranian Red Crescent Medical Journal, 12*(2), 133–137.

Ko, C. H., Yen, J. Y., Liu, S. C., Huang, C. F., & Yen, C. F. (2009). The associations between aggressive behaviors and Internet addiction and online activities in adolescents. *Journal of Adolescent Health, 44*(6), 598–605. doi:10.1016/j.jadohealth.2008.11.011

Krishnamurthy, S., & Chetlapalli, S. K. (2015). Internet addiction: Prevalence and risk factors: A cross-sectional study among college students in Bengaluru, the Silicon Valley of India. *Indian Journal of Public Health, 59*(2), 115–121. doi:10.4103/0019-557X.157531

Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design, 20*(25), 4026–4052. doi:10.2174/13816128113199990617

Lai, C. M., Mak, K. K., Watanabe, H., Ang, R. P., Pang, J. S., & Ho, R. C. (2013). Psychometric properties of the Internet addiction test in Chinese adolescents. *Journal of Pediatric Psychology, 38*(7), 794–807. doi:10.1093/jpepsy/jst022

Li, H. S., & Hu, X. Y. (2014). Association of problematic Internet use and the relationship with loneliness in college students. *Academic Journal of Guangzhou Medical College, 42*(1), 14–16.

Li, L., Bao, Z. X., Chen, B. J., & Zhong, Y. F. (2011). Study on relationship between Internet addiction disorder and loneliness of college students. *China Journal of Health Psychology, 19*(2), 221–222.

Li, Q. (2014). Study on Internet addiction and related behaviors among medical college students. *Chongqing Medical, 43*(29), 3977–3979. doi:10.3969/j.issn.167-8348.2014.29.046

Li, S. M. (2010). On investigation and intervention about university students’ Internet addiction. *Journal of Hebei University of Engineering (Social Science Edition), 27*(3), 71–72.

Li, X. M., Yang, G. L., & Jiang, D. Y. (2015). Logistic regression analysis of current situation and influencing factors of Internet addiction among college students. *Occupation and Health, 31*(5), 665–668.
Internet addiction in university students

Liu, X. L., Zhao, J. B., & Shi, H. X. (2015). Mediating effects of Long, J., Huang, G., Liang, W., Liang, B., Chen, Q., Xie, J., Loney, P. L., Chambers, L. W., Bennett, K. J., Roberts, J. G., & Luo, F. S., Shen, D., & Zhang, S. M. (2009). A study on the Internet use and Internet addiction among college students. Journal of Medical Forum, 29(7), 58–60.

Light, R. J. (1987). Accumulating evidence from independent studies: What we can win and what we can lose. Statistics in Medicine, 6(3), 221–228. doi:10.1002/sim.4780060304

Lin, M. P., Ko, H. C., & Wu, J. Y. (2011). Prevalence and psychosocial risk factors associated with Internet addiction in a nationally representative sample of college students in Taiwan. Cyberpsychology, Behavior, and Social Networking, 14(12), 741–746. doi:10.1089/cyber.2010.0574

Lin, X. M. (2007). Study on college students’ Internet addiction and life events. Journal of Yangzhou University, 11(2), 55–58. doi:10.19411/j.cnki.1007-8606.2007.02.015

Liu, B., & Xu, Y. P. (2009). Investigation on students’ Internet addiction condition and motive in Normal University. Journal of Zhongzhuang Normal University, 63(3), 176–180.

Liu, L. L., & Hu, M. L. (2008). Study on relationship between Internet addiction disorder and type C behavior pattern of college students. China Journal of Health Psychology, 16(4), 370–372. doi:10.3969/j.issn.1008-01.029

Liu, Q. W., Xiao, S. Y., & Cao, H. (2009). Relationship between personality characteristics and quality of life (QOL) in college students with different extent of Internet use. Chinese Mental Health Journal, 23(2), 138–142.

Liu, W., Bao, C.Y., & Wen, B. (2010). Investigation on the Internet dependence of undergraduates and analysis of correlative causes. Chinese General Practice, 13(8), 2485–2487.

Liu, X. L., Zhao, J. B., & Shi, H. X. (2015). Mediating effects of loneliness on relationship between self-identity and Internet addiction: Evidence from university students. Chinese Journal of Public Health Management, 31(2), 235–238.

Loney, P. L., Chambers, L. W., Bennett, K. J., Roberts, J. G., & Stratford, P. W. (1998). Critical appraisal of the health research literature: Prevalence or incidence of a health problem. Chronic Diseases in Canada, 19(4), 170–176.

Long, J., Huang, G., Liang, W., Liang, B., Chen, Q., Xie, J., Jiang, J., & Su, L. (2014). The prevalence of schizophrenia in mainland China: Evidence from epidemiological surveys. Acta Psychiatraca Scandanavica, 130(4), 244–256. doi:10.1111/aps.12296

Luo, F. S., Shen, D., & Zhang, S. M. (2009). A study on the relationship between personality traits and Internet addiction types of college students. Culture and Education, 205–207.

Luo, J. H., Wan, J. J., & Liu, Q. X. (2011). The relationship of Internet use, Internet special self-efficacy and Internet addiction in university students. Psychological Development and Education, 26(6), 618–626. doi:10.16187/j.cnki.issn1001-4918.2010.06.010

Luo, R., & Zhu, D. L. (2015). A study of personality traits of undergraduates with IAD. Journal of Jiangxi Normal University, 48(6), 133–136.

Luo, S. Z., & Guo, J. Z. (2014). Analysis on Internet behavior and influencing factors of college students’ Internet addicts. Chinese Journal of Health Statistics, 31(3), 434–436.

Mak, K. K., Lai, C. M., Watanabe, H., Kim, D. I., Bahar, N., Ramos, M., Young, K. S., Ho, R. C., Aum, N. R., & Cheng, C. (2014). Epidemiology of Internet behaviors and addiction among adolescents in six Asian countries. Cyberpsychology, Behavior, and Social Networking, 17(11), 720–728. doi:10.1089/cyber.2014.0139

Mei, S. L., Kou, C. G., Yu, Y. Q., & Yang, H. (2007). Research on the relationship between Internet addiction disorder and sensation seeking of college students. Medicine and Society, 20(11), 57–59.

Mey, S. L., Yang, H., Kou, C. G., & Yu, Y. Q. (2009). An investigation of the collective characteristics of the Internet addictive population in college students. Medicine and Society, 22(5), 53–55. doi:10.3870/YYSH.2009.05.021

Michael, H. B. (1998). Guidelines for evaluating prevalence studies. Evidence-Based Mental Health, 1, 37–39. doi:10.1136/ebmh.1.2.37

MinniWatts Marketing Group. (2011). World Internet usage and population statistics. Retrieved from http://www.internetworldstats.com/stats.htm

Mohammadbeigi, A., Valizadeh, F., Mirshojaei, S. R., Ahmadzadeh, R., Mohktari, M., Ghaderi, E., Ahmadi, A., Rezaei, H., & Ansari, H. (2016). Self-rated health and Internet addiction in Iranian medical sciences students; prevalence, risk factors and complications. International Journal of Biomedical Science, 12(2), 65–70.

Morrison, C. M., & Gore, H. (2010). The relationship between excessive Internet use and depression: A questionnaire-based study of 1, 319 young people and adults. Psychopathology, 43(2), 121–126. doi:10.1159/000277001

National Bureau of Statistics of China. (2011). Land division and urban and rural areas. Retrieved from http://www.stats.gov.cn/tjzc/ztrbd/sjzt/20120106/t20120106_136806.htm

National Bureau of Statistics of China. (2011). Land division method of east, west and north-east area. Retrieved from http://www.stats.gov.cn/tjzc/ztrbd/sjzt/20120106/t20120106_136807.htm

Ni, X., Yan, H., Chen, S., & Liu, Z. (2009). Factors influencing Internet addiction in a sample of freshmen university students in China. CyberPsychology & Behavior, 12(3), 327–330. doi:10.1089/cpb.2008.0321

Niemz, K., Griffiths, M., & Banyard, P. (2005). Prevalence of pathological Internet use among university students and correlations with self-esteem, the General Health Questionnaire (GHQ), and disinhibition. CyberPsychology & Behavior, 8(6), 562–570. doi:10.1089/cpb.2005.8.562

Pan, J. Y., & Zhang, J. H. (2006). Personality characteristics and psychiatric symptoms in senior university students with Internet addiction disorder. Chinese Journal of Clinical Rehabilitation, 10(18), 56–58.

Pawlowska, B., Zygo, M., Potembska, E., Kapka-Skrzypczak, L., Dreher, P., & Kedzierski, Z. (2015). Prevalence of Internet addiction and risk of developing addiction as exemplified by a group of Polish adolescents from urban and rural areas. Annals of Agricultural and Environmental Medicine, 22(1), 129–136. doi:10.5604/12321966.1141382

Peng, N. N., Zhu, J. P., & Feng, X. G. (2007). Internet addiction and the influencing factors among students in Shanghai. Chinese Journal of School Health, 28(3), 242–245.

Qi, Y. L., & Mei, C. Z. (2012). The cross-sectional survey on the prevalence of Internet addiction disorder among medical college students in Anhui province. Modern Preventive Medicine, 39(22), 5882–5886.
Wang, X. Q., Chen, X., & Zuo, F. H. (2011). Study on the Internet addiction of secondary education students. Eurasian Journal of Educational Research, 53, 131–148.

Shen, P. Y., Zhang, Z. H., & Wang, L. (2013). Relationship between Internet addiction and self-esteem: Mediating role of achievement motive. Chinese Journal of School Health, 34(3), 260–262. doi:10.16835/j.cnki.1000-9817.2013.03.002

Shen, X. M., & Xie, Y. (2011). Study on the relationship between the Internet addiction and interpersonal efficacy among college students. Heilongjiang research on Higher Education, 20(7), 134–136.

Shi, K. X., & Zhang, X. Q. (2005). Research on the Internet activities and Internet addiction disorder of college students. Journal of Shandong Agricultural University, 4(3), 215–217. doi:10.13842/j.cnki.1671-816x.2005.03.008

Song, J. G., Xu, Y., & Li, Y. H. (2014). Relationship between IAD and general well being among college students. Chinese Journal of School Health, 33(5), 691–693. doi:10.16835/j.cnki.1000-9817.2014.05.020

Spada, M. M. (2014). An overview of problematic Internet use. Addictive Behaviors, 39(1), 3–6. doi:10.1016/j.addbeh.2013.09.007

Tan, S. Q., & Li, Z. Q. (2005). Epidemiological study on pathological Internet use among college students. Chinese Journal of School Health, 26(1), 20–21.

Tang, X. X., & Yu, L. Q. (2012). Study on relationship of the connection of IAD college student with psychological, body health, social support and coping style. Modern Preventive Medicine, 39(6), 1455–1457.

Tsai, H. F., Cheng, S. H., Yeh, T. L., Shih, C. C., Chen, K. C., Yang, Y. C., & Yang, Y. K. (2009). The risk factors of Internet addiction—a survey of university freshmen. Psychiatry Research, 167(3), 294–299. doi:10.1016/j.psychres.2008.01.015

Wang, F., & Wang, Q. Z. (2012). Investigation report on college students’ Internet addiction in Huangshi. Health Vocational Education, 30(15), 115–116.

Wang, J., You, Y., & Huang, J. (2012). The relationship between internet addiction and ego-identity, self-control ability of college students. Journal of Psychiatry, 25(5), 350–352.

Wang, T. H., & Guo, S. (2012). Study on the current situation of Internet addiction among college students in Liaoning province. China Science & Technology Overview (21), 193–194.

Wang, X. Q., Chen, X., & Zuo, F. H. (2011). Study on the relationship between Internet addiction and refusing Internet self—Efficacy among college student. China Journal of Health Psychology, 19(5), 611–613.

Winsper, C., Ganapathy, R., Marwaha, S., Large, M., Birchwood, M., & Singh, S. P. (2013). A systematic review and meta-regression analysis of aggression during the first episode of psychosis. Acta Psychiatrica Scandinavica, 128(6), 413–421. doi:10.1111/acps.12113

Wu, H. R., & Zhu, K. J. (2004). Path analysis on related factors causing Internet addiction disorder in college students. China Public Health, 20(11), 1363–1364.

Xi, X. L., Zhang, M. R., & Cheng, Z. H. (2014). Psychosocial risk factors associated with Internet addiction of college students. Chinese Journal of Clinical Psychology, 22(5), 799–803. doi:10.16128/j.cnki.1005-3611.2014.05.054

Xu, Y., Li, Y. H., & Ma, C. R. (2014). Investigation on the Internet addiction disorder and general well-being in medical students. Acta Academiae Medicinae Wannan, 33(2), 181–184. doi:10.3969/j.issn.1002-0217.2014.02.030

Yan, W., Li, Y., & Sui, N. (2014). The relationship between recent stressful life events, personality traits, perceived family functioning and Internet addiction among college students. Stress Health, 30(1), 3–11. doi:10.1002/smi.2490

Yang, C., Zhang, L., Zhu, P., Zhu, C., & Guo, Q. (2016). The prevalence of tic disorders for children in China: A systematic review and meta-analysis. Medicine (Baltimore), 95(30), 1–8. doi:10.1097/MD.0000000000004354

Yang, Y. S., Hou, Y., & Ziang, Q. Y. (2007). Study on the relationship between Internet addiction and anxiety in college students. Journal of Nanning Normal University, 36(6), 73–77.

Yao, J. G., & Zhang, N. (2006). Study on Internet addiction among college students. Journal of Clinical Psychiatry, (3), 170–171.

Yao, L. H., & Yang, D. L. (2014). Analysis of the status of Internet addiction of college students and their emotional characteristics. Value Engineering, (27), 326–328. doi:10.14018/j.cnki.cn13-1085/n.2014.27.523

Yao, R. Y., Li, X., & Tao, F. B. (2011). Effects of Internet addiction on sub—Health status of college students. Journal of Third Military Medical University, 33(13), 1416–1418. doi:10.16016/j.1000-5404.2011.13.028

Yao, Y. S., Gao, C., & Zhou, F. H. (2006). Epidemiological study on Internet use and Internet addiction disorder among college students. Chinese Journal of School Health, 27(10), 844–846.

Ye, Y. L., Wang, P. G., Qu, G. C., Yuan, S., Phongsavan, P., & He, Q. Q. (2016). Associations between multiple health risk behaviors and mental health among Chinese college students. Psychology, Health & Medicine, 21(3), 377–385. doi:10.1080/13548506.2015.1070955

Yen, J. Y., Ko, C. H., Yen, C. F., Chen, C. S., & Chen, C. C. (2009a). The association between harmful alcohol use and Internet addiction among college students: Comparison of personality. Psychiatry and Clinical Neurosciences, 63(2), 218–224. doi:10.1111/j.1440-1819.2009.01943.x

Yen, J. Y., Yen, C. F., Chen, C. S., Tang, T. C., & Ko, C. H. (2009b). The association between adult ADHD symptoms and Internet addiction among college students: The gender difference. Cyberpsychology, Behavior, and Social Networking, 12(2), 187–191. doi:10.1089/cpb.2008.0113

Yoo, H. J., Cho, S. C., Ha, J., Yune, S. K., Kim, S. J., Hwang, J., Chung, A., Sung, Y. H., & Lyoo, I. K. (2004). Attention deficit hyperactivity symptoms and Internet addiction. Psychiatry and Clinical Neurosciences, 58(5), 487–494. doi:10.1111/j.1440-1819.2004.01290.x

Younes, F., Halawi, G., Jabbour, H., El, O. N., Karam, L., Hajj, A., & Rabbaa, K. L. (2016). Internet addiction and relationships with insomnia, anxiety, depression, stress and self-esteem in university students: A cross-sectional designed study. PLoS One, 11(9), e0161126. doi:10.1371/journal.pone.0161126

Young, K. S. (1996). Psychology of computer use: XL. Addictive use of the Internet: A case that breaks the stereotype. Psychological Reports, 79(3 Pt 1), 899–902. doi:10.2466/pr0.1996.79.3.899

Young, K. S. (1997). What makes on-line usage stimulating? Potential explanations for pathological Internet use. Paper
presented at the 105th annual meeting of the American Psychological Association, Chicago, IL, USA.

Young, K. S. (1998a). Caught in the net: How to recognize the signs of Internet addiction – And a winning strategy for recovery. New York, NY: John Wiley & Sons Inc.

Young, K. S. (1998b). Internet addiction: The emergence of a new clinical disorder. CyberPsychology & Behavior, 1(3), 237–244.
doi:10.1089/cpb.1998.1.237

Yu, B. L., & Ji, H. P. (2010). Analysis of Internet addiction status and risk factors of some college students in Jiangsu Province. Acta Universitatis Medicinalis Nanjing, 30(4), 476–501.

Zeng, J., & Chen, X. N. (2006). The comparative study on Internet addiction disorder between middle school and college students of Chengdu. Modern Preventive Medicine, 33(10), 1790–1791 +1794.

Zhang, L. L., & Wang, L. Y. (2011). A study on the influencing factors of college students’ Internet addiction in Gansu province. Chinese Journal of Health Statistics, 28(5), 570–571.

Zhang, L. N., & Shen, Q. J. (2009). Psychological and personality characteristics of college students with Internet addiction disorder in Ningbo. Chinese Mental Health Journal, 23(9), 674–676.

Zhang, M., Tang, D. W., & Jiang, Q. (2015). Prevalence of Internet addiction and influencing factors among college students in Nantong. Chinese Journal of School Health, 36(3), 378–380.
doi:10.1371/journal.pone.0131597

Zhang, M. W. B., Lim, R. B. C., Lee, C., & Ho, R. C. M. (2017). Prevalence of Internet addiction in medical students: A meta-analysis. Academic Psychiatry, 42(1), 88–93.
doi:10.1007/s40596-017-0794-1

Zhao, X. M. (2016). One in five of the world’s college students are in China. Retrieved from https://www.studyinternational.com/news/one-in-five-of-the-worlds-college-students-are-in-china/

Zhao, X. R., & Dai, W. T. (2009). Internet addiction disorder among college students and its influencing factors. Practical Journal of Cardiac Cerebral Pneumal and Vascular Disease, 17(8), 657–659.

Zhao, X. Y., Hu, X. B., Zhang, M. H., & Sun, Y. M. (2012). Relationship of Internet addiction and depression among college students in Lanzhou. Chinese Journal of School Health, 33(10), 1179–1181.
doi:10.16835/j.cnki.1000-9817.2012.10.010