Behaviour & Information Technology, 2014
Vol. 33, No. 7, 757–766, http://dx.doi.org/10.1080/0144929X.2013.810778

Taylor & Francis
Taylor & Francis Group

Prevalence of internet addiction in the general population: results from a German population-based survey

Kai W. Müller[a]*, Heide Glaesmer[b], Elmar Brähler[a], Klaus Woelfling[c] and Manfred E. Beutel[c]

[a]*University Medical Centre Mainz, Mainz, Germany;* [b]*University Medical Centre Leipzig, Leipzig, Germany;* [c]*Outpatient Clinic for Behavioral Addictions, University Medical Centre Mainz, Mainz, Germany*

(*Received 16 October 2012; final version received 3 April 2013*)

Despite a growing number of publications, there is still no generally agreed-upon definition and assessment procedure for Internet addiction, and there is a lack of representative data on its prevalence in the general population. Based on a reliable and valid scale of Internet addiction, the purpose of this study was to determine the proportion of the general population of Internet addiction with psychometric evidence and to identify associated psychosocial and health consequences. Out of a representative survey of the German population ($N = 2512$) the leisure time Internet users ($n = 1382$) were queried by standardised questionnaires on Internet addiction, depression, anxiety (HADS) and depersonalisation (CDS-2). According to strict criteria of the Assessment of Internet and Computer Game Addiction (AICA-S), 2.1% of the sample was characterised as addicted by meeting criteria of craving, withdrawal symptoms, tolerance, etc. These reported daily Internet use, excessive online times. The majority reported additional adverse psychosocial and health consequences. Risk factors were male gender and social factors (unmarried, unemployment, students, low income). Online gambling, social networks, gaming chats and pornography were preferentially used by Internet addicts. Assessment of Internet addiction requires a multifaceted approach; the AICA-S is an instrument suitable for further epidemiological study.

Keywords: cognitive absorption; computer anxiety; depression; time compression

1. Introduction

Already in 1999, Young (1999) postulated an addictive potential of different types of Internet use, which she termed 'cybersexual addiction' (watching or downloading pornographic material), 'cyber-relational addiction' (over-involvement with online relationships), 'net compulsions' (online gambling or shopping), 'information overload' (excessive or collecting) and 'computer game addiction'. In the past two decades, negative repercussions of excessive Internet use have become the focus of an increasing number of publications, particularly from Southeast Asia (Douglas *et al.* 2008, Byun *et al.* 2009). Recently, the growing recognition of its negative psychosocial and health consequences has led to the suggestion to include Internet addiction as a new disease entity in the forthcoming revision of the DSM (American Psychiatric Association 2012). Including Internet addiction – at least as a secondary diagnosis in section III of the DSM-V – would be beneficial in provoking further in-deep empirical studies on this clinical phenomenon. While recognising Internet addiction as a mental disorder may help those suffering from it by empowering the general healthcare system in offering specialised psychotherapy programs, there has also been criticism on its inclusion.

However, evidence on the classification, aetiology and pathogenesis of Internet addiction is still limited. Indeed, progress in establishing a sound clinical characterisation of various kinds of excessive or addicted Internet use as prerequisites for diagnosis and treatment has been hampered by a lack of (a) consensus regarding conceptualisation, (b) standardised and validated measures of Internet addiction, (c) representative epidemiological studies on the characteristics, prevalence and risk factors in the general population.

It has remained an issue of debate whether Internet technology merely constitutes convenient means of acting upon pre-existing mental disorders (e.g. high comorbidities of depression, social phobia or ADHS; Ha *et al.* 2006, Yen *et al*. 2008, Huang *et al.* 2009;, other addictions that can be pursued on the Internet, e.g. pathological gambling) or if it is conceptualised as a genuine disorder that is specifically triggered by technological characteristics of the Internet (Beutel *et al.* 2011a). Proponents of a new disease entity point to evidence for increased cue reactivity when comparing neurobiological responses with Internet -related cues by addicted Internet users compared with regular users (Thalemann *et al.* 2007). Akin to substance disorders, these findings demonstrate the activation of the reward system as a hallmark of addiction (Thalemann *et al.* 2007).

Internet use has been assessed in heterogeneous ways (Young 1998). Table 1 contrasts recent conceptualisations

*Corresponding author. Email: muellka@uni-mainz.de

Table 1. Criteria for substance-related disorders (DSM-IV-TR) adapted for Internet Addiction.

Substance-related disorders (DSM-IV-TR) (American Psychiatric Association 2000)	Young (1998)	Shapira *et al.* (2000)	Tao *et al.* (2010)	Wölfling *et al.* (2011)
Tolerance: marked increase in amount; marked decrease in effect	Tolerance (increased time for online activities)		Tolerance	Tolerance (need for longer online times)
Withdrawal: characteristic withdrawal symptoms; substance taken to relieve withdrawal	Withdrawal		Withdrawal	Withdrawal (feeling bad if not online)
Loss of control: substance taken in larger amount and for longer period than intended; repeated unsuccessful attempts to quit	Loss of control (unsuccessful attempts to stop)	Longer use than planned	Difficulties in controlling behaviour	Loss of control (longer online times than planned; unsuccessful attempts to quit; online times experienced as too long)
Craving: persisting desire		Experience as irresistible		Craving (urge to be online; irresistible desire)
Excessive use: much time/activity to obtain, use, recover	Preoccupation	Preoccupation, excessive use	Preoccupation	Preoccupation, excessive use
Negative consequences: use continues despite knowledge of adverse consequences	Negative consequences (jeopardised loss)	Clinically significant distress or impairment	Disregard of negative consequences; loss of social communication and interests	Negative consequences: family, friends, health, achievement, other leisure activities
	Deceit/lying		Hiding from friends or relatives	
	Escaping from problems/ relieving mood		Alleviation of negative emotions	Avoidance of negative feelings
			Persisting for at least 3 months, at least 6 hours per day	At least 4 hours on a weekday
	At least five criteria to be fulfilled		1 plus 4 criteria to be fulfilled and significant impairment	Cutoff: 2 SD above mean (6.5 points)
		Not during mania	Exclusion of other psychic disorders	

based on the DSM-IV criteria of substance-related disorders (for a review of additional scales, cf. Byun *et al.* 2009). Young (1998) adapted the criteria of the previous version to pathological Internet use requiring at least five criteria to be fulfilled on a 'yes/no' self-report checklist. Neither craving nor continued use are explicitly mentioned; deceit and escaping from problems are added. In their recent application of Young's criteria in a household survey, Fu *et al.* (2010) identified 6.7% of Hong Kong adolescents as Internet addicted by an expert checklist. In an attempt for further specification and validation, the rating by Tao *et al.* (2010) required preoccupation and withdrawal to be fulfilled plus one additional criterion. Duration of at least 3 months and at least 6 hours per day were required as additional diagnostic criteria (other mental disorders were to be excluded). Hiding from friends or relatives was not deemed a good criterion.

So far, few epidemiological studies have been conducted. Criteria were not only inconsistent but also most relied on convenience samples with a preponderance of young participants. In a random-digit-dial telephone survey of 2513 adults in the United States, Aboujaoude *et al.* (2006) achieved an acceptable overall response rate of 56.3%; however, women and older respondents were oversampled. 68.9% of the population were regular Internet users. Altogether 3.7–13.7% endorsed markers of problematic Internet use: 12% stayed online longer than intended and tried to cut back on Internet use, concealing non-essential Internet use (8.7%), utilising the Internet as a way to escape problems or to relieve negative mood (8.2%), feelings that their relationships had suffered (5.9%) and being preoccupied by the Internet when off-line (3.7%). When criteria were combined, 0.3–0.7% of the population were considered as Internet addicted. In further international epidemiological studies, the prevalence of Internet addiction has been estimated to be 3–7% for children, youth and young adults (Batthyany *et al.* 2009, Morrison and Gore 2010). Dramatic increases of Internet addiction disorders have been reported in South Korea, China and other Asian countries (Ha *et al.* 2006). In an online questionnaire-based study with 1319 predominantly female young people and adults, Morrison and Gore (2010) characterised 1.2% of the sample as addicted to the Internet.

Among the predispositions for excessive Internet use, male gender stands out. Other characteristics include social inhibition (Wölfling *et al.* 2011), low self-esteem (Batthyany *et al.* 2009), insecure attachment (Ghassemzadeh *et al.* 2009), low impulse control and ADHS, hostility and depression (Mitchell and Wells 2007). Clinically, in our specialised outpatient clinic, based on over 130 consecutive patients (Beutel *et al.* 2011a), we found a vicious cycle of attempts to cope with social insecurity, depression or social ostracism by means of excessive Internet use or computer gaming, which in turn led to further depressive symptoms, social anxiety and performance failure.

It has been surmised that some Internet applications are more problematic than others. In their survey of mental health professions, Mitchell and Wells (2007) reported that adult clients presenting for an Internet problem were characterised by addiction to child and adult pornography, young clients to gaming and gambling. In Morrison and Gore (2010), Internet addicts engaged more frequently in online sex, games, social networking sites or chats.

The present study is one of the first representative community-based surveys in Germany using a reliable and valid scale designed to measure addicted Internet use. The Assessment of Internet and Computer game Addition (AICA-S) (Müller and Wölfling 2010) is based on a scale measuring computer game addiction (CSV-S) (Wölfling *et al.* 2011) that was validated in large student samples. We sought to determine (1) the proportion of the general population with the evidence of Internet addiction, (2) psychosocial and health consequences associated and (3) risk factors for Internet addiction. Up to now, only one representative study on this topic has been conducted in Germany. Rumpf *et al.* (2011) found in 2011 that 1.0% of the German general population meet criteria for Internet Addiction with a higher percentage of affected minors of 4%.

We hypothesised that Internet addiction (according to AICA-S cut-off scores) is associated with increased negative psychosocial and health consequences compared with regular use as has been indicated by previous studies relying on convenience samples (Zhu and Du 2006). Based on clinical findings (e.g. Bernardi and Pallanti 2009; for an overview see Ko *et al.* 2012) and epidemiological studies (Morrison and Gore 2010), we also hypothesised that subjects showing signs of Internet addiction also display increased levels of depersonalisation (measured by the Cambridge Depersonalisation Scale, CDS) and psychopathological distress (anxiety, depression) measured by the Hamilton Anxiety and Depression Scale (HADS). We further assumed that male gender and social factors (a lack of gainful employment and of a stable partnership) are risk factors along with the use of certain Internet applications (gaming, gambling, pornography; e.g. Morrison and Gore 2010, Rumpf *et al.* 2011). Most of the studies on Internet addiction have identified male gender as a specific risk factor (Morrison and Gore 2010).

2. Methods

2.1. Sampling procedure and study participants

This study is based on a representative sample of the German population recruiting a total of 1401 women and 1111 men between the ages of 14 and 94 years. Data were collected by a market research institution (USUMA, Unabhängiger Service für Umfragen, Methoden und Analysen Berlin) based on 258 sample points that met criteria of representativeness according to ADM-design guidelines in the Eastern and Western parts of Germany. Participants

were (1) questioned by trained interviewers in their homes (face-to-face interviews) and (2) filled in questionnaires. Households were selected by the random-route procedure. That means that for each sampling point the interviewer was equipped with a certain street name and a street number as a starting position. He then had to follow a predefined route and to contact every third household. The target person in each household was also selected randomly using the Kish-Selection-Grid (a combination of the last-birthday-procedure and random selection). The survey followed ADM guidelines (Koch 1997). The procedure was approved by the ethics committee of the University of Leipzig. The sample was representative for the total German population (as confirmed by ADM sample). For that reason, further statistical analyses were conducted with an unweighted sample. Of the initial samples, 54.9% were successfully contacted and participated in the survey; this is well in the range of quotas of other representative community samples (Koch 1997). We conducted an analysis of motives of non-responders and identified the following reasons for non-participations: 33.8% refused to participate due to personal reasons; in 8.3% it was not possible to contact anyone of the household after the third visit. In the detailed analysis, only those participants were included who reported using the Internet during leisure time (n = 1382; 55%). As reported elsewhere (Beutel *et al.* 2011b), leisure time users were younger and had a higher socioeconomic status (education, employment, income) than non-users.

2.2. Measures

The AICA-S is a self-report scale that is based on the CSV-S, a reliable and valid self-report scale designed to measure computer game addiction (Wölfling *et al.* 2011). AICA-S is based on the adapted criteria of addiction of the DSM-IV. In the 14-item self-report scale, some dimensions were further specified by several criteria, e.g. loss of control by online times considered too long, longer than planned and unsuccessful attempts to quit. Frequency and duration of Internet use were assessed specifically for leisure time use. Negative consequences of Internet use were differentiated according to six areas (e.g. problems with school, work, health, etc.). The use of eight Internet applications was also assessed separately. Preliminary cut-offs for addicted use was defined based on the distribution of scores in the population (Müller and Wölfling 2010, Wölfling *et al.* 2011), as well as by comparisons of AICA-S scores with clinical judgments of trained experts in a specialised outpatient clinic for the treatment of Internet and Computer Game Addiction (Müller *et al.* 2011, Müller *et al.* 2013). Following these two approaches, a score of 7 points (3–4 criteria fulfilled) was identified as having the best diagnostic accuracy and so is considered as an indicator for addictive use. A score of 13.5 points (five criteria fulfilled) yielded no false-positive classifications in an analysis of treatment seekers (Müller *et al.* 2013). First, analyses of sensitivity and specificity based on a clinical sample of 221 treatment seekers of a specialised outpatient clinic indicate that AICA-S has satisfying diagnostic accuracy (Müller *et al.* 2013).

To evaluate psychometric properties of AICA-S, basic psychometric parameters (internal consistency, mean interitem correlation and discriminatory power of items) were analysed as well as the factor structure. The internal consistency (Cronbach's α) of $\alpha = 0.89$ can be considered sufficient as well as the mean interitem correlation of $r_{ii} = 0.36$. Discriminatory power of the single items varied between 0.13 and 0.71. Based on the scree test, a principal component analysis revealed one single factor explaining 43.9% of variance that can be interpreted as 'addicted Internet use'.

The CDS-2 is a brief two-item version of the CDS, which differentiates patients with clinically significant DP well from other groups (cut-off of CDS-2 ≥ 3, sensitivity = 78.9%, specificity = 85.7%) with high reliability (Cronbach's $\alpha = 0.92$). Items, e.g. 'Out of the blue, I feel strange, as if I were not real or as if I were cut off from the world', are rated on the scale: 'Over the last 2 weeks, how often have you been bothered by any of the following problems? Not at all = 0/several days = 1/more than half the days = 2/nearly every day = 3′ (Michal *et al.* 2010). For the assessment of anxiety and depression, the German version of the HADS (Hinz and Schwarz 2001) was applied. The HADS comprises anxiety (HADS-A) and depression subscales (HADS-D) with seven items each.

2.3. Statistical analysis

Univariate and multivariate statistics were performed by SPSS Version 17.0; nonparametric statistics (χ^2) were performed where indicated. As items of the AICA-S were skewed, they were compared by the Mann–Whitney U-test. Effect sizes were computed as Cohen's d, Phi res, Cramer-V. Confidence intervals (95% CI) are reported additionally.

3. Results

3.1. Regular and addicted users of the Internet

About 56.4% (1418) of the sample reported using the Internet on a regular basis. The overall score for addicted Internet use was computed corresponding to the procedure established for students in a previous validation study (Wölfling *et al.* 2011): Based on the mean score of 2.1 plus 2 SD (2.28), a cutoff of 7 was estimated (corresponding to the cutoff of 7 according to our former surveys; Rumpf *et al.* 2011, Wölfling *et al.* 2011). Accordingly, 3.7% (n = 53) of all regular Internet users and 2.1% (95% CI = 1.6–2.7) of the total population were considered addicted Internet users with 2.0% (95% CI = 1.5–2.6) of them exceeding the cutoff of 7 points and 0.1% (95% CI = 0.0–0.3) exceeding the cutoff of 13.5 points. Table 2 compares regular and addicted users.

Table 2. Comparison of sociodemographic data – regular versus addicted users (in %).

	Total		Regular		Addicted			
Participants ($N = 1382$)	N	%	N	%	N	%	Overall χ^2	ES
Age								
<25 years	229	16.6	217	94.8	12	5.2		
25–34 years	297	21.5	282	94.9	15	5.1		
35–44 years	320	23.2	310	96.9	10	3.1		
45–54 years	284	20.6	277	97.5	7	2.5		
55–64 years	169	12.2	164	97.0	5	3.0		
>65 years	83	6.0	79	95.2	4	4.8	ns[a]	
Sex								
Male	670	48.5	634	94.8	35	5.2		
Female	712	51.5	692	97.5	18	2.5	6.775**	0.07
Marital status								
Married, living together	694	50.2	679	97.8	15	2.2		
Separated, divorced, widowed	203	15.3	195	96.1	8	3.9		
Single	485	35.1	452	93.2	30	6.2	15.835***	0.11
Living with partner								
Yes	820	59.3	794	96.8	11	1.8		
No	562	40.7	532	94.7	27	3.9	4.029**	0.05
Education								
<10th grade	379	27.4	362	95.5	17	4.5		
10th grade	642	46.5	622	96.9	19	3.0		
Student	219	15.9	204	93.2	13	5.9		
College/university	142	10.3	138	97.2	4	2.8	ns	
Employment status								
Full time/part time	920	73.3	889	96.6	30	3.3		
Unemployed	88	7.0	81	92.0	7	8.0		
Retirement	120	9.6	114	95.0	6	5.0		
School/university	127	10.1	116	91.3	9	7.1	12.153*	0.09
Income								
<1250€/month	215	15.6	199	92.6	14	6.5		
1250–2500€/month	669	48.4	646	96.6	22	3.3		
>2500€/month	458	33.1	443	96.7	15	3.3	7.763*	0.08

ES, effect size.
[a]Level of significance: $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, $^{***}p < 0.001$.

As Table 2 shows, there was no age difference between regular ($M = 40.3$; SD = 14.48 years) and addicted users ($M = 37.7$; SD = 15.86 years). The proportion of Internet addiction in males was almost twice as high (5.2%) as in females (2.5%; $p \leq 0.01$). They were more often single (versus married or separated, divorced or widowed) and did not live with a partner ($p \leq 0.01$). Internet addiction was more frequent in students or unemployed and those with a low income ($p \leq 0.01$). No differences were found regarding education, residency in Eastern or Western Germany, urban or rural areas.

3.2. Internet use in regular and addicted users

Table 3 differentiates the Internet use according to the items of the AICA-S, separately for the total sample, regular users and Internet addiction. Due to their skewness, scores were compared by means of the Mann–Whitney U-test; effect sizes were computed by Cohen's d.

Significant differences were found on all parameters of frequency and duration of Internet use. The average online time of regular users on weekdays (weekend/holiday/vacation in parentheses) was almost twice as high for addicted users with 5.1 (4.4) hours compared with 2.7 (2.2) hours for regular users. Missing data on this item are due to those participants who did not use the Internet on a regular basis (less than once per week). On average, more time was spent on the Internet on weekends compared with weekdays, both in the regular and addicted users. There was, however, a subgroup of 12 participants (22.6%) classified as addicted who spent more time on the Internet on weekdays.

The largest effect sizes between regular and addictive users were found regarding the frequency of Internet

Table 3. Comparison of means of items of AICA-S – regular versus addicted users.

	Total		Regular		Addicted			
Participants ($N = 1382$)	N	M (SD)	N	M (SD)	N	M (SD)	Overall U	Effect size (d)
How many hours are you online on an average weekday?[a]	919	2.8 (2.98)	865	2.7 (2.88)	51	4.9 (3.68)	11,458.00	0.56
How many hours are you online on an average holiday/vacation day?[a]	914	2.3 (2.00)	860	2.2 (1.80)	51	4.4 (3.31)	9796.50	0.69
How frequently are you online?[b]	1375	4.1 (0.84)	1319	4.0 (0.84)	53	4.9 (0.23)	13,015.50	3.14
How long are you usually online?[c]	1373	1.8 (0.84)	1317	1.8 (0.79)	53	3.1 (1.09)	12,071.50	1.23
How strongly are you preoccupied by Internet activities[d]	1378	0.9 (0.98)	1322	0.9 (0.90)	53	2.7 (1.02)	8023.00	2.05
How often are you online/online for longer periods contrary to your intentions?[d]	1379	0.9 (0.97)	1323	0.9 (0.91)	53	2.6 (0.99)	8696.00	1.91
Do you feel bad if you cannot be online?[d]	1379	0.6 (0.95)	1323	0.5 (0.85)	53	2.5 (1.11)	7514.00	1.77
Have you noticed that you need to be online more frequently or for longer periods in order to feel good or relaxed?[d]	1380	0.6 (0.90)	1324	0.5 (0.82)	53	2.3 (1.00)	8583.50	1.77
How strong is your average urge to be online?[d]	1380	1.0 (0.98)	1324	0.9 (0.90)	53	2.9 (0.87)	5329.00	2.18
How often does your urge for Internet activities appear to be irresistible?[d]	1379	0.6 (0.89)	1324	0.6 (0.81)	53	2.4 (0.92)	6438.00	2.32
How often do you avoid negative feelings (e.g. boredom, anger, sadness) by Internet activities?[d]	1379	0.8 (0.97)	1323	0.7 (0.92)	53	2.1 (1.13)	13,072.00	1.23
How often have you tried to cut down or give up your online behaviour?[d]	1377	0.5 (0.82)	1321	0.5 (0.79)	53	1.2 (1.13)	23,964.00	0.68
How often have you forgotten something important (e.g. work, school) due to pursuing Internet activities?[d]	1380	0.7 (0.81)	1324	0.5 (0.75)	53	1.8 (1.10)	13,647.00	1.23
How often have you felt that you are online too much or for too long?[d]	1380	0.8 (0.97)	1324	0.8 (0.91)	53	2.3 (1.16)	12,071.50	1.36

Note: All comparisons significant at $p \leq 0.001$.
[a]Items 1 and 2 (open format): Missing cases due to subjects that stated not to be online regularly (33.1% and 33.3%).
[b]5 = 'daily', 4 = '2–3 times per week', 3 = 'once per week', 2 = 'once per month', 1 = 'less'.
[c]1 = '<1 h', 2 = '1–2 h', 3 = '2–4 h', 4 = '4–6 h' and 5 = 'more than 6 h'.
[d]Scale from 0 = 'not at all/never' to 4 = 'extremely/always'.

use, the urge to use the Internet (irresistibility, strength), preoccupation by Internet activities, loss of control, withdrawal symptoms, duration of online activities, avoidance of negative feelings, and negative consequences.

As differentiated by Table 4, almost all Internet addicts (95%) used the Internet on a daily basis compared with 31% of the regular users. In the latter group, about 50% used the Internet 2–3 times per week.

As Table 5 shows, the great majority (85%) of regular users reported an average duration of Internet sessions of 1–2 hours or less, whereas more than two-third of addicted users reported sessions of 2–4 hours and more.

3.3. Internet applications

An additional question of the AICA-S inquired about preferred online applications. These are listed in Table 6 in descending order. Research portals and online shopping are used by the great majority of regular and addicted users. The greatest differences were found regarding online gambling (more than fourfold proportion in Internet addiction), more than twofold proportions used social networks, online games, chats and pornography.

In an exploratory analysis, we tried to differentiate online applications by the age of addicted users. A total of 40 addicted users were over 25 years, and 16 were at the age of 25 years or younger. About 95.0% of the older users reported online shopping compared with 56.3% of the younger users ($\chi^2(1) = 12.72$; $p \leq 0.001$), and 82.5% (versus 53.5%) of the older users participated in social networks ($\chi^2(1) = 4.89$; $p \leq 0.001$), and there was a trend toward a higher proportion of online gambling (43.6% versus 18.8%; $\chi^2(1) = 3.79$; $p \leq 0.10$); no differences were found regarding online games, pornography and chats.

Table 4. Frequency of Internet use – regular versus addicted users (in %).

	Total		Regular		Addicted			
Participants ($N = 1382$)	N	%	N	%	N	%	Overall χ^2	Effect size
Every day	461	33.5	408	30.9	53	94.6		
2–3 times per week	656	47.7	653	49.5	3	5.4		
Once per week	204	14.8	204	15.5	0	0.0		
One per month	34	2.5	34	2.6	0	0.0		
Less than once per month	20	1.5	20	1.5	0	0.0	97.937***	0.27

***$p \leq 0.001$.

Table 5. Mean duration of Internet use – regular users versus addicted users (in %).

	Total		Regular		Addicted			
Participants ($N = 1382$)	N	%	N	%	N	%	Overall χ^2	Cramer-V
<1 hour	551	40.1	549	41.7	2	3.8		
1–2 hours	583	42.5	568	43.1	13	24.5		
2–4 hours	192	14.0	170	12.9	21	39.6		
4–6 hours	29	2.1	21	1.6	8	15.1		
>6 hours	18	1.3	9	0.7	9	50.0	195.493***	0.33

***$p \leq 0.001$.

Table 6. Comparison of preferred online applications – regular users versus addicted users (in %).

	Total		Regular		Addicted			
Participants ($N = 1382$)	N	%	N	%	N	%	Overall χ^2	Effect size
Mails	1281	93.4	1228	93.1	53	100.0	3.916*	0.05
Research portals	1260	92.0	1208	91.8	52	98.1	ns	–
Online shopping	1025	76.0	980	75.6	45	84.9	ns	–
Chats	829	62.1	778	60.7	51	96.2	27.253***	0.14
Social networks	477	36.1	438	34.5	39	75.0	36.609***	0.16
Online games	445	33.7	409	32.2	36	69.2	30.614***	0.15
Online pornography	171	12.9	154	12.1	17	32.1	18.079***	0.12
Online gambling	118	8.9	98	7.7	20	38.5	58.345***	0.20

*$p < 0.05$, ***$p < 0.001$.

3.4. *Negative consequences of Internet use and their determinants*

Table 7 differentiates the negative consequences of Internet use according to regular and Internet addiction. Whereas only a small minority of 7.6% of regular users reported at least one negative consequence of Internet use, this was the case for 52.8% of addicted users. The greatest differences were found regarding health problems, problems with school or work, problems with family, neglect of other leisure time activities and friends/partner. There was a trend toward more neglect of the partner/friends ($\chi^2(1) = 3.09$; $p \leq 0.10$) of those who spent longer times on the Internet on weekends, holidays or vacations.

We had anticipated correlations between addicted Internet use, depersonalisation, depression or anxiety. The overall AICA-S score was significantly ($p \leq 0.001$) correlated with depersonalisation; the magnitude, however, was small ($r = 0.16$). No overall correlations were found between AICA-S and depression or anxiety. There were no differences between regular and addicted users regarding this kind of psychopathology. Addicted Internet users who used the Internet more on the weekend than on weekdays reported higher scores in anxiety (HADS) than those using it more during the week.

4. Discussion

To our knowledge, this was one of the first representative community-based surveys using a reliable and valid scale of Internet Addiction. According to our strict criterion (score more than 2 SD above the mean in combination with a preliminary clinical validation), a total of 3.7% of regular Internet users (2.1% of the German population) were classified as addicted. Therefore, the prevalence found in this sample is higher than the one reported by previous epidemiological surveys (Aboujaoude *et al.* 2006, Rumpf *et al.* 2011). This may be due to the use of a different self-report measure or to characteristics of the sample. Also it is reasonable that the differing prevalence rate is associated with the sampling procedure used in this survey. Although

Table 7. Comparison of experienced negative consequences – regular users versus addicted users (in %).

	Total		Regular		Addicted			
Participants ($N = 1382$)	*N*	%	*N*	%	*N*	%	Overall χ^2	Effect size
Problems with family	44	3.2	30	2.3	14	26.4	96.413***	0.26
Neglect of other leisure activities	72	5.2	60	4.5	12	22.6	33.875***	0.16
Neglect of friends/partner	33	2.4	24	1.8	9	17.0	50.310***	0.19
Health problems	16	1.2	7	0.5	9	17.0	120.492***	0.30
Problems with school or work	17	1.2	9	0.7	8	15.1	87.123***	0.25
Financial problems	10	0.7	9	1.9	1	1.8	ns	–
At least one negative consequence experienced	129	9.3	101	7.6	28	52.8	123.011***	0.30

***$p < 0.001$.

a well-established selection procedure was chosen and a representative sample according to ADM guidelines was drawn, the sampling method used here differed from that applied, for example by Rumpf *et al.* (2011).

Unlike the majority of regular users who reported leisure time Internet use less than daily, Internet addiction was associated with daily use. The great majority used the Internet on a daily basis and their daily average use was more than twice as long as among regular users (5.1 hours on weekdays and 4.4 hours on weekends or holidays). Significant group differences with large effect sizes were found for all criteria of Internet addiction, craving, preoccupation, loss of control, withdrawal symptoms, tolerance, and avoidance of negative feelings. According to our hypotheses, we found that the majority of Internet addicts (53%) reported negative psychosocial and health consequences of excessive Internet use (compared with 8% of regular users).

Contrary to our hypotheses, we found no increased depression and anxiety in Internet addiction. However, there was a significant, albeit small overall correlation between AICA-S score and depersonalisation. An increased amount of anxiety was only reported by addicted users who used the Internet particularly on weekends. Most previous studies on psychopathological correlates of Internet addiction have found significant relationships with both depressive and anxiety disorders (17;32;33). However, in a sample of adolescents Wölfling *et al.* (2007) found no significant relations between computer game addiction as one frequent subtype of Internet addiction and anxiety. Similarly, in the investigation of computer game addiction in Dutch adolescents, no correlations with anxiety or depressive symptoms were found (van Rooij *et al.* 2010).

However, an alternative explanation might be found in the measurement used here. In the last years, there has been increasing criticism on psychometric properties of HADS (Bagby *et al.* 2004). Bagby and colleagues, for example, come to the conclusion that among other shortcomings, item response format is not optimal. This might have had an impact in this investigation.

According to hypotheses, male gender and social factors (a lack of gainful employment and of a stable partnership) were risk factors for Internet addiction. As we had further hypothesised a variety of gambling, gaming and pornography were used considerably more frequently by Internet addicts; the same applied for chats and social networks. No significant differences were found regarding research portals, online shopping and emails. This stands in line with previous findings (e.g. Morrison and Gore 2010) and indicates that not using the Internet per se has to be regarded as contributing to addiction in some users. Rather specific elements of online contents used may be associated with the development of an addictive pattern of usage. Age was not a risk factor among leisure time Internet users; however, the patterns of use differed across age groups. Compared with younger users ($\leq$25 years), older Internet users reported more online shopping and social networking sites; no age differences were found regarding the other applications.

Concerning assessment our data support the notion that Internet addiction is a multifaceted phenomenon covering a broad range of Internet applications. Single estimates of average hours spent on the Internet per day (e.g. Tao *et al.* 2010) appear to be a rather crude criterion. As an increasing proportion of employees need to be online throughout their work day, it is important to limit assessment of Internet addiction to leisure time use (which not too infrequently occurs during work hours). Rather than specifying certain cut-offs for the extent of online times that may fluctuate between populations and individuals, it is more important to specify patterns of addictive behaviour including their negative health consequences. Also, excessive patterns of use on weekends may interfere with activities with friends or partner.

In this study, we relied on self-report data. While it is highly plausible that we could identify a sample of Internet addicts, we cannot make diagnoses without clinical assessment. However, with AICA-S we used one of the few scales that have been validated in clinical settings. Preliminary analyses of AICA-S (correlations with therapists' ratings on symptoms of Internet addiction) indicate that its sensitivity and specificity can be regarded as satisfying (Müller *et al.* 2011, Müller *et al.* 2013).

In the light of previous studies (Morrison and Gore 2010), it may be surprising that we found no clear association with depression or with anxiety except for pronounced weekend use. Yet, we studied a community and not a clinical sample. In a previous survey of Internet addicts seeking help in a specialised outpatient clinic for computer game and Internet addiction, we found more excessive use particularly on weekends, holidays or vacations (8.3hours per weekday, 10.7 per weekend day or holiday). These patients also showed considerable depression, social phobia, and somatoform symptoms (Beutel *et al.* 2011a). Thus, while clearly fulfilling addiction criteria, in this study computer addicts differed from a clinical sample in the excessiveness and pattern of Internet use.

Despite our sample of Internet addicts is larger than in previous studies (Fu *et al.* 2010), sample size in our study limits subgroup analyses. For example, data on distinct patterns of Internet addiction related to age, specific applications or time patterns (weekday versus weekend) must be considered exploratory. Due to the cross-sectional design of the study, we are unable to make causal inferences. For example, we could show that Internet addiction is associated with the use of a broad range of Internet applications. Yet, we cannot determine if the use of certain Internet applications is a risk factor for the development of Internet addiction, or if it results from excessive use.

A further limitation might be regarded in a comparably small percentage of regular Internet users. In our study, about 56% of the participants reported being online regularly. Although this rate matches findings of the survey conducted by Rumpf *et al.* (2011) with 54.1% regular users, it stands in contrast to general statistics on Internet use behaviour of the Germans (Eimeren and Frees 2012).

5. Conclusion

A prevalence rate of 2.1% persons meeting criteria for Internet addiction was found within German general population. As we could show previously (Wölfling *et al.* 2011), the extent of Internet use per se is not sufficient as a criterion for addiction and other negative consequences; rather, specific consequences need to be identified. If the Internet is used excessively to cope with negative affective states and alternative means of coping (e.g. social support, health-promoting behaviour) are diminished, a vicious cycle may ensue with increasing stress and reliance on the reinforcing properties of certain online activities that may finally lead to addictive behaviour.

References

Aboujaoude, E., *et al.*, 2006. Potential markers for problematic Internet use: a telephone survey of 2513 adults. *CNS Spectrums*, 11 (10), 750–755.

American Psychiatric Association (APA), 2000. *Diagnostic and Statistical Manual of Mental Disorders – DSM-IV-TR.* 4th ed, Text Revision. Washington, DC: American Psychiatric Association.

American Psychiatric Association, 2012. Internet use disorder. Available from: http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=573# [Accessed 20 December 2012].

Bagby, R.M., *et al*., 2004. The Hamilton Depression Rating Scale: has the gold standard become a lead weight? *American Journal of Psychiatry*, 161 (12), 2163–2177.

Batthyany, D., *et al.*, 2009. Computer game playing: clinical characteristics of dependence and abuse among adolescents. *Wiener Klinische Wochenschrift*, 121 (16), 502–509.

Bernardi, S. and Pallanti, S., 2009. Internet addiction: a descriptive study focusing on comorbidities and dissociative symptoms. *Comprehensive Psychiatry*, 50, 510–516.

Beutel, M.E., *et al.*, 2011a. Clinical characteristics of computer game- and Internet-addiction in treatment seekers of an outpatient clinic for computer game-addiction. *Zeitschridt für Psychosomatische Medizin und Psychotherapie*, 57 (1), 77–90.

Beutel, M.E., *et al.*, 2011b. Regular and problematic leisure time Internet use in the community – results from a German population-based survey. *Cyberpsychology, Behavior and Social Networking*, 14 (5), 291–296.

Byun, S., *et al.*, 2009. Internet addiction: metasynthesis of 1996–2006 quantitative research. *Cyberpsychology, Behavior and Social Networking*, 12 (2), 203–297.

Douglas, A.C., *et al.*, 2008. Internet addiction: meta-synthesis of qualitative research for the decade 1996–2006. *Computers in Human Behavior*, 24 (6), 3027–3044.

Eimeren, B.V. and Frees, B., 2012. Prozent der Deutschen online-neue Nutzungssituationen durch mobile Endgeräte. Ergebnisse der ARD/ZDF-Onlinestudie 2012. *Media Perspektiven*, 7, 362–379.

Fu, K.W., *et al.*, 2010. Internet addiction: prevalence, discriminant validity and correlates among adolescents in Hong Kong. *British Journal of Psychiatry*, 196, 486–492.

Ghassemzadeh, L., Shahraray, M., and Moradi, A., 2009. Prevalence of Internet addiction and comparison of Internet addicts and non-addicts in Iranian high schools. *Cyberpsychology, Behavior and Social Networking*, 11 (6), 731–733.

Ha, J.H., *et al.*, 2006. Psychiatric comorbidity assessed in Korean children and adolescents who screen positive for Internet addiction. *Journal of Clinical Psychiatry*, 67 (5), 821–826.

Hinz, A. and Schwarz, R., 2001. Anxiety and depression in the general population: normal values in the Hospital Anxiety and Depression Scale. *Psychotherapie Psychosomatik Medizinische Psychologie*, 51 (5), 193–200.

Huang, R.L., *et al.*, 2009. Features and predictors of problematic Internet use in Chinese college students. *Behaviour & Information Technology*, 28 (5), 485–490.

Ko, C.-H., *et al.*, 2012. The association between Internet addiction and psychiatric disorder: a review of the literature. *European Psychiatry*, 27, 1–8.

Koch, A., 1997. ADM-Design und Einwohnermelderegister-Stichprobe. Stichproben bei mündlichen Bevölkerungsumfragen. *In*: S. Gabler, J.H.P. Hoffmeyer-Zlotnik and D. Krebs, eds. *Stichproben in der Umfragepraxis*. Opladen: Westdeutscher Verlag, 99–116.

Michal, M., *et al.*, 2010. Screening for depersonalization-derealization with two items of the Cambridge depersonalization scale. *Psychotherapie Psychosomatik Medizinische Psychologie*, 60 (5), 175–179.

Mitchell, K.J. and Wells, M., 2007. Problematic Internet experiences: primary or secondary presenting problems in persons

seeking mental health care. *Social Science Medicine*, 65 (6), 1136–1141.

Morrison, C.M. and Gore, H., 2010. The relationship between excessive Internet use and depression: a questionnaire-based study of 1319 young people and adults. *Psychopathology*, 43 (2), 121–126.

Müller, K.W. and Wölfling, K., 2010. Pathological computer game and Internet use – scientific research on phenomenology, epidemiology, diagnostics and comorbidity. *Suchtmedizin*, 12, 45–55.

Müller, K.W., *et al*., 2011. Komorbide Internetsucht im klinischen Setting: Prävalenz und Symptombelastung bei Patienten aus der stationären Suchtrehabilitation [Co-morbid Internet addiction in the clinical context: prevalence and symptoms in patients of the inpatient rehabilitation system]. *Suchttherapie*, 12 (S 01), S39_3.

Müller, K.W., Beutel, M.E., and Wölfling, K., 2013. Clinical characterization of internet addiction: analyses of psychopathological symptoms, level of functioning and co-morbidity in a clinical sample of treatment seekers. *Journal of Behavioral Addictions*, 2 (suppl. 1), 25–26. [Abstract]

Rumpf, H.J., *et al.*, 2011. Prevalence of Internet addictive behavior (PINTA). Final report for the German Federal Ministry of Health. University of Lübeck, Klinik für Psychiatrie und Psychotherapie; 2011. Available from: www.drogenbeauftragte.de/fileadmin/dateiendba/DrogenundSucht/Computerspiele_Internetsucht/Downloads/PINTA-Bericht-Endfassung_280611.pdf, 4(11).

Shapira, N.A., *et al.*, 2000. Psychiatric features of individuals with problematic Internet use. *Journal of Affective Disorders*, 57 (1), 267–272.

Tao, R., *et al.*, 2010. Proposed diagnostic criteria for Internet addiction. *Addiction*, 105 (3), 556–564.

Thalemann, R., Wölfling, K., and Grüsser, S.M., 2007. Specific cue-reactivity on computer game related cues in excessive gamers. *Behavioral Neuroscience*, 121 (3), 614–618.

van Rooij, A.J., *et al.*, 2010. Online video game addiction: identification of addicted adolescent gamers. *Addiction*, 106, 205–212.

Wölfling, K., Thalemann, R., and Grüsser-Sinopoli, S.M., 2007. Computerspielsucht: Ein psychopathologischer Symptomkomplex im Jugendalter [Computer game addiction: a psychopathological symptom complex in adolescence]. *Psychiatrische Praxis*, 35 (5), 226–232.

Wölfling, K., Müller, K.W., and Beutel, M.E., 2011. Reliability and validity of the scale for the Assessment of Pathological Computer Gaming (CSV-S). *Psychotherapie Psychosomatik Medizinische Psychologie*, 61 (5), 216–224.

Yen, J.-Y., *et al.*, 2008. Psychiatric symptoms in adolescents with Internet addiction: comparison with substance use. *Psychiatry and Clinical Neurosciences*, 62 (1), 9–16.

Young, K.S., 1998. Internet addiction: the emergence of a new clinical disorder. *Cyberpsychology, Behavior and Social Networking*, 1 (3), 237–244.

Young, K.S., 1999. Internet addiction: symptoms, evaluation and treatment. *In*: L. VanDeCreek and T.L. Jackson, eds. *Innovations in clinical practice*, Vol. 17. Sarasota, FL: Professional Resource Press, 19–31.

Zhu, Y. and Du, Y., 2006. Emotional correlation of Internet addiction among middle-school students in Shanghai. *Shanghai Archives of Psychiatry*, 18, 69–71.