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A systematic review on internet addiction through various assessment tools among Chinese college student's context

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ABSTRACT

With the rapid development of information technology, the internet has evolved into an essential tool in everyday life. The global proportion of internet users has consistently risen in recent years. Notably, China boasts substantial internet users, with students representing the largest demographic, especially college students. The purpose of this study is to explore the issue of internet addiction among Chinese college students through various assessment tools. This study conducted a systematic literature review with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A total of 409 publications were screened, and 23 were deemed eligible for inclusion in the review. The result revealed that there is no gold standard for evaluating internet addiction. Five types of instruments have been identified, and reported prevalence rates vary due to distinct assessment instruments and thresholds, spanning from 6.81% to 54.86%. Furthermore, internet addiction is associated with four factors among Chinese college students. Therefore, this study furnishes epidemiological evidence to support the prevention of internet addiction and the enhancement of mental health among college students.

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1. INTRODUCTION

With the rapid development of information technology, the internet has evolved into an essential tool in everyday life [1]. Notably, from 2021 to 2023, the global user percentage rose from 59.1% to 64.4% [2], underscoring the pivotal role of the internet in global communication and social interaction. In China, the internet has witnessed remarkable growth, with a 73.0% penetration rate and over 1.051 billion users, representing a substantial segment of the world's internet population [3]. This escalating trend emphasizes the escalating significance of internet access, particularly among college students [3]. However, the alluring potential of the internet is accompanied by a concerning downside—internet addiction, which is classified as a behavioral addiction [4]. Moreover, internet addiction pertains to the excessive and compulsive utilization of the internet, stemming from the incapacity to exercise self-control [5].

In regards to the context of higher institutions, university campuses' easy and unlimited access to the internet fosters students to participate in online activities anywhere and anytime [6]. However, with unstructured time to access the Internet, the increased freedom from parental control, combined with less self-regulatory ability [5], may lead to impulsive behaviors, potentially resulting in excessive internet usage [7]. Due to the internet's anonymity and interactivity, college students tend to not just devote substantial time on the internet, fostering new friendships and establishing relationships within a secure virtual environment

[8], but also as a means to regulate emotions, seek solace from real-life challenges, and escape from the pressures of everyday life [9].

Furthermore, the notable variation can be primarily attributed to the absence of consistent diagnostic standards and assessment tools [10]. To date, there is no recognized gold standard for diagnosing internet addiction [11]. Although the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) and the International Classification of Diseases (11th Revision) (ICD-11), released by the World Health Organization (WHO), are widely acknowledged as the diagnostic standards for internet addiction by the international community, the establishment of these criteria came after the development and application of most of the other diagnostic criteria.

This review emphasized the significant difference in assessment tools employed across various studies, rendering the prospect of conducting cross-comparisons and evaluating epidemiological prevalence rates among varied samples a significant challenge. To date, there is a lack of a comprehensive, systematic evaluation of internet addiction among Chinese college students. To shed light on the possible issue of internet addiction, the primary objective of this paper is to provide a thorough analysis of prevalence research on internet addiction conducted over the last ten years. The present review endeavors to address the subsequent research questions: i) How is internet addiction assessed among Chinese college students? ii) To what extent is internet addiction prevalent? iii) What factors are correlated with internet addiction among Chinese college students?

2. METHOD

This study employed a systematic review method to select previous studies related to the field of internet addiction among Chinese college students. The identification of such studies involved systematic searching of relevant databases (Web of Science and Scopus). The systematic literature search was in accordance with the PRISMA guidelines outlined by Moher *et al*. [12], as shown in Figure 1.

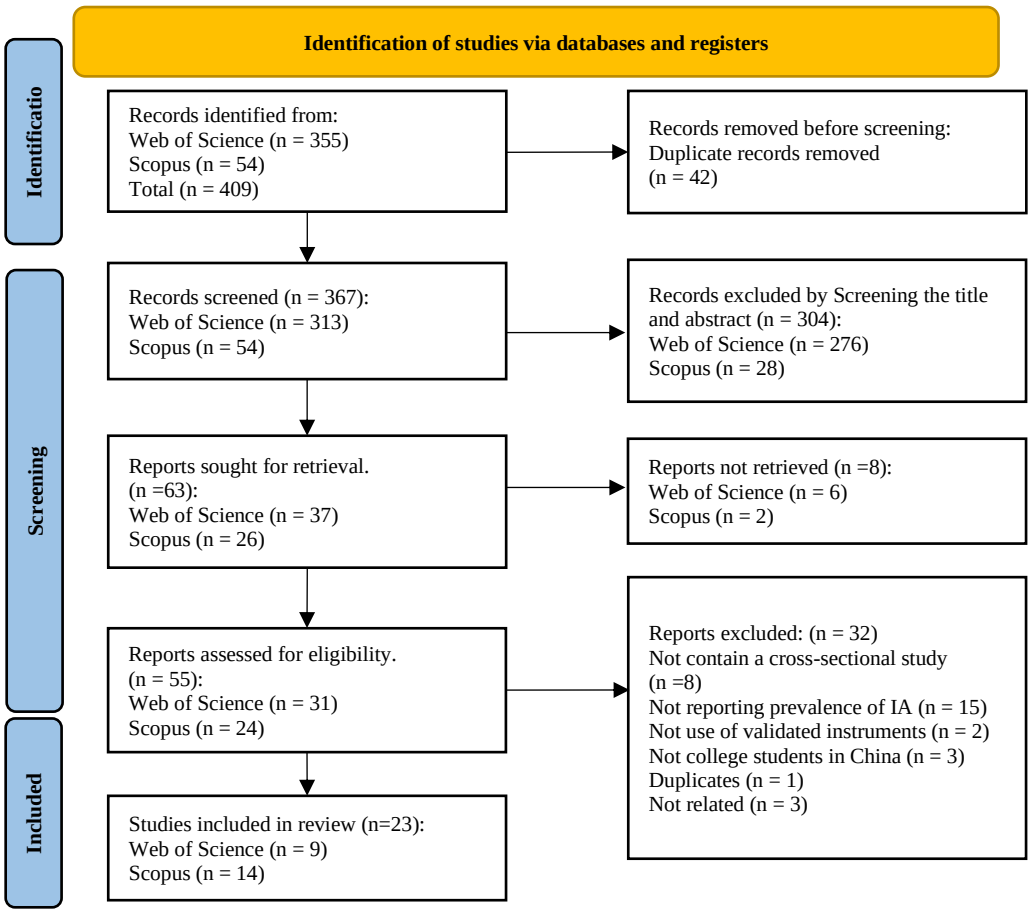

Figure 1. PRISMA diagram outlining steps involved in literature search

2.1. Inclusion and exclusion criteria

Regarding the inclusion criteria, this study only includes studies with the following characteristics: i) published studies from 2013–2023; ii) contain quantitative empirical data and a cross-sectional study; iii) include a full-text article; iv) are written in English; v) include the prevalence of internet addiction among Chinese college students; vi) include an analysis pertaining to internet addiction; and vii) use a validated instrument. Furthermore, this study also excludes studies with the following characteristics: i) not published studies from 2013–2023; ii) not contain quantitative empirical data and a cross-sectional study; iii) not available as a full-text article; iv) articles in other languages than English; v) valid data cannot be extracted from the study; vi) only focus on the analysis of specific online applications (e.g., gaming, social networking, and mobile phones); and vii) not use validated instruments, as shown in Table 1.

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Published studies from 2013-2023	Not published studies from 2013-2023
Contain quantitative empirical data and a cross-sectional study	Not contain quantitative empirical data and a cross-sectional study
Available as a full-text article	Not available as a full-text article
Articles written in English	Articles in other languages than English
Include the prevalence of Internet addiction among Chinese college students	Valid data cannot be extracted from the study
Include an analysis pertaining to Internet addiction	Only focus on the analysis of specific online applications (e.g., gaming, social networking, and mobile phone)
Use of validated instrument	no use of validated instruments

2.2. Search strategy

An exhaustive search was conducted for relevant articles related to Internet addiction and published between 2013 and 2023 in the subsequent electronic databases: Web of Science and Scopus, using the following combination of search terms and their derivatives: ("internet addiction" OR "compulsive internet use" OR "problematic internet use" OR "excessive internet use" OR "pathological internet use") AND ("college students" OR "university students") AND (“China” OR “Chinese”) AND (“prevalence” OR “epidemiology” OR ""detection rate"). In addition, relevant articles were manually searched.

2.3. Study selection/eligibility criterion

In this search process, as many relevant studies as possible addressing the research questions were identified. The databases were searched in August and September 2023. After completing the literature search of the two electronic databases, all identified citations were exported to Microsoft Excel. These duplicates are then electronically found and eliminated from each database. Subsequently, these duplicates are electronically found and eliminated from each database. After eliminating redundant literature, the titles and abstracts of the identified citations were evaluated to make an informed decision about their suitability for inclusion in this review. After evaluation of the titles and abstracts, the full text was initially deemed appropriate for this review. When any part of a reference was unclear, we contacted the author by email for clarification. Finally, the articles were retrieved to conduct a more detailed assessment of their eligibility for inclusion in the final review. An overview of the study selection process based on PRISMA is presented in Figure 1.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1.Preliminary literature research findings

During the initial literature search, a combined total of 409 studies were retrieved from two prominent bibliographic databases (i.e., Web of Science and Scopus). Out of this research, 42 articles in total were eliminated from this review because they were duplicates (n=42). These studies are eliminated by screening the full text that cannot be retrieved (n=8) and the title and abstract (n=304). Thus, in accordance with the inclusion and exclusion criteria outlined in the preceding section, the full texts of 55 studies were comprehensively evaluated to ascertain their eligibility for inclusion in the final review. Accordingly, a total of 32 studies are excluded from this group of studies since they do not include a cross-sectional study (n=8), not report the prevalence of internet addiction (n=15), not use validated instruments (n=2), not college students in China (n=3), duplicates (n=1), or related articles (n=2). Taking into account the foregoing considerations, a total of 23 papers have been included in the final review, as shown in Figure 1.

3.1.2.Internet addiction assessment tools of the studies reviewed

a) The 20-item Young's internet addiction test (IAT)

The 20-item young's IAT is a widely used research tool to evaluate internet addiction in students, but it has different Likert scale scoring approaches, such as Likert four-point scoring, Likert five-point scoring, and Likert six-point scoring. To assess internet addiction using the Likert four-point scale, the Internet Addiction Scale developed by Young *et al.* [13] was employed in a study conducted by Jiang *et al.* [14] to examine the extent of usage and dependence on the network. The scale comprises a total of 20 questions, with responses rated as follows: "almost no" (0 points), "occasionally" (1 point), "sometimes" (2 points), "often" (3 points), and "always" (4 points). A total score exceeding 40 points was deemed indicative of internet indulgence.

The 20-item Young's IAT, which employs a Likert scale ranging from 1 to 5, was the most frequently used scale in the empirical research papers included. A total of nine studies [15]–[23] utilized it to assess internet addiction, generating scores ranging from 20 to 100. IAT is to measure the extent to which internet access affects daily life, social interaction, productivity, sleep, and mood. Higher scores indicate more severe Internet addiction. Different cutoff points were used to categorize individuals, such as normal (0-30 points), mild (31-49 points), and moderate to severe (50-100 points) [24]. It is widely used to evaluate the severity of Internet addiction and screen users for their level of addiction.

A total of three studies [25]–[27] assessed Internet addiction using Young's IAT, a widely employed self-assessment scale consisting of 20 items [28]. The IAT is structured with a 6-point Likert scale, and total scores can range from 0 to 100. A commonly accepted threshold score of 50 was employed to classify individuals, categorizing those scoring 50 or higher as individuals with internet addiction, while those scoring below 50 were deemed non-afflicted by internet addiction. Severity levels were categorized as: normal (0-30), mild (31-49), moderate (50-79), and severe (80-100).

b) The 8-item Young's internet addiction diagnosis questionnaire (IAD)

Five studies [29]–[33] were employed for assessing internet addiction, with the IAT [28] being the most widely used scale globally. The scale consists of 8 items, and participants respond with "yes" or "no." Participants were required to indicate their perceptions of each question, and those answering "yes" to at least five of the eight criteria were classified as experiencing internet addiction [28]. This measurement tool is straightforward and widely utilized in both domestic and international research.

c) The 10-item Young's internet addiction test (IAT)

The 10-item Young IAT, one of the most popular diagnostic tools for assessing Internet addiction, was used to gauge participant levels of addiction [34]. Li *et al*. [35] conducted a translation into Chinese and validation of the 10-item IAT for the Chinese setting. On the scale, respondents had to select "yes" or "no" depending on whether they had encountered the signs of Internet addiction mentioned above in the preceding year. Individuals who indicated support for four or more of the specified actions were classified as having an addiction to the Internet.

d) The Chinese internet addiction scale (CIAS)

To measure internet addiction, Huang *et al*. [36] employed the CIAS, developed by Taiwanese researchers and validated using a sample of Taiwanese college students [37]. The scale comprises 26 items and 5 dimensions: compulsive use of the internet (5 items), withdrawal symptoms of internet addiction (5 items), tolerance symptoms of internet addiction (4 items), interpersonal and health-related problems of internet addiction (7 items), and time management problems (5 items). A 4-point Likert scale (1 being false, 4 being very true) was used for scoring.

e) The revised Chinese internet addiction scale (CIAS-R)

Three studies [38]–[40] utilized the Revised CIAS-R to evaluate internet addiction. The 19-item CIAS-R is a self-reported scale that measures participants' internet addiction, encompassing four dimensions: compulsive and interpersonal health, time-management issues, withdrawal symptoms, and tolerance symptoms of internet addiction. Each item is assessed using a 4-point scale ranging from 1 (indicating complete inconformity) to 4 (indicating complete conformity). The total score on the CIAS-R can range from 0 to 76, and individuals were categorized as having Internet addiction when their score reached or exceeded 53.

3.1.3.The prevalence of Internet addiction of the studies reviewed

The 20-item Young's IAT, Likert four-point scoring, was used in one study to assess internet addiction among 2688 college students in Wuhu, Anhui Province, China. The reported prevalence indicated that 32.4% of the students exhibited a tendency towards internet addiction, with proportions of mild, moderate, and severe cases amounting to 29.8%, 2.5%, and 0.1%, respectively [14]. Nine studies employed the 20-item Likert five-point Young's IAT to measure internet addiction in Chinese college students. The sample sizes ranged from 356 [24] to 11,254 participants [16]. The reported prevalence rates of internet addiction among college students differed, even though the same measuring tool was consistently used in all research due to different cut-off

criteria, ranging from 12.4% in Tangshan, Hebei Province, China, to 28.4% in Wuhan, Hubei Province. The 20-item Young's IAT, employing a Likert six-point scale, was utilized in three studies to evaluate internet addiction among college students in China. The sample sizes ranged from 1,264 [26] to 5,757 participants [25]. The reported prevalence rates of internet addiction among college students varied, ranging from 6.8% in Sichuan, China, to 44.7% in Shenyang, Guizhou, and Hubei Province, China.

The 8-item Young's IAD was used in five studies to assess internet addiction among college students in China. The sample sizes ranged from 494 [29] to 8,879 participants [30]. The reported prevalence rates of internet addiction among college students varied, ranging from 18.8% to 30.6% in Chengdu, Sichuan Province, China. The 10-item Young's IAT was employed in one study to assess internet addiction among 1,173 college students in Hefei, Anhui Province, Eastern China. The reported prevalence indicated that 15.2% of the students are classified as having internet addiction [34]. Chen's Internet Addiction Scale was used in one study among 590 college students [36]. The reported prevalence indicated that 21.2% of the students are classified as having internet addiction. In three studies, the CIAS-R was used to assess Internet addiction among college students in China. The sample sizes ranged from 627 college students in Changsha, Hunan Province [40] to 8,098 college students in Changsha, Hunan Province [38]. The reported prevalence rates of internet addiction in these studies exhibited significant variation. For instance, in a sample of 627 Chinese internet users, 7.7% were identified as addicted to the internet in 2020, while in a sample of 8098 internet users in 2021, the prevalence increased to 54.9%.

3.1.4. The associated factors of the Internet addiction of the studies reviewed

Four primary factors associated with internet addiction include demographic variables, social factors, psychological factors, and lifestyle and health factors. Demographic variables encompass age, gender, place of residence, being the only child at home, school grades, and household economic and health status, which can influence the likelihood of developing internet addiction. Psychological factors are extensive, with nineteen specific elements identified as contributing to internet addiction. Social factors involve school bullying, parent-child relationship, social support, and social environmental risk factors. Lastly, lifestyle and health factors, including insomnia, sleep quality, musculoskeletal pain and upper cross syndrome.A graphic illustration of these factors is shown in Table 2.

Table 2. Factors associated with internet addiction

No	Factors associated with Internet Addiction	Sub-dimension	Citations
1	Demographic variables	Gender	[20], [21], [33], [38]
		Age	[20], [21], [33]
		Place of residence	[20]
		Being the only child at home (yes/no)	[20], [33]
		School grades	[20], [33]
		Household economic and health status	[20], [27]
2	Psychological factors	Childhood trauma	[25]
		Suicidal behavior	[38], [40]
		Suicidal ideation	[25], [39]
		Self-injury	[19]
		Depression	[14], [15], [20], [21], [30], [34], [36],[39], [40]
		Anxiety	[15], [20], [30], [33], [38], [39]
		Attention deficit hyperactivity disorder	[15], [26], [38]
		Post-traumatic stress disorder	[15], [30]
		Feeling stress	[15]
		Internal locus of control	[29]
		Psychological competence	[34]
		Psychological Suzhi	[31]
		Personality trait	[26]
		Rumination	[32]
		Procrastination	[32]
		Metacognition belief	[23]
		Alexithymia	[23]
		Academic behavior	[33]
		Impulsivity	[21]
3	Social factors	School bullying	[15]
		Parent-child relationship	[34], [39]
		Social support	[14], [21]
		Social environmental risk factors	[27]
4	Lifestyle and health factors	Insomnia	[15], [38], [40]
		Sleep quality	[14], [18], [19], [34], [36]
		Musculoskeletal pain	[16]
		Upper cross syndrome	[17]
		Fatigue	[22]
		Quality of life	[20]
		Physical exercise	[33]

3.2. Discussion

In assessing internet addiction, current methods primarily use questionnaires, in line with previous research [41]. This review reinforces established findings but shows a variety of questionnaire tools used to study internet addiction, each with different diagnostic thresholds. Consequently, there is a notable dearth of a universally acknowledged gold standard for diagnosing and evaluating the severity of internet addiction behaviors [11]. Moreover, this review has identified specific questionnaires as the most reliable diagnostic instruments for evaluating internet addiction at this stage [41]. Laconi *et al.* [42] conducted a comprehensive evaluation of available scales for assessing internet addiction, revealing that only 8 out of 45 had undergone multiple assessments of their psychological measurement attributes. These eight scales, including the one used in this study, demonstrated a high level of item universality and result reliability.

In addition to the diversity of diagnostic tools employed to assess Internet addiction, these scales have some drawbacks. Firstly, IAT [43] lacks temporal requirements, meaning diagnostic criteria don't specify a certain timeframe for the manifestation of a set number of symptoms. Additionally, under these criteria, diagnosing someone as internet-addicted requires experiencing five out of eight symptoms over a lifetime. However, this diagnostic approach overlooks the timing and frequency of symptom occurrence, potentially impacting diagnostic accuracy and the effectiveness of clinical treatment [11].

Furthermore, the Internet Addiction Diagnostic Questionnaire (IADQ) utilizes a binary response format (yes/no) for symptom assessment. This format is deemed restrictive as it lacks the capacity to offer an intricate assessment of the severity of individual symptoms, a factor of paramount importance in comprehending the degree of internet addiction. Owing to the lack of time criterion and binary scoring within the assessment tool, there is a suggestion that the prevalence of internet addiction could be overestimated. In essence, when contrasted with the utilization of more comprehensive, time-based assessments, there is a possibility of a greater number of individuals being categorized as internet addicts. The Chen Internet Addiction Scale (CIAS) is a diagnostic tool for assessing the complexities of excessive internet use and includes elements like time management to gauge the internet's impact on daily life. However, concerns arise about using time measurement as the primary diagnostic criterion for internet addiction. Advocates suggest combining time management with usage motivation for a more comprehensive evaluation. Emphasizing usage motives helps distinguish between routine and potentially addictive use. Therefore, a more comprehensive approach may more accurately assess the impact of the internet on individuals.

In this literature review, a wide range of prevalence rates, ranging from 6.81% [27] to 54.86% [40], have been identified. These variations can be attributed to differences in samples, measurement instruments, sampling methods, and study locations [20], as well as the sociocultural and economic backgrounds of the participants. A substantial amount of research is primarily focused on China's central and eastern regions, in line with past research [10]. This may be attributed to the fact that the central and eastern regions of China experience more rapid economic development, resulting in earlier widespread adoption of computers and internet services. Moreover, these areas typically possess superior internet infrastructure and a broader range of internet applications, consequently attracting a greater number of university students and young individuals. In addition, over the past decade, there has been a general upward trend in the overall prevalence of internet addiction among Chinese college students. This underscores the increasing severity of internet addiction as a problem, which may potentially result in various adverse consequences for college students. It is imperative to prioritize addressing this issue and implementing effective interventions.

In addition, numerous additional factors have been empirically associated with internet addiction, encompassing demographic variables, social factors, psychological factors, as well as lifestyle and health factors. Among college students, gender emerged as the predominant demographic variable [38]. Research has revealed inconsistent findings regarding the prevalence of internet addiction in males and females. Some studies indicate a higher prevalence of internet addiction in males [33], attributed to their engagement in riskier online activities such as gaming and gambling, while women tend to engage in lower-risk behaviors. However, other research suggests similar prevalence rates between genders [38]. This could be influenced by the surge in smartphone usage, which provides women with increased access to the internet through various applications, particularly for social interactions [44]. For instance, in China, women extensively use platforms like WeChat, TikTok, and Taobao, contributing to higher rates of internet addiction among them.

Social factors have been the subject of extensive research; the most commonly found correlation is that between internet addiction and social support among Chinese college students [14], [21], [34] and [39]. Higher levels of internet addiction were seen in college students with less positive parent-child connections, implying that youths from dysfunctional family settings who lack parent-child connectedness may resort to the Internet for social support, potentially worsening parent-child discord. A detrimental cycle can consequently form between an unfavorable family environment and internet addiction, rendering the issue of youth internet addiction more challenging to address [45]. Furthermore, college students, who are susceptible

to Internet addiction, experience reduced opportunities for communication and companionship, ultimately limiting their access to social support.

This literature review delves into psychological factors, primarily focusing on the relationship between internet addiction and depression. Research indicates that symptoms of depression, such as feelings of isolation and negative self-perception, may incline individuals towards engaging in online social interaction [34]. This preference stems from a perceived sense of safety and the ability to better express oneself and alleviate stress in the virtual realm [46]. Consequently, university students may gravitate towards seeking stimulation or escape from negative emotions through online platforms, potentially leading to internet addiction [46].

The predominant lifestyle and health factor associated with internet addiction among college students was identified as sleep quality. The following are the underlying causes contributing to this issue: Individuals afflicted with internet addiction commonly manifest deficiencies in their time management skills, and their protracted engagement in internet activities precipitates a decrease in their total sleep duration [47]. Furthermore, the electronic apparatus integrated within personal computers and smartphones emits luminous emissions, particularly in the form of blue light, thereby attenuating the levels of melatonin, a hormone that plays a pivotal role in the regulation of human sleep [48]. Additionally, some research suggests that Internet addiction, typified by excessive online interactions, may directly or indirectly lead to sleep-related issues, thereby diminishing the overall duration of sleep and also inducing alterations in sleep patterns. To summarize, protracted internet use exerts an excessive stimulatory effect on the brain, engendering a spectrum of sleep-related problems, encompassing sleep disorders, social withdrawal, and a decline in sleep efficiency [49].

4. CONCLUSION

In summary, this study highlights the diversity in survey approaches and the wide-ranging prevalence of internet addiction among Chinese college students (6.81% to 54.86%). The primary challenge lies in the lack of a universally accepted gold standard. To more accurately assess internet addiction among Chinese college students, future research needs to establish a consistent measurement framework. Currently, research on internet addiction among Chinese college students is predominantly focused on the central and eastern regions, with relatively less attention given to the northern and southern regions. Future studies should address this gap to gain a more comprehensive understanding of the distribution of internet addiction among Chinese college students. Effective interventions are crucial in addressing associated factors, including educational lectures, internet knowledge competitions, and media campaigns targeting college students. Furthermore, urging schools and communities to play an active role in guiding students to use the internet responsibly upon enrollment and establishing effective communication channels with parents is essential. The emphasis should be on cultivating awareness of internet addiction and advocating for healthy activities. In conclusion, adopting a comprehensive approach that combines standardized measures, regional diversity, and targeted interventions is key to addressing and preventing internet addiction among Chinese college students.

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