Internet Addiction: A Systematic Review of Epidemiological Research for the Last Decade

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Abstract: In the last decade, Internet usage has grown tremendously on a global scale. The increasing popularity and frequency of Internet use has led to an increasing number of reports highlighting the potential negative consequences of overuse. Over the last decade, research into Internet addiction has proliferated. This paper reviews the existing 68 epidemiological studies of Internet addiction that (i) contain quantitative empirical data, (ii) have been published after 2000, (iii) include an analysis relating to Internet addiction, (iv) include a minimum of 1000 participants, and (v) provide a full-text article published in English using the database *Web of Science.* Assessment tools and conceptualisations, prevalence, and associated factors in adolescents and adults are scrutinised. The results reveal the following. First, no gold standard of Internet addiction classification exists as 21 different assessment instruments have been identified. They adopt official criteria for substance use disorders or pathological gambling, no or few criteria relevant for an addiction diagnosis, time spent online, or resulting problems. Second, reported prevalence rates differ as a consequence of different assessment tools and cut-offs, ranging from 0.8% in Italy to 26.7% in Hong Kong. Third, Internet addiction is associated with a number of sociodemographic, Internet use, and psychosocial factors, as well as comorbid symptoms and disorder in adolescents and adults. The results indicate that a number of core symptoms (i.e., compulsive use, negative outcomes and salience) appear relevant for diagnosis, which assimilates Internet addiction and other addictive disorders and also differentiates them, implying a conceptualisation as syndrome with similar etiology and components, but different expressions of addictions. Limitations include the exclusion of studies with smaller sample sizes and studies focusing on specific online behaviours. Conclusively, there is a need for nosological precision so that ultimately those in need can be helped by translating the scientific evidence established in the context of Internet addiction into actual clinical practice.

Keywords: Internet addiction, literature review, epidemiology, empirical research, last decade, quantitative, large-scale.

1. INTRODUCTION

In contemporary society approximately 40% of the world population is online. Furthermore, global Internet usage has grown nearly six-fold over the last decade, with 96% of Internet users in Korea using high-speed Internet connections in comparison to 78% in the UK, and 56% in the USA [1, 2]. Compared to Internet access in 2000, the USA has more than doubled its usage, while mobile Internet use has increased substantially up to 2011 [3], indicating that Internet use via different hardware has become a highly prevalent activity for both adolescents and adults. From a global perspective, *Google* is the most popular online destination, closely followed by the social networking site *Facebook*[1] [3]. In 2012, children and adolescents in Australia spent an average of 24 hours online per month, compared with 65 hours for those aged 18-24 years, and more than 100 hours per month in 25-34 year olds [4]. This suggests that young adults are the most active Internet users as they spend approximately three hours online per day.

The increasing popularity and frequency of Internet use has led to the emergence of clinical cases presenting abuse symptoms. Since the 1980s, school counsellors were advised to take excessive use of video games seriously as it could result in "addiction" [5]. In 1996, the concept of *Internet Addiction Disorder* emerged for the first time, initially as a satirical hoax as a response to the perceived pathologising of everyday behaviours [6]. Goldberg understood the

condition as an analogue to substance dependence, as based on criteria in the Diagnostic and Statistical Manual for Mental Disorders [DSM-IV; 7]. Based on this, the individual had to experience a minimum of three of the following symptoms over the period of twelve months: tolerance, withdrawal, lack of control, relapse, large amounts of time spent online, negative consequences, and continuation of use irrespective of problem awareness [6]. Following this initial proposal, Young (1996a) and Griffiths [8] emerged as the pioneers of early research into Internet addiction as they were the first to scrutinise the phenomenon empirically. Modelling the Internet addiction criteria after the APA's substance dependence diagnosis [7], Young [9] presented the case of a female homemaker who progressively increased her engagement in chat rooms because of her growing commitment to virtual communities, which have been described as offering emotional support and a platform for discussion and information [10]. The homemaker spent increasing amounts of time online to the detriment of her real life responsibilities and eventually developed withdrawal symptoms [9]. This case exemplified for the first time that the stereotypical view of the excessive Internet user, i.e., a young male technophile, had to be overthrown and in its place appeared a female user seeking a sense of belonging and comfort on the Internet. Griffiths (1996) also published case study accounts including both males and females. Following these initial case reports, Young [11] was among the first to present findings from an exploratory survey comprising 396 dependent Internet users who endorsed a minimum of five out of eight criteria adapted from a diagnosis of pathological gambling [7], and 100 non-dependent Internet users. On average, the dependent users spent eight times more hours online than the controls, and used chat rooms and MUDs[2] more frequently [11]. These early studies can be

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seen as the beginning of empirical research into the area of Internet addiction.

Since these initial efforts to shed light upon an emerging mental health problem, empirical research into Internet addiction has greatly increased. Various terms have been used to name the condition, including compulsive computer use (Black, Belsare, & Schlosser, 1999), Internet dependency (te Wildt, 2011), pathological Internet use (Morahan-Martin & Schumacher, 2000), problematic Internet use (Davis, Flett, & Besser, 2002), virtual addiction (Greenfield, 1999), and Internet addiction disorder (Ko, Yen, Chen, Chen, & Yen, 2005a). Recently, the APA (2013b) published the updated version of the DSM and included Internet Gaming Disorder in the appendix as condition that requires further empirical and clinical research. In the DSM-5, Internet Gaming Disorder includes nine criteria, namely preoccupation, withdrawal, tolerance, loss of control, continued use irrespective of problem awareness, neglect of alternative recreational activities, escapism and mood modification as usage motivations, deception, and jeopardisation of relationships and job. This clearly situates the behaviour within the new diagnostic entity of Addiction and Related Disorders. Five or more symptoms need to be met over a 12-month period for diagnosis which must cause the individual clinically significant impairment or distress [13, 14]. The conflation of Internet use and online gaming in this diagnostic category creates further diagnostic imprecision as seven out of the nine criteria relate to gaming specifically. Therefore, although the inclusion of Internet Gaming Disorder in the research appendix of the DSM-5 emphasise the necessity for further research, the new research diagnosis appears somewhat crude and vague, further complicating a clinical evaluation. Although empirical research over the last decade has significantly increased, the classification of Internet addiction is still controversial as no gold standard of Internet addiction assessment has emerged. A number of review papers on Internet addiction have been published since 2005 [15-18]. Some of the most recently published reviews specifically integrated treatment outcome research [19-21] and comorbidity [22], while others have looked at the biological basis and the psychological factors involved in the aetiology for the disorder [e.g., 23, 24]. Another study [25] suggests that current Internet addiction assessment tools tap into the following dimensions of addiction: compulsive use, negative outcomes, salience, withdrawal symptoms, mood regulation, escapism and social comfort, which are comparable with Griffiths' [26] behavioural addiction components. These reviews highlight the dissimilarity in assessment across studies that impede the possibility of cross-comparisons as well as an evaluation of the epidemiological prevalence rates across samples. In order to elucidate the potential problem of Internet addiction, the aim of this paper is to review the epidemiological Internet addiction research of the last decade. This review sets out to answer the following research questions: (i) what is Internet addiction (i.e., how is it assessed)?, (ii) how common is it?, and (iii) what are the associated factors?

2. METHOD

A literature search was conducted using the database *Web of Science*. This database was used as it is more comprehensive than other commonly used databases, such as *Psycinfo* or *PubMed* because it includes various multidisciplinary databases. The following search terms (and their derivatives) were entered with regards to Internet addiction specifically: 'Internet' or 'online' and 'excessive', 'problematic', 'compulsive', and 'addictive'. Studies were selected based on the following inclusion criteria. Studies had to (i) contain quantitative empirical data, (ii) have been published after 2000, (iii) include an analysis relating to Internet addiction, (iv) include a minimum of 1000 participants, and (v) provide a full-text article published in English. For comparison purposes, studies focusing solely on particular online applications (e.g., gaming, social networking) were excluded from analysis. The databases were searched in April and May 2013. The initial search yielded 1,332

results. Following a thorough inspection of the articles' titles and abstracts, the articles not meeting the inclusion criteria were excluded. Data were organised with regards to assessment approach, prevalence, and factors associated with Internet addiction.

3. RESULTS

A total of 69 epidemiological research papers were identified from the literature search that met the initial inclusion criteria. However, one study [27] had to be excluded as it did not provide sufficient information on how Internet addiction was assessed. Therefore, a total of 68 studies were included in this literature review. The first part of the results section will present the assessment approaches adopted, as they highlight the various conceptualisations of Internet addiction, which will be classed in accordance with the specific samples used, namely adolescents and adults. Three main diagnostic assessment approaches comprised Young's Internet Addiction Test and Internet Addiction Diagnostic Questionnaire [11, 28], Chen *et al.*'s Chinese Internet Addiction Scale [29], and various miscellaneous approaches for classification. The next part will summarize the reported prevalence rates, which will be followed by the last part that outlines the factors that that have been found to be statistically associated with Internet addiction.

3.1. What is Internet addiction? Assessment tools and Conceptualisations

3.1.1. The Internet Addiction Test and the Internet Addiction Diagnostic Questionnaire

Two related, but slightly different tools for Internet addiction assessment have been developed by Young [11, 28]. The Internet Addiction Test (IAT) [28] is a 20-item self-report scale that assesses Internet addiction as based on criteria for substance dependence and pathological gambling [7]. The criteria include loss of control, neglecting everyday life, relationships and alternative recreation activities, behavioural and cognitive salience, negative consequences, escapism/mood modification, and deception, and are rated on a Likert scale ranging from 1 ("not at all") to 5 ("always"), allowing a dimensional rather than categorical assessment. Internet users are classed as having significant problems due to Internet use if they score 70-100, and having frequent problems when scoring 40-69 [28]. The internal consistency of the IAT has been reported as satisfactory, with a *Cronbach's alpha* of .84 [30]. The IAT does not contain a temporal dimension by asking the participant to rate the presence of the symptoms over a specified period of time. Moreover, the cut-offs appear rather arbitrary as they are not based on empirical considerations, such as a clinical evaluation of disorder severity based on the presence and impact of symptoms. A recent study [31] including a Greek adolescent sample indicates that a lower cut-off point of 51 presents the highest specificity and sensitivity. This finding raises issues concerning the cultural context of analysis, suggesting that sociocultural factors impact upon Internet addiction assessment.

The Internet Addiction Diagnostic Questionnaire (IADQ) [11] is a parsimonious 8-item self-report measure based on the diagnostic symptoms of pathological gambling [7]. The criteria utilised for the IADQ include preoccupation, tolerance, loss of control, withdrawal, negative consequences, denial, and escapism. Two of the original ten criteria for pathological gambling (i.e., committing illegal acts to finance the behaviour and reliance on others for money) were omitted to produce a "slightly more rigorous cut-off score" [11]. Endorsing five or more of the criteria indicates Internet addiction.

3.1.2. Chen's Internet Addiction Scale

Chen's Internet Addiction Scale (CIAS) [29] was the most frequently used scale in the included empirical research papers as a total of 16 studies made use of it to assess Internet addiction. The CIAS is a 26-item self-report measurement scored on a 4-point Likert scale, assessing the core symptoms of Internet addiction,

tolerance, compulsive use, and withdrawal, as well as related problems in terms of negative impact on social activities, interpersonal relationships, physical condition, and time management. In addition to this, it inquires into weekly online hours and Internet use experience. The internal consistency of the scale was found to be good, with *Cronbach's alpha* values between .79 to .93 for the respective subscales [29]. It has also been reported that the screening cut-off of 57/58 points has high sensitivity, and the diagnostic cut-off point of 63/64 as performed by psychiatrists revealed the highest diagnostic accuracy with 87.6% of patients diagnosed with Internet addiction appropriately [32]. Adopted cut-off points for Internet addiction varied marginally between studies, as scores of 63/64 or 67/68 have been used as cut-offs for Internet addiction classification, without the respective authors specifying reasons for their choice, such as the instrument's factor structure.

3.1.3. Miscellaneous Diagnostic Assessment Tools

The remaining assessment tools represent a plethora of newly designed measurement instruments or alternative criteria based on which Internet addiction and Internet use-related problems have been categorised. A total of 21 studies were identified that used miscellaneous criteria. Of these, 14 studies used miscellaneous criteria to identify Internet addiction in adolescents [33-45]. In addition to the adolescent samples, miscellaneous classification criteria for Internet addiction have been used in adult samples, including a total of eight studies [46-53]. Classifications vary tremendously, ranging from the adoption of official criteria for substance use disorders or pathological gambling, to no or few criteria relevant for an addiction diagnosis. In yet other cases excessive use is assessed based on how much time is spent online or how many problems occur as a consequence of use, providing an overly simplistic picture of Internet addiction. Detailed information concerning each of the assessment instruments, criteria, and problems with the respective classifications are provided in Table **1**.

3.2. How Common is Internet Addiction?

3.2.1. Prevalence of Internet Addiction in Adolescents

A total of seven studies used the IAT for Internet addiction assessment in adolescents and children aged 8 to 24 years [54-60], with sample sizes ranging from 1,618 [58] to 17,599 participants [56]. Although the same measurement instrument has been used in these studies, various cut-offs have been applied to demarcate addiction or excessive use across studies. Reported prevalence rates varied significantly with 0.8% in Italian high school students were considered to be seriously addicted [55], and 20.3% of adolescents and 13.8% of children in a South Korean sample were classed as addicted to using the Internet [60].

In eleven studies, the IADQ [11] was used to assess Internet addiction in adolescents [61-71]. The sample sizes ranged from 1,270 in Greece [64, 65] to 10,988 adolescents and young adults in China, aged 13-23 years [71]. The same cut-off, i.e., endorsing a minimum of five out of eight diagnostic items, has been applied to a majority of these studies. Internet addiction prevalence rates ranged from 1.7% of boys and 1.4% of girls in a representative sample of Finnish adolescents [70] to 26.4% and 26.7% at wave one and wave two, in a longitudinal sample of adolescent students in Hong Kong, respectively [66]. The reported prevalence rates in Asian adolescents have been found to be significantly higher in comparison to both, Western countries, as well as samples of children.

Chen's Internet Addiction Scale was used in nine studies including adolescent samples [72-80]. The sample sizes ranged from 1,890 students in Taiwan [80] to including 9,405 in Southern Taiwan [81]. In all of these studies, the relatively liberal cut-off point of 63/64 on the CIAS has been applied. Prevalence estimates varied substantially, with the lowest rate of 10.8% found in an adolescent sample in Southern Taiwan [72], whereas in other adolescents samples in Southern Taiwan prevalence rates between 18% and 21% were reported [73, 75, 77, 79, 80, 82, 83].

A total of 13 studies used miscellaneous criteria to identify Internet addiction in adolescents [33-45]. Sample sizes varied from including 1,098 adolescents in Singapore [36] to 73,238 adolescents in South Korea [44]. Sung and colleagues [44] used the Internet Addiction Proneness Scale - Short Form [KS-Scale; 84] in a sample of 73,238 adolescents in South Korea and reported that 3.0% and 11.9% of adolescents were at high risk and at potential risk for developing Internet addiction in South Korea, respectively [44]. On the other end of the spectrum, Xu *et al.* [38] used the DRM 52 Scale of Internet use in a random sample of 5,122 adolescents in Shanghai, China with the result that 8.8% of adolescents in this sample were classified as Internet addicts [38]. The only cross-cultural study of Internet addiction prevalence included two separate samples of 1,761 high school students in China and 1,182 students in the USA were used in a longitudinal study by Sun *et al.* [40] using the (CIUS), and showed that the prevalence rates were 5.8% in Chinese females, 15.7% in Chinese males, 9.7% in US females, and 7.3% in US males [40]. A detailed summary of the epidemiological studies that assessed Internet addiction prevalence in adolescents is provided in Table **2**.

3.2.2. The Prevalence of Internet Addiction in Adults

In six studies, Young's Internet Addiction Test [28] was used to assess Internet addiction in adults [85-90]. The sample sizes ranged from 1,034 young adults in Turkey [86] to 13,588 Internet users in Korea [89]. Similar to the usage of the IAT in adolescent samples, in the adult samples, various cut-off criteria have been utilised in order to demarcate Internet addiction from non-pathological Internet usage behaviours. Reported prevalence rates using the IAT ranged from 1.2% of Internet users in the UK [88] to 9.7% of Turkish college students [86].

The Internet Addiction Diagnostic Questionnaire [11] was used in three adult samples [91-93]. The reported Internet addiction prevalence rates in these studies were notably diverse as in a sample of Norwegian adults, 1.0% [92] and in a sample of 1,856 Iranian Internet users 22.8% [91] were found to be addicted to the Internet.

Chen's Internet Addiction Scale was used in seven studies including adult samples [94-100]. All samples included college or university students in Taiwan. Sample sizes ranged from 1,360 university freshmen [96] to 4,456 college students [99]. The studies that reported prevalence rates used teenage samples. Using the rather conservative cut-off of 67/68 on the CIAS, relatively similar prevalence rates of 12.9% and 12.3% have been reported by Yen *et al.* in Taiwan [97, 101], ranging up to 17.9% as reported by Tsai *et al.* [96].

Miscellaneous classification criteria for Internet addiction have been used in a total of eight studies including adult samples [46-53]. All sample sizes were between 1000 and 2000 participants, with the exception of a sample of 16,925 regular Internet users in the Netherlands [46]. Prevalence rates varied, ranging from 1.8% of a sample of 1,147 participants in Sweden (age range 15-94 years) experienced all of the inquired problems due to Internet use, whereas Demetrovics and colleagues [48] reported that of a sample of 1,037 Hungarian young adults, 4.3% had significant problems because of their Internet use as measured via the PIUQ. A complete summary of the epidemiological studies of Internet addiction in adults is provided in Table **3**.

3.3. What are the Associated Factors?

Four main factors have been found to be associated with Internet addiction. A visual representation of these factors is presented in (Fig. **1**).

Table 1.   Internet Addiction Assessment Instruments.

Study	Instrument	Structure	Addiction classification and criteria	Cut-off	Problems
Young, 1998a	Internet Addiction Test (IAT)	20-item self-report scale rated on a Likert scale ranging from 1 ("not at all") to 5 ("always")	Criteria for substance dependence and pathological gambling (American Psychiatric Association, 1994): loss of control, neglecting everyday life, relationships and alternative recreation activities, behavioural and cognitive salience, negative consequences, escapism/mood modification, and deception	- Score of 70-100: significant problems - Score of 40-69: frequent problems	- No temporal dimension - Cut-offs arbitrary
Young, 1998b	Internet Addiction Diagnostic Questionnaire (IADQ)	8-item self-report measure scored dichotomously	Based on the diagnostic symptoms of pathological gambling (American Psychiatric Association, 1994): preoccupation, tolerance, loss of control, withdrawal, negative consequences, denial, and escapism	Endorsing ≥5/8: Internet addiction	- No equivalents for PG criteria committing illegal acts to finance the behaviour and reliance on others for money - Dichotomous scoring
Chen et al., 2003	Chen's Internet Addiction Scale (CIAS)	26-item self-report measurement scored on a 4-point Likert scale	Core symptoms of Internet addiction, tolerance, compulsive use, and withdrawal, as well as related problems in terms of negative impact on social activities, interpersonal relationships, physical condition, and time management	- Liberal scoring: 63/64, - Conservative: 67/68 indicates Internet addiction	Different cut-offs used for classification
Meerkerk et al., 2009a	Compulsive Internet Use Scale (CIUS)	14-item unidimensional self-report questionnaire rated on a 5-point scale	Based on the DSM-IV-TR diagnoses for substance dependence and pathological gambling (American Psychiatric Association, 2000): loss of control, preoccupation, withdrawal symptoms, coping/mood modification, and conflict (inter- and intrapersonal)	N/A	- No cut-off - No assessment of tolerance
Caplan, 2000	Generalized Problematic Internet Use Scale (GPIUS)	29-item self-report questionnaire rated on 5-point Likert scale	Based on Davis' (2001) cognitive-behavioural model of problematic Internet use; measures mood alteration, perceived social benefits online, negative consequences of and compulsive Internet use, excessive amounts of time spent online, withdrawal, and perceived social control online	N/A	Not all items relevant for addiction classification
Caplan, 2010	Modified Generalised Problematic Internet Use Scale (GPIUS2)	15-item self-report questionnaire rated on 8-point Likert scale	Similar to GPIUS (Caplan, 2000), but includes 2 additional factors: preference for online social interaction and deficient self-regulation (as higher-order factor impacting upon cognitive preoccupation and compulsive Internet use), and the previous factors social benefits and social control were combined	N/A	Not all items relevant for addiction classification
Kim et al., 2008	Internet Addiction Proneness Scale - Short Form (KS-Scale)	20 items scored on a 4-point Likert scale	Criteria: tolerance, withdrawal, addictive automatic thoughts, disturbance of adaptive function, deviate behaviours, and virtual interpersonal relationships	- Scoring ≥ 52/80: high risk for Internet addiction - Scoring 48-52: potential risk	Not all items relevant for addiction classification

Study	Instrument	Structure	Addiction classification and criteria	Cut-off	Problems
Lopez-Fernandez *et al.*, 2013	Problematic Internet Enter-tainment Use Scale for Adoles-cents (PIEUSA)	30 items rated on a 7-point Likert scale	Based on DSM-IV-TR criteria for sub-stance dependence and pathological gambling disorders: assesses symptom experience over last 12 months	N/A	No cut-off
Xu*et al.*, 2012	DRM 52 Scale of Internet Use	Includes direct and indirect questions organised into 52 items assessed on a 5-point Likert scale	Adapted from Young's Internet Addic-tion Scale (Young, 1996a); criteria: tolerance, withdrawal, planning, lack of control, time-consuming, socialisation, and negative life consequences because of Internet use	Scoring >163/260 indicates Internet addiction	Not all items rele-vant for addiction classification
Beranuy *et al.*, 2009	Questionnaire on Internet-Related Experiences (CERI)	10 questions scored on a 4-point Likert scale	Criteria: interpersonal and intrapersonal conflicts	N/A	No use of recog-nised diagnostic criteria
Sun *et al.*, 2010	Compulsive Internet Use Scale (CIUS)	4 items on 5-point Likert scale	Based on Davis *et al.*'s (2002) Online Cognition Scale	Scoring mean of 4/possible 5: Internet addiction	No use of recog-nised diagnostic criteria
Liu *et al.*, 2011	Problematic Internet Use Scale (PIU)	6 items scored dichotomously	Based on Minnesota Impulsive Disorder Inventory (Grant, Levine, Kim, & Potenza, 2005)	Endorsing crav-ing, withdrawal, abstinence at-tempts simultane-ously: problem-atic Internet use	Overly simplistic classification
Bener *et al.*, 2011	Excessive Inter-net use	Daily hours spent online	Length of daily Internet use	Spending ≥ 3hours on-line/daily: exces-sive Internet use	Overly simplistic classifcation
Mythily *et al.*, 2008	Excessive Inter-net use	Daily hours spent online	Length of daily Internet use	Spending ≥ 5hours on-line/daily: exces-sive Internet use	Overly simplistic classifcation
Wölfling *et al.*, 2010	Assessment for Computer and Internet Addic-tion-Screener (AICA-S)	16 items scored on 5-point Likert scale	Based on diagnostic criteria of substance dependence by DSM-IV-TR (American Psychiatric Association, 2000) and ICD-10 (World Health Organization, 1992); criteria: craving, tolerance, withdrawal, loss of control, preoccupation and nega-tive consequences concerning poorer health, family conflicts or deteriorating achievements, mood modification	Scoring ≥ 13.5/27: Internet addiction	Lack of time crite-rion
Thatcher & Goolam, 2005	Problematic Internet Use Questionnaire (PIUQ)	20 items scored on 5-point Likert scale	Based on Young's criteria for Internet addiction (1996b) and the South Oaks Gambling Screen (Lesieur & Blume, 1987), assesses online preoccupation, adverse effects, and online social interac-tions	N/A	Not all items rele-vant for addiction classification

(Table 1) Contd….

Study	Instrument	Structure	Addiction classification and criteria	Cut-off	Problems
Demetrovics *et al.*, 2008	Problematic Internet Use Questionnaire (PIUQ)	30 items scored on a 5-point Likert scale	Based on the Internet Addiction Questionnaire (Nyikos, Szeredi, & Demetrovics, 2001) and the Internet Addiction Test (Young, 1998a), assesses obsession, neglect and control disorder	- Scoring > 2SD above mean: significant problems because of Internet use - Scoring 1-2SD above mean: problematic Internet use	Overly simplistic classification, lacks some addiction criteria
Ceyhan *et al.*, 2007	Problematic Internet Use Scale (PIUS)	33 items scored on 5-point Likert scale	Factors: negative consequences, social benefit/comfort, and excessive usage	N/A	Overly simplistic classification, lacks important addiction criteria
Huang *et al.*, 2007	Chinese Internet Addiction Inventory (CIAI)	42 items scored on 5-point Likert scale	Based on Young's Internet Addiction Test (1998a), 3 dimensions of Internet addiction: conflicts, mood modification, and dependence; classification based on "5+3" principle (Beard & Wolf, 2001)	For diagnosis, all of the following must be endorsed: preoccupation, tolerance, lack of impulse control, mood modification, increasing usage, and ≥ 1 of conflict, lying to others, and escaping from problems	N/A
Bergmark *et al.*, 2011	Indicators of Internet addiction	Presence of 5 indicators rated on 4-point Likert scale	Indicators: time spent online, family conflicts due to Internet use, withdrawal symptoms, neglect of needs, and unsuccessful abstinence attempts	N/A	- Likert-scale scores converted to binary measures - Not all items relevant for addiction classification used
Beutel *et al.*, 2011	Problems because of Internet use	Number of problems due to Internet use	Problem areas: work, school, family, partnership, finances, recreational activities, health-related	N/A	No use of recognised diagnostic criteria

Table 2.   Epidemiological Internet Addiction Studies in Adoelscents.

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Ak *et al.*, 2013	*N* = 4,311 adolescents in Turkey (46% male, age range 15-19 years)	- Turkish version of Internet Addiction Test (IAT) (Young, 1998b)	- Scoring ≥60/100 on the IAT = excessive Internet users	- 5% excessive users - Predictors of Internet addiction: Internet access at home, male gender, family income
Poli & Agrimi, 2012	*N* = 2,533 high school students in Cremona, Italy (44.3% males, mean age = 16.4 years, *SD* = 1.51, range 14-21)	- Italian version of the Internet Addiction Test (IAT) (Young, 1998b)	- Scoring 50-79/100 = moderately addicted - Scoring ≥ 80 = seriously addicted	- 5.01% moderately and 0.79% seriously addicted to the Internet - Higher prevalence in males

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Cao *et al.*, 2011	*N* = 17,599 students in 8 cities in China (51.2% male, mean age = 16.1, *SD* = 2.8 years, range = 10-24)	- Young's Internet Addiction Test (YIAT) (Young, 1998a) - Multidimensional Sub-health Questionnaire of Adolescents (Tao, Hu, Sun, & Hao, 2008) - Multidimensional Students' Life Satisfaction Scale (Tian & Liu, 2005) - Demographics and Internet usage patterns	- Potential problematic Internet use (PIU): scores > 50/100 on YIAT	- Problematic Internet use prevalence 8.1% - PIU associated with male gender, high school status, urban, Eastern and Western areas, high family economy, Internet for entertainment use, loneliness motivation, and Internet use frequency - PIU adolescents had higher psychosomatic symptoms, lacked physical energy, physiological dysfunction, weakened immunity, emotional and behavioural symptoms, social adaptation problems , low life satisfaction relative to non-PIU
Wang *et al.*, 2011	*N* = 14,296 high school students in Guangdong Province, China (48.7% males)	- Young Internet Addiction Test (YIAT) (Young, 1998a) - Demographics - Family and school factors - Internet usage pattern	- Potential problematic Internet use: scoring > 50/100 on YIAT	- 12.2% problematic Internet users - Risk factors for PIU: study-related stress, social friends, poor relations with teachers and students, conflicts in family relations, time spent online
Lam *et al.*, 2009	*N* = 1,618 adolescents (45.4% male, age range = 13-18 years) in Guangzhou city, China	- Internet Addiction Test (Young, 2009) - Zung Self-Rating Depression Scale (Zung, 1965)	- Scoring 20-49 on IAS = normal, 50-79 moderate, and 80-100 = severe Internet addiction	- 10.2% moderately and 0.6% severely addicted to the Internet - Risk factors: male gender, drinking behaviour, family dissatisfaction, and recent stressful events
Choi *et al.*, 2009	*N* = 2,336 high school students in South Korea (57.5% male, mean age = 16.7, *SD* = 1.0 years)	- Korean version of Young's Internet Addiction Test (Kim, 2000; Young, 1998a) - Epworth Sleepiness Scale (ESS) (Johns, 1991)	- Scoring ≥ 70 on IAT addicted, 40-69 possibly addicted	- Prevalence of Internet addiction and possible Internet addiction: 2.5% and 53.7% for boys, and 1.9% and 38.9% for girls - Internet addicts more likely to be male, drink more alcohol, have poor health condition, experience EDS
Kim *et al.*, 2006	*N* = 1,573 high school students in Korea (35.0% males, aged 15-16 years)	- Korean version of the modified Internet Addiction Scale (Kim, 2000; Young, 1998a) - Korean version of the Diagnostic Interview Schedule for Children-Major Depression Disorder-Simple Questionnaire (Korean Neuropsychiatry Association, 1999) - Suicidal Ideation Questionnaire-Junior (Reynolds, 1988)	- Scoring > 70/100 on IAS = Internet addiction, scoring 40-69 = possible Internet addiction	- 1.6% addicted to the Internet - 38.0% possibly addicted to the Internet - Depression and suicidal ideation highest in the Internet addicts

(Table 2) Contd….

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Ha *et al.*, 2006	- Structured clinical interview - *N*s = 455 children (50.3%; mean age = 11, *SD* = .9 years) and 836 adolescents (92.9% male; mean age = 15.8, *SD* = .8 years) - Of Internet addicts, 12 children and 12 adolescents randomly selected for psychiatric evaluation	- Young's Internet addiction scale - K-SADS-PL-K for children - SCID-IV for adolescents	- Cut- off of 80	- Internet addiction prevalence in adolescents 20.3%, in children 13.8% - In child Internet addiction group, 7 with ADHD - In adolescent Internet addiction group, 3 with depression, 1 schizophrenia, 1 obsessive-compulsive disorder
Guo *et al.*, 2012	*N* = 3,254 children (mean age = 12.56, *SD* = 1.83 years; age range = 8-17-years), with n = 1143 left behind children (LBC; 49.9% male), n = 574 migrant children (MC; 57.1% male), and n = 1287 non-left-behind rural children (RC; 51.8% male) in China	- Young's 8-item Internet Addiction Scale (Young, 1998) - Children's Depression Inventory-Short Form (CDI-S) (Kovacs, 2004) - Nutritional status, health condition and health behaviours	- Endorsing ≥ 5/8 items on IAT = Internet addicted	- Internet addiction prevalence = 3.7% in RC, 6.4% in MC and 3.2% in LBC - LBC and MC with Internet addiction, and MC without Internet addiction more at risk for depression than RC with no Internet addiction
Siomos *et al.*, 2012	*N* = 2,017 teenage students (51.8% males, boys' mean age = 15.05, SE = .05;8, girls' mean age = 15.08, SE = .05; overall age range = 12-19) in Greece, and *n* = 1,214 parents	- Diagnostic Questionnaire for Internet Addiction (YDQ) (Young, 1998) - Greek version of Adolescent Computer Addiction Test (ACAT; modelled after Internet Addiction Test) (Siomos, Floros, Mouzas, & Angelopoulos, 2009) - Parental Bonding Instrument (Parker, 1990)	- Scoring min. 5/8 indicates Internet addiction	- 15.2% addicted to the Internet, 26.9% moderately addicted - Internet addiction predicted by parental bonding, not parental security practices - Online activities associated with Internet addiction: online pornography, gambling, and gaming
Siomos *et al.*, 2008	Randomized stratified sample of *N* = 2,200 adolescents students in Greece (mean age = 15.34, *SD* = 1.66, range = 12-18 years)	- Diagnostic Questionnaire for Internet Addiction (YDQ) (Young, 1998) - Sociodemographics	- Scoring min. 5/8 indicates Internet addiction	- Prevalence of Internet addiction 8.2%, mostly male online gamers who visit Internet cafés
Fisoun *et al.*, 2012	*N* = 1,270 adolescent students on Kos (48.3% male, mean age = 15.99, *SE* = .05, girls' mean age = 16.02, *SE* = .05, age range 14-18 years)	- Diagnostic Questionnaire for Internet Addiction (YDQ) (Young, 1998) - Internet Addiction Test (Young, 1998) - Demographic questions	N/A	- 5.3% addicted users, 14.7% heavy Internet users - Correlations between antisocial and aggressive behaviours with Internet abuse regarding interest-driven activities for boys, and communication activities for girls
Fisoun *et al.*, 2012	*N* = 1,270 adolescent students on Kos (48.3% male, mean age = 15.99, *SE* = .05, girls' mean age = 16.02, *SE* = .05, age range 14-18 years)	- Internet Addiction Test (Young, 1998) - Demographic questionnaire, incl. questions on substance use - Eysenck's Personality Questionnaire (Gossop & Eysenck, 1980)	- Scoring 5/8 on IAT = addicted to the Internet	- 7.2% of males, and 5.1% of females addicted to the Internet - Internet and substance abusers share personality characteristics, i.e., psychoticism - Pathological Internet use severity related to illicit substance use

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Shek & Yu, 2012	- Longitudinal survey (2 waves) in Hong Kong - N_1 = 3,328 students, (52.1% males; mean age = 12.59, SD = .74 years) - N_2 = 3,580 students, mean age = 13.50 years, SD = .75)	- Internet Addiction Test (IAT) (Young, 1998)	- Internet addiction diagnosis based on DSM-IV gambling criteria (5/8?) - Chinese Positive Youth Development Scale (CPYDS)	- Internet addiction prevalence 26.4% in W1, and 26.7% in W2 - Internet addiction at W1 increased chance of Internet addiction at W2 by 7.6
Gong *et al.*, 2009	N = 3,018 secondary school and university students (47% male, mean age = 15.8, SD = 2.1 years, age range = 11-23 years) in Wuhan, China	- Young's Internet Addiction Diagnostic Questionnaire (DQ) (Young, 1999) - Lifetime drug use - Susceptibility to drugs - PDA and ADA as based on Standardized Attitudes and Knowledge Scale (STAK) (Chappel, Veach, & Krug, 1985) - Social norm of drug use	- Scoring ≥ 5/8 on DQ = Internet addicted	- Prevalence of addictive Internet use 5% - DU and DU intentions predicted by AIU, and mediated by PDA, ADA, and perceived social norm of DU
Lin *et al.*, 2009	N = 1,289 adolescents from 11 senior high schools in Taiwan (52.1% males, mean age = 17.46, SD = 1.00, range 16-19 years)	- Internet Addiction Diagnostic Questionnaire (Young, 1998) - Parental monitoring (Patterson & Stouthamer-Loeber, 1984) - Adapted Leisure Boredom Scale (Iso-Ahola & Weissinger, 1990) - Leisure activities participation	- Endorsing ≥ 5/8 of criteria = Internet addiction	- 23.4% addicted to the Internet - Internet addiction predicted by parental monitoring perception, leisure boredom and activities - Family and outdoor activities, supportive parental monitoring decreased addiction likelihood
Johansson & Gotestam, 2004	Representative sample of Norwegian youth (N = 3,237, 51.0% male, mean age = 14.9 years, age range 12-18 years)	- Internet Addiction Diagnostic Questionnaire (Young, 1998)	- Endorsing ≥ 5/8 criteria = classed as Internet addicts, endorsing 3-4 = at risk	- 1.98% Internet addicts - 8.68% at risk for developing Internet addiction
Kaltiala-Heino *et al.*, 2004	Representative sample of Finnish adolescents (N = 7,292, age range 12-18 years)	- Internet Addiction Test (Center for On-Line Addiction, 2001)	- Endorsing ≥ 4/7 DSM –IV pathological gambling criteria classed as Internet addicted	- 1.7% of boys and 1.4% of girls addicted to the Internet - Addicts spent more time online than non-addicts
Wang *et al.*, 2013	N = 10,988 adolescents from 9 cities in China (age mean = 17.2 years, range 13-23 years)	- Diagnostic Questionnaire (DQ) for Internet addiction (Kuang, Cao, & Dai, 2011) - Center for Epidemiologic Studies Depression Scale (Chien & Cheng, 1985) - Rosenberg Self-esteem Scale (Rosenberg, Schooler, & Schoenbach, 1989) - Adolescent's Satisfaction with Life Scale (Zhang & Gao, 2010)	- Endorsing ≥ 5/8 symptoms = Internet addiction	- 7.5% prevalence of Internet addiction - Breadth of extracurricular activities, age of first Internet use, Internet use for first time in Internet bar: significant predictors of Internet addiction - Problematic use associated with low self-esteem, life satisfaction, high depression

(Table 2) Contd….

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Ko *et al*., 2009	- 2-year prospective study - *N* = 2,293 adolescents (51.4% male, mean age = 12.36, *SD* = .55 years) in Southern Taiwan	- Chen Internet Addiction Scale (Chen, Weng, Su, Wu, & Yang, 2003) - Modified Vanderbilt ADHD Diagnostic Parent Rating Scale (Wolraich *et al*., 2003) - Mandarin Chinese version of the Center for Epidemiological Studies Depression Scale (CES-D) (Chien & Cheng, 1985) - Brief Version of the Fear of Negative Evaluation Scale (BV-FNE) (Leary, 1983) - Buss-Durkee Hostility Inventory-Chinese Version-Short Form (BDHIC-SF) (Lin *et al*., 2008)	- Scoring ≥ 64/104 on CIAS = addicted to the Internet	- 10.8% addicted to the Internet - Depression, ADHD, social phobia, and hostility predicted Internet addiction - Hostility predicted Internet addiction in males and ADHD in predicted Internet addiction in females
Ko *et al*., 2009	*N* = 9,405 adolescents (48.2% male, age range = 13-17 years) in Southern Taiwan	- Chen Internet Addiction Scale (CIAS) (Chen, *et al*., 2003) - Adolescent Aggressive Behaviors Questionnaire (McConville & Cornell, 2003) - Internet behaviours - Violent TV programme exposure - Chinese version of APGAR index of family function satisfaction (Smilkstein, 1978) - Mandarin Chinese version of Center for Epidemiological Studies' Depression Scale (CES-D) (Chien & Cheng, 1985) - Rosenberg Self-Esteem Scale (Rosenberg, 1986)	- Scoring ≥ 64/104 on CIAS indicates Internet addiction	- 18.8% addicted to the Internet - Internet addicts more likely to behave aggressively during last year (particularly in junior high school rather than senior high school)
Yen *et al*., 2009	*N* = 8,941 adolescents in Taiwan (48.0% male, mean age = 17.7, *SD* = 1.7 years)	- Chen Internet Addiction Scale (CIAS) (Chen, *et al*., 2003) - Chinese version of the Center for Epidemiological Studies' Depression Scale (CES-D) (Radloff, 1977) - Adapted subscale of the Adolescent Family and Social Life Questionnaire (AFSLQ) (Yen & Shieh, 2006; Yen, Yang, & Chong, 2006) - Chinese-version of the Family APGAR Index (Smilkstein, 1978) - Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1965)	- Scoring >63 on CIAS = Internet addicted	- Internet addiction prevalence: 13.8% in old girls (≥ 15 years), 12.2% in young girls (< 15 years), 26.6% in old boys (≥ 15 years), and 22.5% in young boys (< 15 years) - Internet addiction predicted by depression, low family monitoring, low connectedness to school, family conflict, drinking peers, living in rural areas

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Ko *et al.*, 2008	*N* = 2,114 high school students (57.0% male, mean age = 16.26, *SD* = .99 years, range 15-23 years) in Taiwan	- Chen Internet Addiction Scale (CIAS) (Chen, *et al.*, 2003) - CRAFFT Substance Abuse Screening Test (Knight *et al.*, 1999) - Behaviour inhibition system and behaviour approach system Scale (BIS/BAS) (Gray, 1991) - Alcohol attitudes - Rosenberg Self-Esteem Scale (RSES) (Rosenberg, 1986) - Family APARG Index (APGAR) (Smilkstein, 1978) - Brief Multidimensional Students' Life Satisfaction Scale (BMSLSS) (Zullig, Huebner, Gilman, Patton, & Murray, 2005)	- Scoring $\geq$ 63/104 on CIAS indicated Internet addiction	- Prevalence of Internet addiction 18.3% - Internet addiction associated with problematic alcohol use and psychosocial variables (i.e., psychosocial proneness for problem behaviours)
Ko *et al.*, 2008	*N* = 2,113 senior and vocational high school students in Taiwan (57.0% male, mean age = 16.26, *SD* = .99, range = 15-23 years)	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Frustration Discomfort Scale (FDS) (Harrington, 2005)	- Scoring $\geq$ 64 on CIAS indicated Internet addiction	- 18.3% classed as addicted to the Internet - Internet addiction and frustration intolerance significantly associated with each other in males
Yen *et al.*, 2008	*N* = 3,662 junior and vocation high school students (63.6% males, mean age = 15.48, *SD* = 1.65, range = 11-21 years) in Kaohsiung City and County in Taiwan	- Chen Internet Addiction Scale (Chen, Weng, Su, Wu, & Yang, 2003) - Brief Symptom Inventory (BSI) assessing somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism (Derogatis & Melisaratos, 1983) - Questionnaire for Experience of Substance Use (Yen, Yang, Ko, & Yen, 2005)	- Scoring > 63/104 on CIAS indicates Internet addiction	- Internet addiction prevalence 20.8% - Internet addiction associated with psychiatric symptoms (i.e., hostility, depression, phobic anxiety, low anxiety) and male gender
Yen *et al.*, 2007	*N* = 3,480 junior, senior, and vocational high school students in southern Taiwan (62.9% male, mean age = 15.47, *SD* = 1.65 years)	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Questionnaires for Experience of Substance Use (Q-ESU) (Yen, Yang, Ko, & Yen, 2005) - Family APGAR Index (APGAR) (Smilkstein, 1978)	- Internet addiction classification when scoring > 63 on CIAS	- 20.7% prevalence of Internet addiction - Internet addiction predicted by parent-adolescent conflict, siblings' habitual alcohol use, perceived positive parents' attitude to adolescent substance use, low family function - Internet addiction and substance use experience have common family factors

(Table 2) Contd….

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Ko *et al.*, 2006	*N* = 3,412 junior, senior and vocational high school students (62.5% male, mean age = 15.48, *SD* = 1.65, range = 11-21 years) in southern Taiwan	- Chen Internet Addiction Scale (CIAS) (Chen, *et al.*, 2003) - Tridimensional Personality Questionnaire (TPQ) (Kuo, Yang, Soong, & Chen, 2002) - Questionnaires for Experience in Substance Use (Q-ESU) (Yen, *et al.*, 2005)	- Scoring ≥ 64 on CIAS classed as addicted to the Internet	- 20.7% addicted to the Internet - Internet addicts likely to have experience with substance use - Novelty seeking, harm avoidance and low reward dependence predicted Internet addiction
Yen *et al.*, 2007	*N* = 1,890 students (56.3% male, mean age = 16.26, *SD* = 1.00, range = 15-23 years) in Kaoshiung City and County in Taiwan	- Chen Internet Addiction Scale (CIAS) (Chen, Weng, Su, Wu, & Yang, 2003) - Modified Vanderbilt ADHD Diagnostic Parent Rating Scale (Wolraich *et al.*, 2003) - Center for Epidemiological Studies' Depression Scale (CES-D), Mandarin version (Chien & Cheng, 1985) - Social Phobia Inventory (SPIN) (Connor, Davidson, Churchill, Sherwood, & Weisler, 2000) - Chinese Hostility Inventory-Short Form (CHI-SF) (Lin & Weng, 2002)	- Scoring ≥ 64/104 on CIAS indicated Internet addiction	- 17.9% classed as addicted to the Internet - Internet addicts: higher ADHD symptoms, depression, social phobia, and hostility, all associated with Internet addiction in males, but only ADHD symptoms and depression associated with Internet addiction in females
Kuss *et al.*, 2013	*N* = 3,105 Dutch adolescents (48.3% male; mean age = 14.2, SD = 1.1 years, range 11-19)	- Compulsive Internet Use Scale (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009) - Quick Big Five (Vermulst & Gerris, 2005)	- Scoring 28/56 on CIUS = potentially addicted to the Internet	- 3.7% potentially addicted to the Internet - Risk factors: online gaming and social applications, low emotional stability, low agreeableness, low conscientiousness, resourcefulness - Preventative factors for online gamers: extraversion and conscientiousness
van der Aa *et al.*, 2009	*N* = 7,888 Dutch adolescents (77.1% male, mean age = 17.79, *SD* = 2.22 years, age range = 11-21 years)	- Compulsive Internet Use Scale (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009) - Daily Internet use - UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980) - Rosenberg Self-Esteem Scale (Rosenberg, 1989) - Depressive Mood List (Kandel & Davies, 1986) - Quick Big Five (Vermulst & Gerris, 2005)	- CIU used as dimensional measure	- CIU moderated relationship between daily Internet use and low well-being - CIU associated with loneliness in introverted, low-agreeable, less emotionally stable participants

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
van den Eijnden *et al*., 2010	- Pen-and-paper study using a cross-sectional sample of *n* = 4,483 Dutch students (51.3% male, mean age = 13.1, *SD* = 1.15 years, age range = 11-15 years) - Longitudinal online survey of sample of 510 Dutch adolescents at T1 and 6 months later (32.2% male, mean age = 14.1, *SD* = .80 years, age range = 10-15 years)	- Adapted version of Compulsive Internet Use Scale (Meerkerk, *et al*., 2009) - Internet-specific parenting practices (i.e., rules about time and content, reactions to excessive use, quality and frequency of communication)	- Dimensional view of Internet addiction, i.e. high CIUS score indicated high level of CIU	- Good communication, parental reactions to excessive Internet use and rules for content of Internet use: preventative tools - Internet times rules promote compulsive engagement - CIU predicted parental communication about Internet use decrease
Gamez-Guadix *et al*., 2012	*N* = 1,491 Mexican adolescents (47.6% female, mean age = 14.51, *SD* = 1.57, range = 12-18)	- Generalized Problematic Internet Use Scale 2 (GPIUS2) (Caplan, 2010) - Time spent online - Scale of Interference of Internet Use in Daily Life - Depression and anxiety subscales of Spanish version of Brief Symptom Inventory (Derogatis & Melisaratos, 1983; Pereda, Forns, & Peró, 2007) - Spanish version of Dysfunctional Impulsivity subscale of the Dickman Impulsivity Inventory (Chico, Tous, Lorenzo-Seva, & Vigil-Colet, 2003; Dickman, 1990)	N/A	- GPIUS2: adequate construct and convergent validity and internal consistency - Preference for online social interaction and Internet use for mood regulation increased deficient self-regulation (i.e., compulsive Internet use and cognitive preoccupations with Internet use), associated with negative life outcomes
Ang *et al*., 2012	*N* = 1,098 adolescents (49.2% male, mean age = 14.54 years (*SD* = 0.61)) in Singapore	- Generalized problematic Internet use scale (GPIUS) (Caplan, 2002) - UCLA loneliness scale (Russell, *et al*., 1980)	N/A	- Perceived parental knowledge moderated relationship between loneliness and generalized PIU - Parental knowledge differentiated adolescents' level of generalized PIU at lower levels of loneliness better than at higher levels
Sung *et al*., 2013	*N* = 73,238 adolescents drawn from South Korea Youth Risk Behavior Web-based Survey KYRBWS-V (age M = 15.1, *SD* = 1.7 years, range = 13-18 years)	- Korean self-reporting internet addiction scale short form (KS-scale) (Kim, Jeng, Lee, Kim, & Joe, 2008), 20 items scored with a four-point Likert scale - KYRBWS-V containing 128 questions in 14 fields including demographics, smoking, alcohol, drugs, obesity, eating behaviors, physical activity, prevention of trauma, sexual behaviors, psychiatric illness, oral hygiene, individual hygiene, atrophy/asthma, and internet use; heavy smokers ≥ 10 cigarettes/day; defined as drug users when they ever used any drugs	Scoring ≥52/80 on KS-S = high risk, 48-52 = potential risk	- 11.9% Internet users with potential risk for Internet addiction 3.0% users with high risk for Internet addiction - Smoking and drug use predict high risk

(Table 2) Contd….

Study	Sample and design[1]	Instruments	Addiction classification and criteria	Results
Lopez-Fernandez *et al.*, 2013	$N = 1,131$ high school students ($M = 14.55$, $SD = 1.82$, range = 12 and 18 years) in Spain	- Problematic Internet Entertainment Use Scale for Adolescents (PIEUSA), based on DSM-IV-TR criteria for substance dependence and pathological gambling disorders in adults; diagnostic criteria proposed for IUD in adults and adolescents and literature on adolescent IUD prevalence. - Scale contains 30 items rated on a 7-point Likert scale, total score between 30-210	PIEUSA highest score representing the maximum presence of the construct under study over the last 12 months	- Prevalence of problematic behaviour in Spanish adolescents ca. 5% - Scale was unidimensional, with excellent internal consistency (Cronbach's alpha of 0.92), good construct validity, and positive associations with alternative measures of maladaptive Internet use
Xu *et al.*, 2012	Random sample of $N = 5,122$ adolescents in Shanghai, China (age mean = 15.9 years, range 11-20 years)	- DRM 52 Scale of Internet-use (DRM Study Group, 2006), adapted from Young's Internet Addiction Scale (Young, 1996)	- Scoring >163/260 = Internet addiction	- 8.8% Internet addicts - Poor academic achievement, male gender, being in senior high school, have monthly spending >100 RMB, online hours, gaming and chatting predicted Internet addiction
Carbonell *et al.*, 2012	$N = 1,879$ students in Spain (45.5% males, mean age = 15.5, $SD = 2.43$ years)	- Questionnaire on internet-related experiences (CERI) (Beranuy, Chamarro, Graner, & Carbonell, 2009) with two factors, intra-and interpersonal conflicts - Questionnaire on cell phone related experiences (CERM) (Beranuy, 2009)	- Cluster analysis revealed 3 groups; highest scoring group (26-40 points) classed as having frequent problems	- 6.1% of sample had frequent problems with Internet use with no gender differences - Specific Internet application usages explained 27.5% of total CERI variance
Sun *et al.*, 2012	- Longitudinal study (2 waves) - $N = 1,761$ students in China (49% male, mean age = 16.8, $SD = .93$ years) - $N = 1,182$ students in the USA (57% male, mean age = 15.9, $SD = .76$ years)	- Compulsive Internet Use Scale based on Scale for Problematic Internet Use (Davis, 2004; Davis, Flett, & Besser, 2002) - Frequency of cigarette smoking and binge drinking in last 30 days	- Scoring a mean of 4/5 on CIUS as indicative of Internet addiction	- No relationship between CIU and substance use at baseline - CIU at baseline predicted change in CIU and substance use in females - Substance use at baseline was not predictive of CIU increase
Liu *et al.*, 2011	$N = 3,560$ high school students in Connecticut, USA (age range 14-18 years)	- Demographics - Risk behaviours - Internet use - Problematic Internet use	- PIU modelled after Minnesota Impulsive Disorder Inventory and defined as affirming symptoms of craving, withdrawal, and abstinence attempts simultaneously	- Prevalence of problematic Internet use 4% - PIU more common among Asian and Hispanic students, girls, associated with substance use, depression, and aggression
Bener *et al.*, 2011	- Interviews based on questionnaire - $N = 3000$ school students (age range = 6-18 years) in Qatar	- Excessive Internet use and television viewing - Vision and vision disorders - Obesity and overnutrition	- Excessive Internet use defined as spending ≥ 3hours/day online	- Obesity linked to online hours - 1.9% spent ≥ 3hours/day online, were overweight/obese and had low vision
Mythily *et al.*, 2008	$N = 2,735$ adolescents in Singapore (49.3% male, mean age = 13.9, $SD = 1.0$ years)	- Sociodemographic questions - Academic performance - Social support and general wellbeing	- Excessive Internet use = using the Internet > 5 hours/day	- 17.1% excessive Internet users - Excessive Internet use related to no rules regarding Internet use, less confidants, sadness and depression, poor academic performance

Note 1. If not otherwise indicated, the study design was a cross-sectional survey.

Table 3.　Epidemiological Internet Addiction Studies in Adults.

Study	Sample and design	Instruments	Addiction classification and criteria	Results
Barke *et al.*, 2012	Total $N = 1,882$ (online sample [$n = 1,041$, mean age = 24.2 years, $SD = 7.2$ years, 46.7% male] and offline student sample [$n = 841$, mean age = 23.5, $SD = 3.0$ years, 46.8% male] and student sample [$n = 108$, mean age = 21.5, $SD = 2.0$ years, 25.7% male]) in Germany	- German version of the Internet Addiction Questionnaire (Young, 1998a) - Generalised Problematic Internet Use Scale (GPIUS2) (Caplan, 2010) - Demographics - Internet use	- Scoring ≥ 70/100 on IAT = significant problems, scoring 40-69 = frequent problems	- 2% addicted to the Internet - German IAT with good psychometric properties - 2-factorial structure - IAT high correlation with GPIUS2 scores (good convergent validity)
Canan *et al.*, 2012	$N = 1,034$ students (age range = 18-27 years) in Turkey	- Turkish version of Internet Addiction Scale (IAS) (Nichols & Nicki, 2004) - Dissociative Experiences Scale (Bernstein & Putnam, 1986)	- Scoring > 80 on IAS indicated Internet addiction	- 9.7% of the study sample addicted to the Internet - Internet addiction correlated with dissociative experiences - Internet addiction higher in males
Yates *et al.*, 2012	$N = 1,470$ college students (62.9% female, age mean = 19.13, $SD = 1.49$) in the USA	- Young's Internet Addiction Test (Young, 1998b) - Child Abuse and Trauma Scale (CATS) - Toronto Alexithymia Scale (TAS-20) (Sanders & Becker-Lausen, 1995) - Self-Perception Profile for College Students (Bagby, Parker, & Taylor, 1994) - Duke-UNC Functional Social Support Questionnaire (PSSQ) (Broadhead, Gehlbach, de Gruy, & Kaplan, 1988)d - Symptom Checklist-90-Revised (SCL-90-R) (Derogatis, 1983)	- Problematic Internet Use (PIU) = scoring ≥50/100 - PIU = moderate Internet addiction	- 6% addicted - Higher levels of PIU in males and Asian students - PIU associated with low self-concept, low social support, high psychopathology, child maltreatment experiences (latter partially mediated by alexithymia)
Morrison & Gore, 2010	$N = 1,319$ UK online social network users (63% female, mean age = 21.24, $SE = .11$, age range = 16-51)	- Internet Addiction Test (Young, 1998a) - Internet Function Questionnaire - Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961)	- Scoring ≤ 49 considered normal, 50–79 problematic, 80–100 significantly problematic Internet use	- 1.2% Internet addiction prevalence - Internet addicts more depressed than controls - Internet addiction higher in males and younger people, engagement in gaming, chat, and online sexual gratification
Whang *et al.*, 2003	$N = 13,588$ Internet users in Korea (7,878 males, mean age = 26.74, $SD = 7.27$ years, age range = 20-40 years)	- Modified Internet Addiction Scale (Young, 1998a) - Internet use - Modified Diagnostic Scale of Excessive Internet Use	- Internet addiction classification when scoring > 60/80 on IAS, scoring 50-60 classed as possible Internet addicts	- 3.5% Internet addicts, 18.4% possible Internet addicts - Internet addiction associated with escape from reality, dysfunctional social behaviours, depressed mood, loneliness, compulsivity, vulnerability to interpersonal dangers

(Table 3) Contd….

Study	Sample and design	Instruments	Addiction classification and criteria	Results
Ni *et al.*, 2009	N = 3,557 first-year university students in China (68.18% male, mean age = 18.77, SD = 1.15 years, age range = 17-24 years)	- Young's Internet Addiction Test (Young, 1998b) - Self-Rating Depression Scale (SDS) (Zung, 1965) - Self-Rating Anxiety Scale (SAS) (Zung, 1971) - Basic information	- Scoring 50/100 on IAT = Internet addicts	- 6.44% addicted to the Internet - Internet addiction predicted by SDS and SAS scores, single-parent family, first Internet exposure, age, city residence, home sickness
Kheirkhah *et al.*, 2010	N = 1,856 Internet users from Mazandaran Province cities, Iran (50.9% males, mean age = 20.25, SD = 4.19 years)	- Farsi version of Young's Internet Addiction Questionnaire - Time spent online	- Endorsing ≥ 5/8 dichotomous items was indicative of Internet addiction	- Internet addiction incidence = 22.8% - Internet addicts spent more time online than non-addicts and used two-way communication functions (i.e., chat rooms) - More male Internet addicts
Bakken *et al.*, 2009	N = 3,399 Norwegian adults (1,598 male, age range 16-74 years)	- Young Diagnostic Questionnaire (YDQ) (Young, 1998b) - Subjective mental illness assessed with 1 question each over last 12 months (i.e., sleep disorders, depression, suicidal ideation, anxiety, obsession and compulsions, alcohol/substance abuse)	- Scoring 5/8 on YDQ = Internet addicts, scoring 3-4 = at risk users	- Prevalence of Internet addiction 1.0%, 5.2% at risk users - Highest prevalence in young males - Male gender, young age, university level education, and unsatisfactory financial situation increased odds of problematic Internet use - YDQ score associated with online time, sleeping disorders, depression, and other psychological problems
Huang *et al.*, 2009	N = 4,400 college students in Wuhan, China (54.3% male, mean age = 20.19, SD = 1.26 years, range = 16-30 years)	- Young's Diagnostic Questionnaire for Internet Addiction (YDQ) (Young, 1998b) - Zung Self-Rating Depression Scale (Kitamura, Sugawara, Shima, & Toda, 1999) - Demographic questions	- Scoring ≥ 5/8 on YDQ = Internet addiction - Problematic Internet users scored ≥ 4 on YDQ	- 9.58% with problematic Internet use - Heavy Internet use, poor academic achievement, lack of family love, depression, male gender associated with PIU
Lin *et al.*, 2011	Nationally representative sample of college students in Taiwan (N = 3,616, no information about age provided)	- Chen Internet Addiction Scale-Revised (CIAS-R) (Ko, Yen, Chen, Chen, & Yen, 2005; Ko *et al.*, 2009) - Positive Outcome Expectancy of Internet Use Questionnaire (Lin, Ko, & Wu, 2008) - Refusal Self-Efficacy of Internet Use Questionnaire (Lin, Ko, *et al.*, 2008) - Ko's Depression Inventory (KDI) (Chiu, Ko, & Wu, 2007) - Barratt Impulsiveness Scale Short-Form (Li, Ko, Weng, Liau, & Lu, 2002) - Chinese Version of the Relationship Questionnaire (Bartholomew & Horowitz, 1991) - Social Support Scale (Yeh, Ko, Wu, & Cheng, 2008a)	- Internet addiction measured via 26 items: scoring >67 on CIAS-R	- Internet addiction prevalence 15.3% - Internet addiction correlated with depressive symptoms, Internet use positive outcome expectancy, time spent online, low refusal self-efficacy of Internet use, impulsivity, low academic performance satisfaction, male gender, insecure attachment style

Study	Sample and design	Instruments	Addiction classification and criteria	Results
Yen *et al.*, 2011	N = 2,262 college students (47.5% males, mean age = 20.77, SD = 1.83 years) in Taiwan	- Chen Internet Addiction Scale (Chen, Weng, Su, Wu, & Yang, 2003) - Center for Epidemiological Studies' Depression Scale (Chien & Cheng, 1985a; Radloff, 1977) - Questionnaire for online activity - Buss-Durkee Hostility Inventory, Chinese version short form (Lin *et al.*, 2008)	Scoring ≥ 67/104 classified as Internet addicts	- No prevalence reported - Hostility in real world and online higher in Internet addicts than depressed individuals - Internet addiction associated with expressive hostility behaviours
Tsai *et al.*, 2009	N = 1,360 university freshmen in Taiwan (69.6% male)	- Chinese Internet Addiction Scale-Revised (CIAS-R) (Chen, *et al.*, 2003) - Chinese Health Questionnaire (CHQ-12) (Chong & Wilkinson, 1989) - Measurement of Support Functions (MSF) (Berkman & Glass, 2000) - Neuroticism subscale of the Maudsley Personality Inventory (MPI) (Eysenck & Eysenck, 1975) - Lifestyle habits	Scoring >63/84 indicated Internet addiction	- 17.9% Internet addicts - Male gender, neuroticism, habit of skipping breakfast, mental health morbidity, deficient social support, and CHQ scores increased odds for Internet addiction
Yen *et al.*, 2009	N = 2,793 students (33.5% male, mean age = 20.46, SD = 2.07 years, age range = 18-48 years) in Taiwan	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Adult ADHD Self-Report Scale (Kessler *et al.*, 2005) - Demographic questions	Internet addiction when scoring ≥ 68/104 on CIAS	- 12.9% addicted to the Internet - Attention deficit and impulsivity most strongly related to Internet addiction - Attention deficit among females more strongly related to Internet addiction
Yen *et al.*, 2009	N = 1,992 college students (29.2% male, mean age = 20.45, SD = 2.16 years) in Taiwan	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Behavior Inhibition System and Behavior Approach Scale (BIS/BAS) (Gray, 1991) - Alcohol Use Disorders Identification Test (AUDIT) (Babor, Fuente, Saunders, & Grant, 1989)	Scoring ≥ 67 on CIAS were classified as addicted to the Internet	- 12.3% nternet addicts - Internet addiction related to harmful alcohol use - Internet addicts scored more highly on BIS and BAS fun-seeking subscales
Lin *et al.*, 2008	N = 4,456 college students in Taiwan (46.7% male, mean age = 19.87, SD = 1.62 years)	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Outcome Expectancy Questionnaire - Refusal Self-Efficacy of Internet Use Questionnaire (RSEIUQ)	No information about cut-off provided	- No prevalence reported - Refusal self-efficacy of Internet use negatively, and positive outcome expectancy positively predicted Internet addiction, negative outcome expectancy predicted Internet addiction via refusal self-efficacy of Internet use

(Table 3) Contd….

Study	Sample and design	Instruments	Addiction classification and criteria	Results
Yeh *et al.*, 2008	*N* = 3,477 college students in Taiwan (45% male, mean age = 22.45, *SD* = 1.56 years)	- Chen Internet Addiction Scale (Chen, *et al.*, 2003) - Social Support Scale - Virtual Social Support Scale - Ko's Depression Inventory (Ko, 1989)	No information about scoring provided	- No prevalence reported - Actual and virtual social support predicted Internet addiction and were mediated by depressive symptoms in females - Virtual social support mediated and not mediated by depressive symptoms predicted Internet addiction in males
Kuss *et al.*, 2013	*N* = 2,257 UK university students (33.0% male; mean age = 22.67 years, *SD* = 6.34, range 18-64)	- Assessment for Computer and Internet Addiction-Screener (AICA-S; Wölfling, Müller, & Beutel, 2010) - NEO-Five Factor Inventory (Costa & McCrae, 1992)	Scoring ≥13.5/27 indicates potential Internet addiction	- 3.2% addicted to the Internet - Risk factors: combination of online gaming and openness to experience; online shopping and social online activities, high neuroticism and low agreeableness - Preventative factor in online shoppers: neuroticism
Meerkerk *et al.*, 2009	Representative samples of heavy Dutch Internet users (*n*s = 447 at T1 (49.4% male, mean age = 38.5, *SD* = 12.5 years) and 229 at T2) and a convenience sample of regular Internet users (*n* = 16,925, 77.4% male, mean age = 25.3, *SD* = 10.0 years)	- Compulsive Internet Use Scale (CIUS) - Online Cognition Scale (OCS) 14 - Time spent online - Subjective problems	Internet addiction labelled "compulsive Internet use" because addicted to certain activities not Internet use per sé, leading to compulsive use	- No prevalence reported - CIUS with good internal consistency, good concurrent and criterion validity
Thatcher *et al.*, 2008	*N* = 1,399 technologically savvy Internet users from South Africa (1,065 males, aged between 24-35 years)	- Problematic Internet Use Questionnaire (PIUQ) (Thatcher & Goolam, 2005) - Distraction subscale of the online cognition scale (OCS) (Davis, *et al.*, 2002) - Modified version of Flow Scale (Webster, Trevino, & Ryan, 1993)	N/A	- No prevalence reported - Strong relationship between problematic Internet use, online procrastination and online flow
Demetrovics *et al.*, 2008	*N* = 1,037 participants in Hungary (54.1% male, mean age = 23.3, *SD* = 9.1 years)	- Problematic Internet Use Questionnaire (PIUQ) based on Internet Addiction Questionnaire (Nyikos, Szeredi, & Demetrovics, 2001) and Internet Addiction test (Young, 1998a)	- Significantly problematic Internet use = scoring > 2*SD*s above the mean on PIUQ - Problematic Internet use = scoring between 1 and 2 *SD* above mean on PIUQ	- 4.3% with significant problems because of Internet use, 10.1% with problems - PIUQ with good internal consistency, test-retest reliability - Most problematic Internet users with high male proportion, live with restructured family, are single

Study	Sample and design	Instruments	Addiction classification and criteria	Results
Cuhadar, 2012	$N = 1,235$ students at a teacher training programme in Turkey (30.0% male)	- Problematic Internet Use Scale (Ceyhan, Ceyhan, & Gürcan, 2007) - Social Interaction Anxiety Scale (Sübasi, 2003)	- PIUS ranges between 33-165, higher score indicates less healthy Internet use, stronger negative effects, higher tendency for Internet addiction pathology	- No prevalence reported - Internet use more problematic for males - Problematic Internet use correlated with time spent online - Social interaction anxiety predicted problematic Internet use
Huang *et al.*, 2007	$N = 1,029$ Chinese undergraduate students in Beijing split into two: $n_1 = 516$ (47.5% male, mean age = 20.5, $SD = 1.47$, range = 17-24 years), $n_2 = 513$ (46.2% males, mean age = 20.7, $SD = 1.51$, range = 17-24 years) - $N_3 = 67$ (27 diagnosed Internet addicts; 31.3% male, mean age = 20.6, $SD = .93$ years, range = 19-25 years)	- Chinese Internet Addiction Inventory (CIAI) based on Young's Internet Addiction Test	Classification of Internet addiction based on 5+3 criteria (Beard & Wolf, 2001) (i.e., endorsing preoccupation, tolerance, impulse control, mood modification, and increasing usage, and min. one of conflicts, lying to others, escaping from problems)	- Subscale items with high internal consistency and acceptable test-retest reliability, criterion validity
Bergmark *et al.*, 2011	$N = 1,147$ participants in Sweden (50.4% male, mean age = 45, range = 15-94 years)	- Demographics - Internet related problems	Internet related problems	- 5% spend >30hours/week online at home - 40% experience ≥1 problem because of Internet use - 1.8% experience all problems
Beutel *et al.*, 2011	Representative survey of German population aged between 14 and 94 years ($N = 2,512$, 44.2% male, mean age = 49.5 years)	- Leisure time Internet use - Negative consequence of Internet use - Use of Internet for emotional coping - Cambridge Depersonalization Scale (CDS-2) (Michal *et al.*, 2010) - Hospital Anxiety and Depression Scale (HADS) (Hinz & Schwarz, 2001)	- Problematic Internet use based on experience of ≥1 problem due to Internet use (i.e., work, school, family, partnership, finances, recreational activities, health-related)	- 9.3% experienced ≥1, and 3.5% >1 negative consequence because of Internet use - Problematic use associated with time online, negative emotion avoidance, preference for gaming, gambling, online sex, depersonalization

3.3.1. Factors Associated with Internet Addiction in Adolescents

3.3.1.1. Sociodemographic Variables

In addition to the prevalence estimates reported, the studies have found that in adolescents, Internet addiction to be associated with the following sociodemographic variables: higher family income levels [54, 56], male gender [38, 54-56, 58, 59, 63, 76, 102], female gender [41], being left behind (i.e., abandoned), and migrant [61], living in rural areas [102], being in senior high school, and having a monthly spending over 100 RMB [38]. The discrepancy between findings concerning associations between Internet addiction and gender can possibly be explained by the measures utilised, i.e., Liu *et al.* (2011) found that a higher percentage of girls reports excessive usage behaviours, which might be indicative of their increased problem awareness relative to boys. Also, uninvestigated cultural differences could be the reason for these controversial socio-demographic findings.

3.3.1.2. Internet use Variables

Moreover, the following Internet use variables have found to be associated with Internet addiction in adolescents: age of first exposure to the Internet [71], Internet use for entertainment purposes [56], frequency and length of Internet use [38, 56, 57, 69], Internet access at home [54], Internet usage at an Internet café [63, 71], the use of online gaming [39, 45, 62, 103], social applications [38, 39, 45], and other Internet applications [62]. In addition to this, parental guidance with regards to Internet behaviours was reported to be associated with Internet addiction, specifically little parental communication about Internet use, rules about Internet times [34], and a lack of rules regarding Internet use [43].
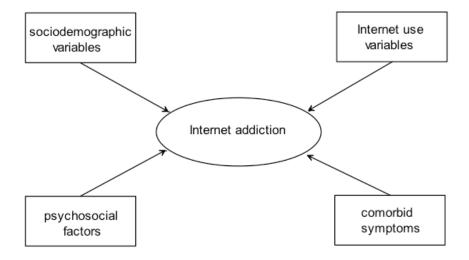
Fig. (1). Factors Associated with Internet Addiction.

3.3.1.3. Psychosocial Factors

Psychosocial factors have included internal characteristics such as Internet use for mood regulation (Gamez-Guadix, *et al.*, 2012), low life satisfaction [56, 71], low well-being [33], loneliness [36, 56], lack of confidants [43], preference for online social interaction, negative life outcomes [35]. Moreover, the following personality characteristics were reported: novelty seeking, harm avoidance, and low reward dependence [79], low self-esteem [71], frustration intolerance [particularly for males; 82], introversion [33], low agreeableness, low emotional stability [33, 45], low conscientiousness and resourcefulness [45]. In addition, social variables were social adaptation [56], stress [58], low academic achievement [38, 43], poor relations with school [58, 74], leisure boredom [68], breadth of extracurricular activities [71], peers and siblings who drink alcohol [74, 83]. Furthermore, a variety of family variables were associated with Internet addiction. These included family conflict and dissatisfaction [57, 58, 74, 83], parental bonding [62], perceived parental monitoring [68, 74], and perceived positive attitude to adolescent substance use by parents [83].

3.3.1.4. Comorbid Symptoms

Comorbid symptoms have included alcohol and substance use [40, 41, 44, 58, 59, 64, 67, 75, 104], proneness for problem behaviours [75], depression [41, 43, 60, 61, 71, 76, 80, 102, 105], suicidal ideation [105], ADHD [60, 72, 80], social phobia and phobic anxiety [72, 77, 80], schizophrenia, obsessive-compulsive disorder [60], psychoticism [64], and antisocial/aggressive behaviours [41, 65, 72, 73, 80, 82]. Finally, a number of psychosomatic problems have been linked to problematic Internet use, such as a poor health condition, excessive daytime sleepiness [59], lack of energy, physiological dysfunction, weakened immunity [56], obesity, and poor vision [42].

3.3.2 Factors Associated with Internet Addiction in Adults

3.3.2.1. Sociodemographic Variables

A number of factors have been found to be associated with Internet addiction in adults. With regards to sociodemographic variables, this includes male gender [48, 49, 86, 88, 91-94, 96], younger age [88, 92], city residence [90], single parent and restructured family [48, 90], being single [48], financial difficulties, university level education [92], as well as Asian ethnicity [87] were reported.

3.3.2.2. Internet use Variables

Various Internet use variables have been found to be associated with Internet addiction. These include increased time spent online [49, 51, 52, 91, 92, 94], early Internet exposure [90], positive outcome expectancy, low refusal self-efficacy of Internet use [94, 99], online flow and online procrastination [47]. Furthermore, the usage of a number of different Internet applications has been linked to Internet addiction. These include social applications [53, 88, 91], online gaming and other applications [52, 88], and a combination of online gaming and openness to experience [53].

3.3.2.3. Psychosocial Factors

A number of psychosocial factors were found to be associated with Internet addiction. Psychological variables have included impulsivity [94, 97], neuroticism [53, 96], low agreeableness [53], low self-concept [87], escapism [89], loneliness [89], fun-seeking [101], and negative emotion avoidance [52]. Social variables were low satisfaction with academic performance (Lin *et al.*, 2011; Huang *et al.*, 2009), an insecure attachment style [94], child maltreatment experiences [87], low social support [87, 96], lack of family love [93], homesickness [90], virtual social support directly and indirectly via depressive symptoms, and low actual social support directly and indirectly via depressive symptoms [100]. In addition to this, dysfunctional social behaviours and vulnerability to interpersonal dangers [89] were reported. Moreover, a behavioural factor, i.e., a habit of skipping breakfast [96] was statistically associated with Internet addiction.

3.3.2.4. Comorbid Symptoms

In terms of comorbid symptoms, the following factors have been found: depression [88-90, 93, 94, 100], anxiety [90, 92], harmful alcohol use [101], compulsivity [89], sleeping disorders [92], ADHD [97], hostility [95], dissociative experiences and depersonalisation [52, 86], psychological problems and high psychopathology in general [87, 92, 96].

4. DISCUSSION

The aim of this paper was to review and describe epidemiological Internet addiction research since the millennium. The conceptualisation of Internet addiction was assessed by inquiring into commonly utilised assessment tools. Based on this, the prevalence rates in the studies to date have been identified, and the associated factors highlighted. Overall, this literature review supports conclusions about the Internet addiction research field that have been made previously [15-17], indicating that Internet addiction assessment is inauspiciously varied. This literature review has highlighted that to date, no gold standard for Internet addiction diagnosis and assessment exists.

A sum total of 21 different Internet addiction questionnaires have been identified in this review, some of which use criteria as

indistinctive as the number of problems experienced by individuals [e.g., 52], or the number of hours spent on the Internet as being suggestive of Internet addiction problems [42, 43]. Moreover, other studies [e.g., 35, 36, 106] used dimensional measures that do not allow for the assessment of prevalence rates. If Internet addiction research aims to run parallel to actual clinical assessment, standardised cut-offs need to be implemented so that findings can be compared and disseminated [107]. The label "Internet addiction" inherently refers to a psychopathology, a diagnosable clinical entity, which is capable of distinguishing individuals that are not affected (i.e., not addicted) from those that are addicted to using the Internet, thus denoting diagnostic sensitivity and specificity [108]. If the nosology of addiction is used, its usage must be justified against actual presenting problems in clinical settings and thus clinical utility is called for in assessment scales.

In addition to the wide variability in diagnostic tools used for Internet addiction assessment, the most commonly used scales [11, 28, 29] suffer from a variety of shortcomings. First of all, none of Young's [11, 28] measures include a time criterion. If Internet addiction was to be treated as a behavioural analogue to substance dependence [109], a minimum number of symptoms need to be present simultaneously over the same 12-month period. Using Young's criteria, an individual would be classed as Internet addict when he or she experienced five of eight symptoms altogether over their lifetime, evidently questioning the clinical validity of the diagnostic construct. Moreover, the binary response format in the IADQ [11] is very limited with regards to the amount of information utilised relative to a dimensional assessment of symptom presence [110]. The lack of a temporal dimension and binary scoring is likely to lead to inflated prevalence rates of Internet addiction [15]. A dimensional approach to symptom evaluation can offer a "more valid description of psychopathology" [111] as it overcomes the limitations of categorical approaches. The CIAS [29], on the other hand, includes items such as time management to assess the degree of Internet use-related problems. It is questionable to what extent variables like time management constitute a criterion that is relevant for diagnosis, and therefore, the Internet addiction prevalence rates reported using the CIAS may be an overestimate. In light of this, the time management criterion could be combined with the reason for Internet use being either instrumental (i.e., information seeking) or ritual (i.e., entertainment) [112], as it appears not to be the time that constitutes the criterion, but the time combined with the usage motivation which distinguishes Internet use from potential abuse.

In this literature review, it has been found that prevalence rates are particularly diverse across samples and across measurement instruments, indicating a relatively low validity across studies. The prevalence rates for adolescents ranged between 0.8% in Italy [55] and 13.8% in South Korea [60] assessed via the IAT, between 1.4% in Finnish girls [70] and 26.7% of adolescents in Hong Kong [66] using the IADQ, and between 10.8% in Southern Taiwan [72] and 22.5% of boys under 15 in Taiwan [102] assessed via the CIAS. Using miscellaneous criteria and instruments, the Internet addiction prevalence varied between 3.0% in South Korea [44] and 17.1% in Singapore [43]. Similar divergence was found in the adult samples. Prevalence rates varied between 1.2% of Internet users in the UK [88] and 9.7% of College students in Turkey [86] assessed via the IAT, between 1.0% in Norwegian adults [92] and 22.8% of Iranian Internet users [91] as evaluated using the IADQ, and between 12.3% [98] and 17.9% of college first-years in Taiwan [96] using the CIAS. Finally, the usage of miscellaneous criteria in adults revealed that between 1.8% of Swedish adults [51] and 4.3% of Hungarian adults [48] experience significant problems because of their Internet use.

Taken together, the dissimilar prevalence rates reported can thus partially be attributed to different classification criteria used, more so than differences between age groups (i.e., adolescents and

adults). Internet addiction (or Internet-use related symptoms) appears to be prevalent across the age spectrum, as both adolescent and adult groups seem to experience associated problems. Another reason for different prevalence rates concerns the population studied, as conceivably there may exist differences between general populations and Internet users specifically. Similarly, some studies used convenient online sampling [e.g., 53], which allows for the collection of a large pool of data [113], but might introduce a sampling bias. Moreover, the cultural context of the studies must be attended to as measurement instruments are not universal and mental problems are experienced and reported in different ways across various cultures [114].

In addition to this, although in some studies the same scales have been used, different cut-off criteria have been adopted. Presumably, the severity of Internet-addiction related symptoms in a person scoring 50 on a 100-point scale is lower than for a person scoring 80 on the same scale. This needs to be borne in mind when evaluating actual prevalence. The use of cut-off points is common practice in clinical evaluation of patients. The diagnostic manuals used in clinical practice today, i.e., the DSM IV-TR (American Psychiatric Association, 2000) and the ICD-10 [115] use cut-offs based on which the presence of symptoms can be evaluated from a clinical point of view. The usage of commonly agreed upon cut-off points for mental disorder diagnosis primarily serves the purpose of clinical utility by facilitating diagnosis, medical record keeping, and clinical research (such as meta-analyses) relative to a potential dimensional approach [107].

Moreover, the self-report survey methodology (rather than actual clinical assessment by specially qualified professionals) necessitates additional caution in the evaluation of results. However, in favour of self-reports, it needs to be stated that their usage is very common in psychological research as it has a number of advantages over other methods, such as interviews [116]. Surveys reduce interviewer bias, are anonymous, allow for considered answers rather than immediate responses, and are accessible to wider samples. Furthermore, they are more cost-effective as they do not require professional training for administration. The disadvantages include simple (and thereby possibly limited) questions, lack of probing, limited control, and a relatively low response rate [116]. In terms of the applicability of self-reports in clinical assessment situations, it has been found that there does not appear to be a significant difference between self-rating and clinical rating with regards to major depressive disorder [117], suggesting that self-reports may realistically reflect the symptom experience of individuals suffering from psychopathology. In addition to this, the usage of psychometric tools to evaluate patients' mental health status prior to treatment initiation is common practice in modern clinical psychology [118, 119]. Moreover, it has been shown that self-reported symptom severity distinguished medical outpatients with mental disorders significantly from patients without [120], supporting the usefulness of self-reports for initial psychiatric evaluation of a patient's mental health status. This indicates that self-reports are a valuable tool in initial psychopathology assessment.

Various additional factors have been specified as statistically related to Internet addiction, namely sociodemographic, Internet use, and psychosocial variables, as well as comorbid symptoms and disorders. The most common sociodemographic variable associated with Internet addiction was male gender both in adolescents (e.g., Lam, Peng, Mai, & Jing, 2009; Yen, Ko, Yen, Chang, & Cheng, 2009) as well as in adults (e.g., Bakken, *et al.*, 2009; Lin, *et al.*, 2011). Research suggests that the link between male gender and Internet addiction may be mediated by other variables, such as the type of online application used. For instance, males have preferences for online activities that are more frequently dysfunctional, such as online games and online sex [18]. Moreover, the higher prevalence reported in males could be mediated by individual differences in personality traits, such as low self-control, impulsivity

and sensation seeking [121, 122]. Results of the National Comorbidity Survey indicated that adolescent males have been identified to be 30% to 80% more at risk for developing substance-related disorders than adolescent females [123], suggesting that they might be more vulnerable to addictions generally.

Internet use variables have been investigated with the most commonly identified link being between Internet addiction and time spent online [e.g., 38, 91, 94] and the use of specific online applications, notably gaming and social applications [38, 39, 45, 53, 88]. The time spent online may be a tentative indicator of an increasing tolerance to using the Internet, which is a core criterion for substance dependence [109]. The studies presented however mainly used cross-sectional data, which do not provide for an evaluation of a potential progression of online times. This indicates that the statistical associations between time spent online and Internet addiction symptoms appear as short-cut for appraising the presence of tolerance. In addition to this, time that is spent online is time that is not spent offline, i.e., engaging in alternative recreational activities, and spending time with friends and significant others, which can lead to significant problems and potentially cause impairment. Moreover, factors related to the virtual context of Internet use may furthermore play a special role in the development of potentially addictive behaviours. In a recent study, it was found that flow (i.e., a state where the activity at hand matches challenge and skill [124]) and telepresence (i.e., the perception of being present in the virtual environment [125]) were predictive of Internet abuse [126].

Nevertheless, it still appears relatively unclear what individuals get addicted to as online, they can engage in a multitude of behaviours, possibly with different consequences. Previous reviews have indicated that the engagement in specific behaviours on the Internet may lead to symptoms associated with addiction, such as online gaming [127] and online social networking [128], suggesting that certain behaviours on the Internet might be more problematic than others. Online gaming has been identified as potentially addictive in previous research, highlighting that certain personality traits, self-regulation capacities, gaming motivations, as well as structural game characteristics may increase the risk for online gaming addiction [127]. The literature base for Internet social application addiction, relative to gaming, is diminutive, however, the usage of social networking sites has been found to be potentially addictive as overuse can result in a variety of negative consequences for the individual [129].

This review has moreover shown that certain psychosocial problems associated with Internet addiction may prove fruitful in distinguishing between adolescent and adult Internet related problems. For instance, in some studies using adolescents, various forms of family conflicts and problems have been noted [e.g., 57, 58, 102], indicating that stressors in the realm of family may reinforce the excessive engagement with the Internet as a form of dysfunctional coping. A secure and supportive family environment thus appears to be particularly relevant for adolescents as the lack of it increases the risk for Internet addiction. In addition to this, poor academic achievement was noted in a variety of studies as risk factor for Internet addiction [e.g., 43, 93, 130]. Scholastic and academic pressures (particularly in Asian countries) appear to have a negative influence on the adolescents' and young adults' adjustment and life satisfaction which again may lead them to seek refuge in online worlds by applying a dysfunctional coping strategy. Furthermore, from the analysis, it appeared that in general, certain personality characteristics (e.g., impulsivity, neuroticism) may put individuals at risk for developing Internet addiction. That is, specific individual factors may increase the vulnerability for Internet addiction, which, possibly in the presence of external stressors such as poor family function and/or insufficient academic achievement, may potentiate the risk for Internet addiction relative to individuals with none or fewer such predisposing factors.

The presence of a variety of comorbid symptoms and disorders as well as psychosocial and psychosomatic problems indicates that Internet addiction does not occur in a vacuum. Presumably, the Internet is used in order to cope with problems (e.g., loneliness, family conflict, depressive symptoms), which in turn may exacerbate potential Internet addiction symptoms [e.g., 131, 132]. Similar relationships between alcohol use for coping purposes and alcohol abuse have been established [133], suggesting that the link between everyday problems and Internet use as coping mechanism appear viable. It could be possible that in some cases, rather than being a psychopathology per se, the excessive use of the Internet could be used as (dysfunctional) coping mechanism to deal with primary disorders, such as depression or Post-Traumatic Stress Disorder. Future research is required to more closely pay attention to these potentialities and to establish the theoretical framework for Internet addiction, which as yet appears to be somewhat limited.

Moreover, research indicates that gaming addiction can appear as both, a primary and a secondary disorder [134], suggesting that the same may hold true for other forms of addictive online behaviours. In general, the comorbidity between mental disorders and addiction is high [135], with individuals suffering from mental health problems three times more likely to be addicted relative to healthy populations [136]. The widely reported co-existence of Internet addiction and substance use/abuse suggests that addictions share etiological mechanisms, such as neurobiological and psychosocial factors [26], supporting the syndrome model of addiction [137]. Overall, investigating associated factors allows for the identification of populations at risk for developing Internet addiction. These can be specifically targeted by prevention campaigns as well as specialised health care initiatives.

As regards the different classifications adopted in the studies reviewed, one could argue that the construct of Internet addiction has been created from an atheoretical perspective. Scholars have conceptualized the problematic use of the Internet in the framework of substance abuse a priori following the DSM-IV-TR criteria [109], and developed assessment tools based on these criteria. This approach to Internet addiction classification and assessment is problematic as it lacks a theoretical basis and may oversimplify the issue. In light of this, research is required which assesses the biopsychosocial processes that contribute to the development of addictive behaviours on the Internet. Discerning similarities in brain activity and structural abnormalities across addictions including Internet addiction seems to be a first step on the way towards understanding Internet addiction more fully [24]. Although the reported prevalence rates vary, they suggest that an Internet-use related disorder exists.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

A number of limitations need to be addressed. First, the goal of a review of epidemiological studies of Internet addiction studies precluded the inclusion of (i) studies of smaller sample sizes and (ii) studies specifically focusing on online gaming addiction. These have been discussed in detail elsewhere [127, 138] and were therefore left out of the present analysis. Future research should contrast and compare the studies assessing Internet addiction and addictions to specific Internet activities. This will shed additional light upon the APA's decision to limit the new preliminary diagnostic category of addictive Internet use to games [14]. Second, the current literature review does not contain specific information about the respective number of studies excluded due to not meeting the required inclusion criteria. In future studies, it is advised to pay closer attention to the frequency of exclusion as per specified criterion.

CONCLUSION

In sum, the present literature review of epidemiological empirical Internet addiction research has shown that there are problems in

the assessment of Internet addiction. No clear gold standard exists based on which the status and severity of Internet addiction symptoms can be evaluated, and neither is the usage of current tools standardised in such a way that cross-study comparisons are facilitated. In light of this, it is recommended that (i) a clearly defined nosology of Internet addiction is established as clear-cut psychopathological entity, (ii) a single denomination for this entity is adopted, and (iii) to standardise the assessment tools and procedures to ensure high clinical utility. Internet addiction has been named an "important global mental health problem" [22], as Internet use–related problems and associated addiction symptoms have been reported on a global scale throughout adolescence and adulthood. Clearly, there is a need for nosological precision so that ultimately those in need can be helped by translating the scientific evidence established in the context of Internet addiction into actual clinical practice.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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