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A comprehensive measure assessing different types of problematic use of the internet among Chinese adolescents: The Assessment of Criteria for Specific Internet-use Disorders (ACSID-11)

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ABSTRACT

Background: Problematic use of the internet (PUI) is prevalent, particularly among adolescents and young adults. Given the limited measures to assess specific types of PUI, which encompasses a broad spectrum of activities such as online gaming, social media use, pornography use, shopping, gambling, and web-streaming, Muller et al. (2022) developed the Assessment of Criteria for Specific Internet-use Disorders (ACSID-11) to comprehensively assess different types of PUI (i.e., gaming, shopping, social media use, gambling, and pornography use). The

Abbreviations: ACSID-11, Assessment of Criteria for Specific Internet-use Disorders; BSMAS, Bergen Social Media Addiction Scale; CE, Continuation/escalation; CFA, Confirmatory factor analysis; CFI, Comparative fit index; DSM-5, Diagnostic and Statistical Manual of Mental Disorders; FI, Functional impairment; IC, Impaired control; ICD-11, International Classification of Diseases; IGD, Internet gaming disorder; IGDS9-SF, Internet Gaming Disorder Scale-Short Form; IP, Increased priority; MD, Marked distress; MGCFA, Multi-group CFA; ML, Maximum likelihood; PUI, Problematic use of the internet; PUSM, Problematic use of social media; RMSEA, Root mean square error of approximation; SABAS, Smartphone Application Based Addiction Scale; SRMR, Standardized root mean square residual; TLI, Tucker-Lewis index.

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present study aimed to validate the Chinese ACSID-11 among adolescents incorporating cross-cultural adaptations.

Methods: Using forward-backward translation method, a culturally adapted version of the ACSID-11 was prepared. Then, a cross-sectional online survey was administered between September 8 and September 26, 2023. Adolescents, using a convenience sample ($N = 11,492$; mean age = 16.42 years [SD ± 0.91]; 59.1% male), were recruited from six schools to complete the translated ACSID-11, Internet Gaming Disorder Scale-Short Form (IGDS9-SF), Bergen Social Media Addiction Scale (BSMAS), and Smartphone Application Based Addiction Scale (SABAS) via an online platform. Pearson correlation coefficients assessed convergent/discriminant validity. Factor structure and measurement invariance were examined through confirmatory factor analysis (CFA) and multi-group CFA. Cronbach's alpha and McDonald's omega tested internal consistency.

Results: Associations between the ACSID-11 components and other scales supported convergent validity (i.e., ACSID-11 gaming scale with IGDS9-SF [$0.37 \leq r \leq 0.41$]; social networks use scale with BSMAS [$0.24 \leq r \leq 0.31$]) and discriminant validity (i.e., online gambling scale with BSMAS [$0.16 \leq r \leq 0.19$] and with SABAS [$0.11 \leq r \leq 0.13$]). A four-factor solution indicated good fit with comparative fit index (CFI) ranging from 0.982 to 0.958. The ACSID-11 was measurement invariant across sexes (ΔCFI = -0.001 to 0.000) and different levels of related addictive behaviors (ΔCFI = -0.001 to 0.000). Both Cronbach's alpha and McDonald's omega (0.63 to 0.97) were acceptable for both frequency and intensity of responses.

Conclusions: The ACSID-11 is an appropriate scale to assess different kinds of PUI among Chinese adolescents and students. Psychometric assessment of the measure in other cultures and among clinical samples is recommended.

1. Introduction

The internet provides many benefits for individuals worldwide and is a practical platform for many endeavors involving business, education, entertainment, and medical treatment [1]. Internet use may also be a driving force for many behavioral changes, particularly among adolescents and young adults [2,3]. This population can spend considerable time engaged in different online activities that may directly affect their mood, social relationships, and task completion [4]. Problematic use of the internet (PUI), which encompasses a broad spectrum of activities such as online gaming, social media use, pornography use, shopping, gambling, web-streaming [5], and related use on electronic devices may be harmful to a small minority. Individuals may experience problematic use of social media (PUSM), characterized by an overuse of social media, potentially leading to symptoms resembling addiction [6], or internet gaming disorder (IGD), a condition where an individual is unable to control their gaming habits, prioritizing gaming over other activities, and continuing to game despite negative consequences, leading to significant impairment in various areas of functioning [7]. These conditions may be considered as specific forms of PUI [8,9].

Individuals with PUI (such as those with problems regarding online behaviors, which include but not limited to gaming, gambling, sex, social media use, and shopping) may experience addictive symptoms such as mood modification (fluctuations in emotional states before and after internet use), preoccupation, tolerance, withdrawal symptoms, conflict (in interpersonal relationships, occupation and/or education), and relapse (recurrence of the behavior after a period of abstinence). However, there are some other kinds of addiction that may cause similar problems/symptoms to PUI but are different types of technology addiction. For example, problematic smartphone use is viewed by some scholars as a behavioral addiction. Smartphones (like computers and laptops) provide access to the internet for their users, and users can therefore become addicted to its many different applications such as gaming, gambling, and social media use [10]. As with substance use and related disorders, adolescents and young adults may be at high risk of PUI [4]. Because adolescence is an important transitional period, risky behaviors may extend into (and impact functioning during) adulthood [3].

A recent systematic review reported that the global prevalence rates of smartphone addiction and social media addiction were 17.4% and 14.2% respectively, and that those living in low to middle income countries as well as being male were at higher risk of these addictions [11]. Stevens et al. [12] in assessing studies from 2009 to 2019 from 17 different countries reported that the worldwide prevalence of gaming disorder was nearly 3% (and just under 2% when only including data from studies with higher quality data), and that males were 2.5 times more likely than females to be at risk of gaming disorder. However, they attributed about 77% of the variance to the choice of screening tool. The point that choosing different tools may provide different results regarding the prevalence of gaming disorder was also noted in Pan et al.'s study [13]. They also found that the prevalence of internet addiction was higher than internet gaming disorder. Moreover, some evidence shows gender differences in internet addiction when considering factors such as economy and social norms [14].

Another study assessing internet addiction among adolescents reported that the prevalence in Hong Kong ranged from 3% to 26% and was higher than many other regions in the world [15]. They also reported that being male and having higher school grades were risk factors for internet addiction [15]. Similarly, the higher prevalence of such addiction and its obsessive-compulsive symptoms among male Chinese students have been noted by Gao et al. [16]. Moreover, Cheng et al. [17] found that cultural factors may have a determinative role in interpreting social media addiction. More specifically, social media addiction in collectivist nations (e.g., the South-East Asia countries) was twofold higher than that observed in the individualist ones (e.g., western countries).

There is no uniformly agreed-upon classification of or definition for PUI. Potential classifications include PUI as an addictive, impulse-control or obsessive-compulsive disorder [18,19]. PUI has been associated with various problems and symptoms [4,9,19,20]. Individuals with PUI may be at high risk for anxiety, depression, and impaired social relationships with peers [2,9]. Lifestyle-associated concerns, including sedentary behaviors, limited physical activity, and unhealthy eating, also have been reported among individuals with PUI [21–23].

Despite evidence concerning the negative correlates of PUI, it has not been formally introduced as a disorder/disease in the DSM-5 or the ICD-11. One specific type of PUI, IGD, has been included as a tentative disorder in Section III of the DSM-5, with 'gaming disorder' formally included in the ICD-11 [24,25]. In the ICD-11, both gaming and gambling disorders have online and offline specifiers, and the designation of "other specified disorders due to addictive behaviors" has been proposed as a possible entity for diagnosing other forms of PUI (e.g., PUSM) [18,25]. Therefore, the internet may be considered a delivery device for potential addictive behaviors, while specific online activities may be better considered as the focus of potentially addictive behavior. Given this, both generalized and specific forms of PUI warrant investigation [8,26,27].

Prior research shows that up to 26% of US adolescents and university students and 13.5% of adolescents aged 14–16 years in Europe may be considered as using the internet in a maladaptive way [28–30]. The

estimated prevalence of PUI among Chinese adolescents is approximately 12%, which is slightly higher than the global average of 10% [16,31]. However, prevalence estimates for PUI of 1% in some European countries to over 25% in some Asian countries have been reported although higher estimates are typically reported among convenience samples [32–34]. The wide range may also reflect a lack of standardized measures and consensus on the definition of PUI criteria.

Because there is no agreement on a single definition for (and specific domains of) PUI, it is not surprising that several different psychometric instruments have been developed for its measurement. Many of these instruments extend from the Internet Addiction Test [35], modeled in part on the DSM-IV criteria for pathological gambling, and were further modified by Demetrovics et al. to assess associated harms [36]. By 2014, >45 instruments had been developed to assess generalized or specific PUI. However, studies have shown that the psychometric properties of many instruments were not fully supported and suffered from shortcomings such as (i) using different conceptual frameworks of PUI, (ii) being designed just for adults, (iii) having no well-defined cut-points to detect at-risk groups, (iv) using only the criteria proposed by DSM-5 for gaming or gambling disorders, (v) having insufficient description of the theoretical foundations, and (vi) an absence of adequate psychometric testing [37,38].

In response to this, Muller et al. developed the Assessment of Criteria for Specific Internet-use Disorders (ACSID-11), a comprehensive yet relatively brief scale to assess specific internet use disorders based on ICD-11 criteria [25]. The ACSID-11 covers different internet-based activities including gambling, gaming, shopping, social networking, and pornography consumption and has demonstrated adequate psychometric properties in German, Thai, and traditional Chinese versions [25,39–41]. Another advantage of the scale compared to others is that it assesses both frequency and intensity of PUI symptoms that may provide more insight into PUI and the detection of high-risk individuals [7].

To develop the measure, Müller et al. [25] gathered an expert group of clinicians and researchers who worked in the addiction field and through multiple discussions based on ICD-11 criteria, a multifactorial structure was proposed and Talk-Aloud Analysis was used to assess content validity. For preparing the scale, a number of participants were asked to indicate the most common activities engaged in on the internet during the past year. These activities with their definitions were then presented to the participants and they asked to apprise them as accepted or not accepted using a two-part response format for frequency and intensity. They used the 10-item Internet Gaming Disorder Test to assess convergent validity, and scales such as Patient Health Questionnaire-4 and Life Satisfaction Short Scale were used to assess discriminant validity. The confirmatory factor analysis also examined the construct validity of the scale among 958 participants aged between 16 and 69 years old.

The ACSID-11 was developed to assess specific internet-use addiction among adults and has only been validated in three languages (German, Thai and traditional Chinese) [25,39,41]. The Chinese language includes several dialects. The most prevalent form is Mandarin, which is spoken by >70% Chinese population around the world. However, written Chinese has two general formats (i.e., Traditional Chinese and Simplified Chinese). Traditional Chinese includes complicated and historical characters and is mainly used in Hong Kong, Taiwan, and Macau. Simplified Chinese (as the name suggests) consists of less intricate characters and is mainly used in mainland China, Malaysia, and Singapore [42]. In other words, apart from the limited evidence regarding different language versions of the ACSID-11, the ACSID-11 has never been validated among an adolescent sample. Given that adolescents are at high risk of having PUI and parents may want to know if their children have an issue of PUI, there is an urgent need to know if the ACSID-11 is valid in the specific population.

Moreover, in the previous ACSID-11 validation studies, the scale showed significant correlations with other scales assessing different variants of PUI (i.e., internet gaming disorder, problematic social media use) as well as other scales examining specific kinds of technology addiction (i.e., smartphone addiction) [25,39–41]. Therefore, it was hypothesized that the scales used would show significant correlations with the ACSID-11 (as evidence of convergent validity). Therefore, the aim of the present study was to translate the ACSID-11 into simplified Chinese and to assess psychometric properties among a large sample of adolescents. Moreover, based on the previous findings from German, Thai, and traditional Chinese ACSID-11 [25,39,41], the present study hypothesized that the ACSID-11 would have a four-factor structure and promising psychometric properties. The present study also hypothesized that the ACSID-11 would be measurement invariant across sex and different levels of related addictive behaviors.

2. Methods

2.1. Participants and procedures

The present study was approved by the Human Subjects Ethic Review Board of Jiangxi Psychological Consultant Association (Reference no: JXSXL-2023-SE0906) before the commencement of the study. Participants (n = 11,492 students) were recruited from six schools (including three junior and three senior vocational schools) in China using convenience sampling between September 8 and September 26, 2023. All six schools were located in a city in a northern province of China. The participants were predominantly of Han ethnicity. To ensure adherence to ethical data collection procedures, the research purpose was initially presented to the classroom teachers of these schools through the administrators. The teachers were then encouraged to discuss the purpose with the students' parents, either through face-to-face meetings or online chat groups. Electronic consent was obtained from parents who allowed their children to participate in the survey. Subsequently, participating students completed the online survey in their school's computer classroom. Written informed consent was obtained from parents or guardians of the participants. Moreover, all participants provided their assent for participation.

All participants were requested to complete an online questionnaire including demographic information and specific measures comprising the ACSID-11, Internet Gaming Disorder Scale-Short Form (IGDS9-SF), Bergen Social Media Addiction Scale (BSMAS), and Smartphone Application Based Addiction Scale (SABAS). The inclusion criteria included: (i) being aged between 12 and 18 years, inclusive; (ii) having the ability to read and understand simplified Chinese characters; (iii) studying at a school in China; and (iv) voluntarily agreeing to participate in the study along with permission from their parents or guardians. To control the data quality, the online survey link was sent out by the schoolteachers to the students who agreed to participate. This ensured that only eligible participants could complete the survey. Moreover, data from participants completing the survey in <5 min were excluded from data analysis to ensure that the answers were of good quality.

2.2. Translation process

After obtaining permission from Professor Matthias Brand for translation of the ACSID-11 into Chinese, translation guidelines were adopted for cross-cultural adaptation [43]. Details of translation process are described in Supplementary Material A. In brief, two translators conducted individual translation to forward translate the ACSID-11 into Chinese. Then, an expert panel evaluated the two forward translations to integrate it into a single one for back translation. A third translator then back-translated the Chinese ACSID-11 into English. All translations and the original ACSID-11 were reviewed by the expert panel and pilot tested by several schoolteachers and university students to ensure readability. During the translation process, cross-cultural adaptions were made in relation to different online activities (e.g., *eBay* was not used for online shopping; instead, *Taobao* was used). However, the wordings regarding item content were not changed for adolescents

because pilot testing indicated that the items were understandable to this cohort.

2.3. Measures

2.3.1. Assessment of Criteria for Specific Internet-use Disorders (ACSID-11)

The ACSID-11 is an 11-item scale with three main criteria: impaired control (IC), increased priority (IP) given to the online activity, and continuation/escalation (CE) of internet use despite negative consequences. Please also see Supplementary Material A for the detailed translation procedure. It also has two other items that assess functional impairment (FI) in daily life and marked distress (MD) due to the online activity [25]. Participants answered which specific forms of internet behaviors in which they had engaged in during the previous year: specifically, 'gaming', 'online shopping', 'online pornography use', 'social networks use', 'online gambling', and 'other'. Thereafter, participants answered ACSID-11 relating to the behaviors they had engaged in. Responses are rated on four-point Likert scale categorized into two responses: frequency (or how often?) ranging from 0 (*never*) to 3 (*often*); and intensity (or how intense?) ranging from 0 (*not at all intense*) to 3 (*intense*). Higher summed scores reflect more severe risk of addictive behaviors. The original version (German language) presented excellent internal consistency (Cronbach's alpha = 0.90–0.95 for frequency response, and Cronbach's alpha = 0.89–0.94 for intensity response) [25]. In other studies that assessed the psychometric properties of the ACSID-11, the internal consistency of the scale had a Cronbach's alpha value equal or higher than 0.82 for both frequency and intensity response [39–41].

2.3.2. Internet Gaming Disorder Scale-Short Form (IGDS9-SF)

The IGDS9-SF is a nine-item scale assessing severity of IGD based on the nine DSM-5 diagnostic criteria for IGD [44]. Responses are rated from 1 (*never*) to 5 (*very often*), with a cut-off score of 32 (total score is 45) reflecting IGD [45]. The IGDS9-SF has been validated in Chinese (Cronbach's alpha = 0.93–0.94) [46].

2.3.3. Bergen Social Media Addiction Scale (BSMAS)

The BSMAS is a six-item scale assessing social media addiction based on six proposed core addiction features [47–49]. Responses are rated from 1 (*very rarely*) to 5 (*very often*), with a cut-off score of 19 (total score is 30) reflecting PUSM [6,48]. The BSMAS has been validated in Chinese (Cronbach's alpha = 0.82–0.85) [46]. Significant associations between the BSMAS and ACSID-11 were found in a German sample [40].

2.3.4. Smartphone Application-Based Addiction Scale (SABAS)

The SABAS is a six-item scale assessing smartphone application-based addiction based on six proposed core addiction features [48,50]. Items in the SABAS concern general smartphone use and do not ask about specific applications or internet use on smartphone. Responses are rated from 1 (*strongly disagree*) to 6 (*strongly agree*), with a cut-off score of 21 (total score is 36) reflecting problematic smartphone use [51]. The SABAS has been validated in Chinese (Cronbach's alpha = 0.78–0.79) [46].

2.3.5. Demographics

Two items were used to obtain the participants' age and sex information. For age, the participants were asked to provide their age in years. For sex, the participants were asked to answer if they are male or female (a binary response).

2.4. Statistical analyses

Descriptive statistics were used to summarize participants' characteristics and report mean scores of the study measures (ACSID-11, IGDS9-SF, BSMAS, and SABAS) as well as mean scores of ACSID-11 items. Item properties of the ACSID-11 were investigated using factor loadings obtained from confirmatory factor analysis (CFA) and the item-total correlations. Factor loadings and the item-total correlations above 0.4 were interpreted as acceptable [52]. Moreover, Cronbach's α and McDonald's ω coefficients were used to examine internal consistency in each domain of the ACSID-11 (i.e., IC, IP, CE, FI domains). Cronbach's α and McDonald's ω above 0.7 were interpreted as acceptable [53].

For factor structure analysis, two proposed models were examined (between one-factor and four-factor structures) with diagonally weighted least squares (DWLS) estimation. The four-factor structure was the model proposed by Müller et al. [25]. Therefore, the four-factor structure was also the initially hypothesized model for the present study. The one-factor structure was also examined by Müller et al. [25] but in an exploratory nature. Therefore, the present study also examined the one-factor structure as a comparative model. Additionally, the analysis adopted a nonsignificant χ^2 test, a comparative fit index (CFI) $>$ 0.9, a Tucker-Lewis index (TLI) $>$ 0.9, a standardized root mean square residual (SRMR) $<$ 0.08, and a root mean square error of approximation (RMSEA) $<$ 0.08 to determine model fit indices [54].

To determine measurement invariance, multi-group CFA (MGCFA) was used to assess consistency of the ACSID-11 structure across subgroups: sex (female and male), IGDS9-SF score ($<$ 32 and $\geq$ 32), BSMAS score ($<$ 19 and $\geq$ 19) and SABAS score ($<$ 21 and $\geq$ 21). Three nested models in the MGCFA with three steps were tested and compared. Configural invariance (M1) tested the equivalence overall factor structure of the ACSID-11 across subgroups. Metric invariance (M2) tested the equivalence of factor loadings of the ACSID-11 across subgroups. Scalar invariance (M3) tested the equivalence of item intercepts of the ACSID-11 across subgroups. A non-significant χ^2 difference test and values of ΔCFI, ΔRMSEA, ΔSRMR below 0.01 were used to determine if measurement invariance was supported [55].

Additionally, Pearson correlation coefficients were used to assess the association between all domains of the ACSID-11 (IC, IP, CE, and FI domains) and IGDS9-SF, BSMAS and SABAS scores to indicate convergent/discriminant validity. Moreover, there was no analytic procedure to tackle the issue of missing data because the online survey could not be submitted unless all questions were answered. Consequently, there were no missing data. Data were analyzed using JASP (https://jasp-stats.org/).

2.5. Sample size calculation

The sample size was calculated using the following considerations: (i) the prevalence of problematic gambling for Chinese individuals is approximately 2.5% to 4% [56]; (ii) the prevalence of problematic pornography use is approximately 9% to 25% [57]; (iii) a CFA needs to have at least 200 participants [58]. Given that the smallest prevalence mentioned above was 2.5% (for gambling), 8000 participants are required. However, given that individuals with gambling or pornography use issues may not have wanted to participate in the study, the size was increased two-fold (i.e., to 16,000).

3. Results

The response rate was 71.8% (11,492 of the 16,000 invited participants agreed to participate), and the completion rate was 100% (all 11,492 participants completed the survey). There were no missing data because the online survey could not be submitted unless all questions were answered. Participant characteristics, prevalence of specific internet-use behaviors engagement, and prevalence of different PUIs are shown in Table 1. The present study comprised 11,492 participants (4700 females and 6792 males) with a mean age of 16.42 ± 0.91 years (ranging between 12 and 18 years). Among the 11,492 participants, 51.4% had engaged in online gaming, 60.1% had engaged in online shopping, 13.3% had engaged in online pornography use, 46.4% had engaged in social networks use, and 10.1% had engaged in online

Table 1
The characteristics of study participants ($N = 11,492$).

	Mean (SD)	Total n (%)	Female		Male	
			Mean (SD)	n (%)	Mean (SD)	n (%)
Age (in years)	16.42 (0.91)	11,492	–	4700 (40.9)	–	6792 (59.1)
12		5 (0.04)	–	1 (20)	–	4 (80)
13		7 (0.06)	–	3 (42.9)	–	4 (57.1)
14		20 (0.2)	–	6 (30)	–	14 (70)
15		1712 (14.9)	–	713 (41.7)	–	999 (58.3)
16		4543 (39.5)	–	1811 (39.9)	–	2732 (60.1)
17		3757 (32.7)	–	1572 (41.8)	–	2185 (58.2)
18		1448 (12.6)	–	594 (41.1)	–	854 (58.9)
ACSID-11						
Gaming (Yes)	–	5906 (51.4)	–	1721 (29.1)	–	4185 (70.9)
Online shopping (Yes)	–	6910 (60.1)	–	2987 (43.2)	–	3923 (56.8)
Online pornography use (Yes)	–	1533 (13.3)	–	344 (22.4)	–	1189 (77.6)
Social networks use (Yes)	–	5330 (46.4)	–	2263 (42.5)	–	3067 (57.5)
Online gambling (Yes)	–	1111 (10.1)	–	319 (27.6)	–	837 (72.4)
IGDS-T	17.00 (7.02)	–	16.06 (6.43)	–	17.66 (7.33)	–
Score $<$ 32	16.58 (6.40)	11,261 (98)	–	4647 (41.3)	–	6614 (58.7)
Score $\geq$ 32	37.55 (4.57)	231 (2.0)	–	53 (22.9)	–	178 (77.1)
BSMAS-T	13.38 (4.60)	–	13.52 (4.22)	–	13.29 (4.84)	–
Score $<$ 19	12.63 (3.96)	10,498 (91.4)	–	4324 (41.2)	–	6174 (58.8)
Score $\geq$ 19	21.34 (3.06)	994 (8.6)	–	376 (37.8)	–	618 (62.2)
SABAS-T	15.10 (6.76)	–	15.64 (6.65)	–	14.73 (6.81)	–
Score $>$ 21	12.32 (4.65)	8878 (77.3)	–	3525 (39.7)	–	5353 (60.3)
Score $\geq$ 21	24.56 (3.42)	2614 (22.7)	–	1175 (45)	–	1439 (55)

SD Standard deviation.
ACSID-11 Assessment of Criteria for Specific Internet-use Disorders.
IGDS-T Internet Gaming Disorder Scale-Short Form (total score).
BSMAS-T Bergen Social Media Addiction Scale (total score).
SABAS-T Smartphone Application Based Addiction Scale (total score).

gambling. Based on the IGDS9-SF cutoff, 2.0% were considered as being at-risk of IGD, 8.6% as being at-risk of PUSM, and 22.7% as being at-risk of problematic smartphone use. The item properties of the ACSID-11 are shown in Table 2. The factor loadings obtained from CFA and item-total correlation reported higher than 0.4 for all behaviors of ACSID-11 in both frequency and intensity responses. Most internal consistency coefficients were higher than 0.7 for the ACSID-11 in both frequency and intensity responses.

The CFA results are shown in Table 3. The four-factor structure showed excellent fit compared with one-factor structure for all specific internet-use behaviors of the ACSID-11. In addition to the model fit indices, Supplementary Tables S1-S4 show that measurement invariance was supported across various groups. Gender (female and male), IGDS9-SF score ($<$ 32 score and $\geq$ 32 score), BSMAS score ($<$ 19 score and $\geq$ 19 score), and SABAS score ($<$ 21 score and $\geq$ 21 score), all reached the expected values for model fit.

Results of convergent/discriminant validity are shown in Table 4. All domains of the ACSID-11 (i.e., IC, IP, CE, FI domains) reported significant and positive associations with scores on the IGDS9-SF, BSMAS, and SABAS for both frequency and intensity responses. Moreover, IGDS9-SF score was significantly and positively associated with BSMAS and SABAS scores.

4. Discussion

The present study was conducted to provide a culturally adapted version of a newly developed measure (ACSID-11) assessing specific aspects PUI among a large sample of adolescents. The results indicated that the measure included the four hypothesized dimensions. The prevalence of internet-use behaviors in the present study was highest for online shopping (60.1%), followed by gaming (51.4%) and using social networks (46.4%). Only 10.1% of participants reported online gambling, and the frequency of reported pornography use was also low (13.3%). These prevalence findings are comparable with the results of the German and Thai versions of the ACSID-11 [25,39]. The high prevalence rates of shopping, gaming, and using social networks found in the present study indicate the urgency for authorities to foster effective prevention programs to tackle the PUI. Although the main goal of the present study was not to determine the prevalence of these behaviors, the findings here together with the results from the two previous studies suggest that using an assessment tool that includes a number of potentially addictive internet use behaviors is needed. Moreover, a multi-dimensional assessment instrument may be more beneficial than single-dimensional measures to assess different aspects of PUI, especially when considering different ages, cultural backgrounds, and other factors. However, to better understand prevalence rate or to find cases who need special care due to pathological use of internet, a validated cut-off point would be helpful. Oelker et al. in their application of ACSID-11 suggested some cutoffs for the ACSID-11 that are not clinically validated but may be used as basis to identify individuals who might be at higher risk of internet addiction disorders and may also be considered as a screening tool to identify at-risk populations [40].

Using the IGDS9-SF, BSMAS and SABAS, the ACSID-11 had good convergent and discriminant validity. Moreover, it was found that problematic smartphone use had higher prevalence compared with two other types of problematic internet use behaviors (i.e., IGD and PUSM). This is consistent with a recent meta-analysis that reported frequent smartphone use among adolescents [59]. However, another recent meta-analysis assessing IGD and PUSM during COVID-19 pandemic reported much higher prevalence rates than those in the present study [60]. The differences in the prevalence rates might be explained by the population (i.e., the present study assessed adolescents and the meta-analysis [60] had no restriction on age for the studied populations) and the international context (i.e., the present study was conducted after COVID-19 pandemic was over and the meta-analysis assessed the prevalence rates during the COVID-19 pandemic). As such, PUI in different specific forms such as IGD and PUSM warrants further investigation to enhance understanding of clinically relevant correlates and possible health promotion approaches, especially given guidance about, for example, social media use and adolescent mental health [61].

The reliability of the ACSID-11 was measured using two internal consistency indices including Cronbach's α and McDonald's ω. Although the Cronbach's α is a widely used index of reliability in the literature, several methodologists have emphasized that it is not an optimal measure for this purpose [62,63]. Therefore, applying both measures concurrently may help better assess how the study's aims may be supported by the data. Both approaches found that there were significant correlations between the items and total score to confirm the reliability of the scale. However, the stability of the findings across time has not been assessed and warrants examination in future studies.

Table 2
Psychometric properties of the ACSID-11 at the item level.

Gaming ($N = 5906$)														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
AC-IC						0.82	0.82						0.90	0.91
Item 1	0.63	0.61	1.18 (0.94)	0.25	−0.92			0.77	0.76	0.93 (0.84)	0.57	−0.40		
Item 2	0.78	0.73	0.89 (0.89)	0.65	−0.49			0.88	0.86	0.84 (0.86)	0.74	−0.30		
Item 3	0.93	0.68	0.71 (0.83)	0.96	0.13			0.96	0.81	0.75 (0.85)	0.90	−0.03		
AC-IP						0.94	0.94						0.77	0.89
Item 4	0.86	0.81	0.80 (0.87)	0.82	−0.24			0.90	0.80	0.77 (0.86)	0.88	−0.07		
Item 5	0.93	0.90	0.67 (0.82)	1.05	0.31			0.40	0.36	0.14 (0.39)	2.81	7.56		
Item 6	0.95	0.89	0.65 (0.82)	1.08	0.39			0.93	0.83	0.68 (0.83)	1.05	0.29		
AC-CE						0.97	0.97						0.97	0.97
Item 7	0.96	0.92	0.59 (0.79)	1.21	0.74			0.97	0.93	0.63 (0.81)	1.14	0.54		
Item 8	0.96	0.93	0.60 (0.80)	1.20	0.69			0.97	0.95	0.62 (0.81)	1.17	0.60		
Item 9	0.93	0.92	0.56 (0.78)	1.31	1.00			0.94	0.93	0.60 (0.80)	1.23	0.76		
AC-FI						0.94	0.94						0.63	0.63
Item10	0.96		0.60 (0.80)	1.20	0.71			0.53	0.49	0.27 (0.56)	2.24	5.16		
Item11	0.93	0.89	0.56 (0.78)	1.29	0.95			0.93	0.49	0.59 (0.80)	1.24	0.78		

Online shopping ($N = 6910$).														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
AC-IC						0.82	0.82						0.90	0.83
Item 1	0.61	0.59	1.11 (0.90)	0.30	−0.84			0.76	0.75	0.87 (0.81)	0.62	−0.28		
Item 2	0.79	0.73	0.83 (0.86)	0.74	−0.30			0.88	0.85	0.78 (0.83)	0.81	−0.09		
Item 3	0.94	0.69	0.67 (0.80)	1.00	0.24			0.95	0.80	0.70 (0.81)	0.95	0.15		
AC-IP						0.94	0.94						0.79	0.90
Item 4	0.88	0.83	0.72 (0.82)	0.90	0.01			0.90	0.81	0.70 (0.81)	0.96	0.19		
Item 5	0.94	0.91	0.62 (0.79)	1.10	0.50			0.47	0.42	0.14 (0.39)	2.79	7.47		
Item 6	0.95	0.90	0.61 (0.78)	1.12	0.53			0.93	0.84	0.63 (0.80)	1.10	0.48		
AC-CE						0.97	0.97						0.97	0.97
Item 7	0.96	0.93	0.56 (0.77)	1.23	0.81			0.97	0.93	0.59 (0.78)	1.18	0.72		
Item 8	0.96	0.94	0.56 (0.76)	1.23	0.83			0.96	0.95	0.59 (0.78)	1.21	0.79		
Item 9	0.94	0.92	0.53 (0.75)	1.30	1.02			0.95	0.93	0.56 (0.77)	1.26	0.92		
AC-FI						0.95	0.95						0.72	0.72
Item10	0.97	0.91	0.55 (0.76)	1.24	0.91			0.64	0.59	0.28 (0.57)	2.13	4.47		
Item11	0.94	0.91	0.53 (0.75)	1.31	1.05			0.92	0.59	0.56 (0.77)	1.27	0.94		

Online pornography use ($N = 1533$).														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
AC-IC						0.84	0.84						0.90	0.90
Item 1	0.78	0.66	0.33 (0.66)	2.12	3.84			0.85	0.76	0.28 (0.61)	2.40	5.50		

(*continued on next page*)

Table 2 (*continued*)

Online pornography use ($N = 1533$).														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
Item 2	0.72	0.69	0.36 (0.76)	2.22	4.08			0.84	0.83	0.29 (0.66)	2.46	5.67		
Item 3	0.90	0.76	0.28 (0.65)	2.51	5.94			0.91	0.83	0.27 (0.63)	2.57	6.38		
AC-IP						0.96	0.96						0.82	0.91
Item 4	0.92	0.88	0.25 (0.59)	2.60	6.61			0.92	0.84	0.25 (0.60)	2.63	6.83		
Item 5	0.94	0.92	0.23 (0.57)	2.71	7.34			0.54	0.50	0.08 (0.29)	4.00	16.64		
Item 6	0.94	0.91	0.23 (0.58)	2.74	7.43			0.93	0.85	0.23 (0.58)	2.74	7.56		
AC-CE						0.96	0.96						0.97	0.97
Item 7	0.95	0.92	0.22 (0.55)	2.83	8.13			0.96	0.93	0.23 (0.57)	2.78	7.82		
Item 8	0.95	0.93	0.22 (0.56)	2.81	8.00			0.96	0.94	0.23 (0.57)	2.81	8.01		
Item 9	0.94	0.92	0.21 (0.55)	2.85	8.27			0.94	0.92	0.22 (0.56)	2.87	8.45		
AC-FI						0.96	0.95						0.74	0.74
Item10	0.97	0.92	0.21 (0.54)	2.86	8.37			0.70	0.64	0.12 (0.37)	3.32	10.98		
Item11	0.95	0.92	0.21 (0.55)	2.90	8.56			0.92	0.64	0.22 (0.56)	2.87	8.41		

Social networks use ($N = 5330$).														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
AC-IC						0.80	0.80						0.89	0.90
Item 1	0.59	0.57	1.12 (0.98)	0.38	−0.95			0.76	0.74	0.90 (0.88)	0.68	−0.38		
Item 2	0.79	0.71	0.79 (0.88)	0.86	−0.18			0.87	0.84	0.77 (0.87)	0.89	−0.08		
Item 3	0.92	0.67	0.64 (0.82)	1.12	0.45			0.95	0.79	0.68 (0.84)	1.03	0.24		
AC-IP						0.93	0.93						0.77	0.89
Item 4	0.85	0.80	0.72 (0.87)	0.97	0.01			0.89	0.81	0.69 (0.84)	1.03	0.23		
Item 5	0.94	0.90	0.60 (0.80)	1.19	0.65			0.44	0.38	0.14 (0.38)	2.85	7.81		
Item 6	0.94	0.88	0.58 (0.80)	1.23	0.75			0.92	0.82	0.61 (0.81)	1.21	0.69		
AC-CE						0.96	0.96						0.97	0.97
Item 7	0.96	0.92	0.53 (0.76)	1.36	1.17			0.96	0.93	0.57 (0.79)	1.30	0.95		
Item 8	0.95	0.93	0.53 (0.77)	1.36	1.17			0.96	0.95	0.56 (0.78)	1.33	1.07		
Item 9	0.93	0.91	0.50 (0.75)	1.45	1.44			0.94	0.93	0.54 (0.78)	1.39	1.22		
AC-FI						0.94	0.94						0.71	0.71
Item10	0.96	0.89	0.53 (0.76)	1.38	1.22			0.64	0.59	0.26 (0.53)	1.89	2.67		
Item11	0.93	0.89	0.50 (0.75)	1.46	1.47			0.92	0.59	0.53 (0.77)	1.39	1.25		

Online gambling ($N = 1111$).														
Frequency rating								Intensity rating						
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
AC-IC						0.82	0.82						0.89	0.89
Item 1	0.78	0.65	0.27 (0.62)	2.43	5.40			0.83	0.74	0.24 (0.58)	2.63	6.84		
Item 2	0.69	0.66	0.33 (0.75)	2.38	4.86			0.83	0.81	0.26 (0.64)	2.69	6.97		

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Table 2 (*continued*)

Online gambling ($N = 1111$).													
Frequency rating								Intensity rating					
	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]	Factor[a] loadings	Item-total correlation	Mean (SD)	Skewness	Kurtosis	α[b]	ω[c]
Item 3	0.89	0.74	0.25 (0.61)	2.70	7.06			0.90	0.81	0.24 (0.61)	2.75	7.44		
AC-IP						0.95	0.95						0.80	0.91
Item 4	0.93	0.89	0.22 (0.56)	2.80	7.79			0.92	0.85	0.22 (0.56)	2.83	8.10		
Item 5	0.94	0.91	0.21 (0.56)	2.90	8.49			0.49	0.45	0.06 (0.26)	4.57	22.17		
Item 6	0.94	0.91	0.21 (0.56)	2.91	8.59			0.93	0.84	0.21 (0.56)	2.92	8.66		
AC-CE						0.96	0.96						0.97	0.97
Item 7	0.95	0.92	0.20 (0.54)	2.97	9.04			0.96	0.92	0.21 (0.55)	2.95	8.90		
Item 8	0.94	0.93	0.20 (0.54)	2.99	9.14			0.95	0.94	0.21 (0.55)	3.00	9.23		
Item 9	0.95	0.92	0.20 (0.53)	3.01	9.34			0.95	0.93	0.20 (0.54)	3.03	9.47		
AC-FI						0.96	0.96						0.75	0.75
Item10	0.97	0.92	0.19 (0.53)	3.03	9.50			0.71	0.65	0.11 (0.36)	3.47	12.13		
Item11	0.95	0.92	0.20 (0.54)	3.06	9.66			0.91	0.65	0.20 (0.54)	3.06	9.67		

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders.
AC-IC Assessment of Criteria for Specific Internet-use Disorders (impaired control domain score).
AC-IP Assessment of Criteria for Specific Internet-use Disorders (increased priority given to the online activity domain score).
AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score).
AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score).
SD Standard deviation.
α Cronbach alpha coefficient.
ω McDonald omega coefficient.
[a] Factor loadings derived by standardized coefficients in the confirmatory factor analysis.
[b] α and [c]ω Reliability analysis for each domain.

Table 3
Fit indices of confirmatory factor analyses for one-factor or four-factor structures of the ACSID-11.

Structure	Frequency rating						Intensity rating					
Domain	χ^2 (*df*)	*p*-value	CFI	TLI	RMSEA (90% CI)	SRMR	χ^2 (*df*)	*p*-value	CFI	TLI	RMSEA (90% CI)	SRMR
One-factor												
Gaming	1379.52 (44)	< 0.001	**0.992**	**0.990**	**0.051 (0.049, 0.054)**	**0.055**	1395.00 (44)	< 0.001	**0.990**	**0.988**	**0.052 (0.049, 0.054)**	**0.074**
Online shopping	1109.72 (44)	< 0.001	**0.993**	**0.992**	**0.046 (0.044, 0.048)**	**0.051**	1171.52 (44)	< 0.001	**0.992**	**0.989**	**0.047 (0.045, 0.050)**	**0.067**
Online pornography use	152.53 (44)	< 0.001	**0.998**	**0.998**	**0.015 (0.012, 0.017)**	**0.033**	228.16 (44)	< 0.001	**0.996**	**0.995**	**0.019 (0.017, 0.022)**	**0.048**
Social networks use	1184.41 (44)	< 0.001	**0.992**	**0.990**	**0.047 (0.045, 0.050)**	**0.053**	1406.12 (44)	< 0.001	**0.989**	**0.987**	**0.052 (0.050, 0.054)**	**0.070**
Online gambling	104.07 (44)	< 0.001	**0.999**	**0.999**	**0.011 (0.008, 0.014)**	**0.029**	171.15 (44)	< 0.001	**0.997**	**0.996**	**0.016 (0.013, 0.018)**	**0.045**
Four-factor												
Gaming	434.97 (38)	< 0.001	**0.998**	**0.996**	**0.030 (0.028, 0.033)**	**0.028**	631.78 (38)	< 0.001	**0.996**	**0.994**	**0.037 (0.034, 0.039)**	**0.060**
Online shopping	316.03 (38)	< 0.001	**0.998**	**0.998**	**0.025 (0.023, 0.028)**	**0.026**	532.85 (38)	< 0.001	**0.996**	**0.996**	**0.034 (0.031, 0.036)**	**0.053**
Online pornography use	27.78 (38)	0.889	**1.000**	**1.000**	**0.000 (0.000, 0.003)**	**0.013**	127.40 (38)	< 0.001	**0.998**	**0.997**	**0.014 (0.012, 0.017)**	**0.038**
Social networks use	409.15 (38)	< 0.001	**0.997**	**0.996**	**0.029 (0.027, 0.032)**	**0.027**	618.85 (38)	< 0.001	**0.995**	**0.995**	**0.036 (0.034, 0.039)**	**0.053**
Online gambling	19.36 (38)	0.995	**1.000**	**1.001**	**0.000 (0.000, 0.000)**	**0.012**	104.17 (38)	< 0.001	**0.998**	**0.997**	**0.012 (0.010, 0.015)**	**0.037**

Note. **Bolded** values indicate acceptable fit (i.e., CFI and TLI > 0.9; RMSEA and SRMR <0.08).
ACSID-11 Assessment of Criteria for Specific Internet-use Disorders.
CFI Comparative fit index.
TLI Tucker-Lewis index.
RMSEA Root mean square error of approximation.
SRMR Standardized root mean square residual.
CI Confidence interval.

Table 4
Correlations between domain scores of the ACSID-11 and IGDS-SF9, BSMAS, SABAS scores.

		Frequency rating				Intensity rating			
		IC	IP	CE	FI	IC	IP	CE	FI
Gaming	IGDS-T	0.40*	0.41*	0.40*	0.39*	0.41*	0.41*	0.38*	0.37*
	BSMAS-T	0.29*	0.27*	0.25*	0.24*	0.29*	0.28*	0.25*	0.25*
	SABAS-T	0.36*	0.34*	0.29*	0.28*	0.38*	0.34*	0.29*	0.28*
Online shopping	IGDS-T	0.30*	0.32*	0.32*	0.31*	0.30*	0.30*	0.30*	0.28*
	BSMAS-T	0.30*	0.27*	0.25*	0.24*	0.30*	0.27*	0.25*	0.24*
	SABAS-T	0.31*	0.28*	0.24*	0.23*	0.32*	0.28*	0.24*	0.23*
Online pornography use	IGDS-T	0.32*	0.31*	0.30*	0.30*	0.31*	0.30*	0.29*	0.28*
	BSMAS	0.20*	0.19*	0.18*	0.18*	0.19*	0.18*	0.17*	0.17*
	SABAS	0.18*	0.14*	0.14*	0.14*	0.16*	0.14*	0.13*	0.13*
Social networks use	IGDS-T	0.29*	0.31*	0.32*	0.31*	0.29*	0.31*	0.30*	0.29*
	BSMAS-T	0.31*	0.29*	0.26*	0.25*	0.31*	0.29*	0.25*	0.24*
	SABAS-T	0.31*	0.29*	0.25*	0.25*	0.33*	0.29*	0.25*	0.24*
Online gambling	IGDS-T	0.30*	0.29*	0.29*	0.28*	0.29*	0.28*	0.27*	0.27*
	BSMAS-T	0.19*	0.17*	0.17*	0.16*	0.18*	0.17*	0.16*	0.16*
	SABAS-T	0.13*	0.11*	0.11*	0.11*	0.12*	0.12*	0.11*	0.12*
IGDS-T	BSMAS-T	0.64*							
	SABAS-T	0.48*							
BSMAS-T	SABAS-T	0.43*							

ACSID-11 Assessment of Criteria for Specific Internet-use Disorders.
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AC-CE Assessment of Criteria for Specific Internet-use Disorders (continuation/escalation domain score).
AC-FI Assessment of Criteria for Specific Internet-use Disorders (functional impairment domain in daily life and marked distress score).
IGDS-T Internet Gaming Disorder Scale - short form (total score).
BSMAS-T Bergen Social Media Addiction Scale (total score).
SABAS-T Smartphone Application Based Addiction Scale (total score).
* $p < 0.001$.

One new finding in the present study was the invariance result. The present study utilized CFA for both dimensionality and invariance assessments. Regarding the factor structure of the ACSID-11, the results indicated that a four-factor solution provided a better fit than a one-factor solution. As suggested by Müller et al., subscales including IC, IP, CE, and FI may be classified as the four main components of the scale [25]. However, obtaining acceptable findings for the one-factor solution may also confirm the construct validity of the scale because all theoretical components in the four-factor solution are also inter-correlated and assess a unified construct of PUI. The point of note in invariance measurement across sex and PUI types is that the multi-group CFA was carried out for the first time. The results indicated that the ACSID-11 is acceptable in assessing PUI among both males and females and among students who may and may not have IGD, PUSM, and smartphone use addiction.

The present study also considered convergent/discriminant validity. Although of these types of validity were also examined in previous studies, the assessment in the present study eis more comprehensive because three independent scales were used (i.e., IGDS9-SF, BSMAS and SABAS), which have been reported to demonstrate convincing psychometric properties [44–46,50,51], for validity testing instead of just one (i.e., IGDS9-SF). Moreover, a larger sample was also used to test for convergent/discriminant validity in the present study to provide a more reliable outcome. However, the correlations between the ACSID-11 domains and other scales used to assess the convergent/discriminant validity produced findings that need further discussion.

First, although high correlations were expected between the individual parts of the scale and corresponding relevant scales (i.e., IGDS9-SF and BSMAS), the correlation coefficients were not higher than 0.40, while all these scales assessed some kind of problematic online behavior. Second, the correlations of ACSID-11 for social networks use showed partly higher correlations with the IGDS9-SF (gaming) than with the BSMAS (social media) (e.g., for functional impairment). Finally, correlations of ACSID-11 score (for each behavior) with the total scores on other scales (i.e., IGDS9-SF and BSMAS) indicated that the strengths of hypothetical relationships may differ based on the given domain. There are some likely explanations for these observed correlations. Low strength correlations might be due to low variance in the ACSID-11 domains. For example, FI consists of only two items.

Another issue that should be considered, particularly for low correlation between relevant constructs, is related to different domains assessed by ACSID-11. When using individual domains to define addictive behaviors, each domain may lead to correlations that may differ based on the behaviors. Nevertheless, this may provide a more comprehensive profile on the real associations between the domains and behaviors instead of just including a total score. In other words, while including different domains may increase the comprehensiveness of the scale (i.e., ACSID-11), these different domains may provide lower correlations with other scales that were specifically designed to assess one single domain (i.e., IGDS9-SF for internet gaming disorder and BSMAS for social media addiction). All common variants of PUI have been included in the ASCID-11 rather than just focusing on a single PIU behavior. Therefore, lower or higher correlations between different kinds of online disorders and corresponding components is arguably not surprising.

The present study includes some strengths. For example, a large sample was used for a validation study that may have increased the rigor of the findings. In addition, for the first time, the scale was validated among an adolescent sample, individuals that are at increasing risk of internet use disorders. Moreover, the study used an online survey to collect data, a process that may facilitate increased participation and is more cost-effective relative to face-to-face surveys.

There are also some limitations in the study. First, a convenience sample was used that may not be representative for all Chinese adolescents. Second, the present study used an online survey to collect data, which may have biases regarding anonymity and other factors. To mitigate against such biases, the importance of the study was communicated to participants and they were provided with simple instructions on how to complete the survey. Third, as participation was based on personal willingness to satisfy ethical concerns, it is possible that individuals who had PUI issues declined to participate in the study. Therefore, the prevalence PUI in the present study might be an

underestimate. Fourth, the present participants were asked for their sex using a binary response (i.e., male or female); therefore, it is unclear if the ACSID-11 could be generalized to those not identifying as male or female. Finally, due to using a cross-sectional design, the stability of the scale across time was not examined.

Based on the present findings, some future directions and clinical applications can be made. More specifically, the ACSID-11 appears to efficiently identify different high-risk behaviors related to PUI among Chinese youth. It may be useful for school administrations and health professionals to screen at-risk individuals for PUI and to plan interventions to prevent harms and complications among developing youth. However, further investigation is needed to identify additional criteria and finding practical cutoffs of the scale to distinguish clinical samples and its application as a screening tool for abnormal populations in term of internet use disorders. Cultural adaptation of the scale among other populations and languages, particularly in developing countries who may include a considerable number of people with problematic internet behaviors, is also recommended.

5. Conclusion

The present study's findings aligned with previous studies indicating that the ACSID-11 has a four-factor structure across all different online activities (e.g., gaming, social networks use) among Chinese adolescents. The ACSID-11 was also found to be invariant across sexes and addictive behaviors (according to the cutoff scores using the IGDS9-SF, BSMAS, and SABAS). Based on the promising psychometric properties found, further investigation is needed to identify practical cutoffs for the ACSID-11 to distinguish individuals having each specific internet disorder.

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CRediT authorship contribution statement

Mohsen Saffari: Writing – review & editing, Writing – original draft, Validation, Conceptualization. **Chao-Ying Chen:** Writing – review & editing, Writing – original draft, Validation, Methodology, Conceptualization. **I-Hua Chen:** Writing – review & editing, Validation, Methodology, Data curation. **Kamolthip Ruckwongpatr:** Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis. **Mark D. Griffiths:** Writing – review & editing, Validation, Methodology. **Marc N. Potenza:** Writing – review & editing, Validation, Methodology. **Xue Lian Wang:** Writing – review & editing, Validation, Data curation. **Yu-Ting Huang:** Writing – review & editing, Validation, Methodology. **Jung-Sheng Chen:** Writing – review & editing, Validation, Methodology. **Ching-Chung Tsai:** Writing – review & editing, Validation, Supervision, Funding acquisition, Conceptualization. **Chung-Ying Lin:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare no conflict of interest. MNP has consulted for Opiant Pharmaceuticals, Idorsia Pharmaceuticals, AXA, Game Day Data, Baria-Tek and the Addiction Policy Forum; has been involved in a patent application with Yale University and Novartis; has received research support (to Yale) from Mohegan Sun Casino and the Connecticut Council on Problem Gambling; has participated in surveys, mailings or telephone consultations related to drug addiction, impulse-control disorders or other health topics; has consulted for and/or advised gambling and legal entities on issues related to impulse-control/addictive disorders; has performed grant reviews for research-funding agencies; has edited journals and journal sections; has given academic lectures in grand rounds, CME events and other clinical or scientific venues; and has generated books or book chapters for publishers of mental health texts. MDG has received research funding from *Norsk Tipping* (the gambling operator owned by the Norwegian government). MDG has received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling and gambling treatment from *GambleAware* (formerly the *Responsibility in Gambling Trust*), a charitable body which funds its research program based on donations from the gambling industry. MDG undertakes consultancy for various gambling companies in the area of player protection and social responsibility in gambling.

The other authors declare no disclosures.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.comppsych.2024.152517.

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