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ORIGINAL ARTICLE

Increased problematic smartphone use among children with attention-deficit/hyperactivity disorder in the community: The utility of Chinese version of Smartphone Addiction Proneness Scale

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Abstract

Background: Problematic smartphone use is more prevalent in children than before. This study aimed to evaluate the reliability and validity of the Chinese version of the Smartphone Addiction Proneness Scale (SAPS).

Methods: We recruited 319 students aged 9 to 12 years including 70 attention-deficit/ hyperactivity disorder subjects at a university hospital and 249 controls from elementary school. Finally, 164 males and 138 females were collected for data analysis with mean age of 10.99 ± 0.88 years. Item analysis, exploratory factor analysis, internal consistency test, and *t* test were performed to verify the reliability and validity of the SAPS-Chinese version. Correlations were examined for relation between the score in the SAPS-Chinese version and the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* diagnostic criteria.

Results: Factor analysis showed two factors: problematic use–associated behaviors and impaired daily functions. Item analysis for every item in the SAPS-Chinese version showed significant differences in *t* values ($p < 0.001$) and high correlation in all items ($r = 0.37$-0.79). The Kaiser-Meyer-Olkin (KMO) was equal to 0.94 and Bartlett's test of Sphericity was significant ($p < 0.001$). Cronbach's α for the SAPS-Chinese version was 0.93. It revealed high reliability and validity.

Conclusion: The SAPS-Chinese version is reliable, valid, and suitable for clinical and research uses with satisfactory properties. Applying the modified SAPS-Chinese version offers early detection of problematic smartphone use.

Keywords: Attention-deficit/hyperactivity disorder; Behavioral addiction; Problematic smartphone use; Smartphone Addiction Proneness Scale

1. INTRODUCTION

Smartphones have gained popularity in daily life. Not only adolescents and adults, but also children, rely on smartphones for communication and searching for information. The prevalence of smartphone possession in Taiwan was reported to be 70.4%, and the mean daily Internet use was around 3 hours. About 87.5% of elementary and junior high school students had smartphone use experience, and 68.7% of them had their own smartphone or tablet.[1] Internet service use via smartphones is usually inevitable. This might result in technological addiction, including problematic Internet and smartphone use.

"Technological addiction" is defined as nonchemical (behavioral) addiction involving human-machine interaction with inducing and reinforcing features.[2,3] On the basis of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV),[4] experts regard "Impulse control disorders" as behavioral addictions and imply a link between behavioral and substance addictions.[5] Behavioral addictions exhibit symptoms of repetition, self-destructive behavior, compulsive engagement, craving, euphoria related to the behavior, and declined role function.[6] However, some researchers have proposed replacing "addiction" with "problematic use" so as to reduce connotations leading to stigma and prejudice.[7]

Problematic Internet use is thought to be an impulse control disorder and can be regarded as a behavioral addiction.[8] Five factors, including tolerance, withdrawal, compulsive symptoms, time management, and interpersonal and health problems, were recognized in Internet addiction.[9] On the other hand, problematic smartphone use (PSU) is defined as excessive and dysregulated smartphone use, which leads to obsession, impulsivity, and daily life impairment.[10] This concept puts more emphasis on function impairment and mood dysregulation than on tolerance and withdrawal symptoms, in association with PSU.

With increased rates of smartphone ownership among children, specific smartphone use–related problems emerge, including financial problems, sleep disturbance, depression, and anxiety.[11–14] Previous studies have suggested that children and adolescents with Internet addiction usually have attention-deficit/

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hyperactivity disorder (ADHD) and related symptoms.[15–17] It is not clear whether PSU should be considered as a primary or secondary psychiatric disorder.

Several rating scales have been developed for problematic smartphone or Internet use evaluation, including Chen Internet Addiction Scale (CIAS),[9] Internet Addiction Proneness Scale (KS scale),[18] Problematic Mobile Phone Use Questionnaire (PMPUQ),[19] Smartphone Addiction Scale (SAS),[20] Smartphone Addiction Inventory (SPAI),[21] Smartphone Addiction Proneness Scale (SAPS),[22] and Mobile Phone Addiction Craving Scale (MPACS).[23] The mean age of participants in these studies ranged between 15.25 and 22.9 years. The SAPS is a 15-item self-report scale developed in Korea, to screen adolescents for risk of smartphone addiction. The data were collected from 795 Korean students, proportionally representing the actual distribution of the Korean population. SAPS is validly structured around four subdomains: adaptive functions, withdrawal, tolerance, and virtual life. Cronbach's α was 0.88, indicating it to be a reliable and valid diagnostic scale for screening risks of smartphone addiction in adolescents.[21]

To our knowledge, no research has been done on the patterns of PSU among young children in society, which limits the early detection of at-risk individuals. Our research aimed to establish the Chinese version of SAPS and assess signs for early detection of PSU in young children.

2. METHODS

2.1. Instrument

Permission for translation and validation of the SAPS into Chinese was obtained from Professor Lee, the developer of SAPS. Forward translation was performed by a team of pediatric psychiatrists and psychologists, whereas back translation was done by a psychologist, who is bilingual in Chinese and English. Each item received a four-point score on the Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree).

In our study, the children's families were asked to answer the SAPS questionnaire. After a series of meetings and discussions between team members, and approval by the original author of this questionnaire, we included several modifications to SAPS so as to adapt it to the local (Taiwanese) culture, and enhance its usefulness in screening both in the community and in medical units. For instance, our team decided to replace the word "I" with "my child" in each item. Moreover, we rearranged the order of the questions, and deleted one of the questions in original SAPS, namely "family or friends complain that my child excessively uses his smartphone" because of its similarity to the question "people frequently comment on my child's excessive smartphone use." We have also added two new questions for the parents on the impacts of their children's PSU on daily experiences. These being questions number 15 and 16, which state the following: "My child would more easily quarrel with family members due to smartphone use" and "My child more easily gets angry and flies into rage when cannot use the smartphone." Due to these modifications to the SAPS, we renamed the questionnaire as the "modified SAPS-Chinese version."

2.2. Subjects

We recruited 249 healthy students from a local school and 70 ADHD patients from the child psychiatric outpatient clinic of a university hospital in Taipei City (Figure). All participants were elementary school students, aged 9 to 12 years (fourth to sixth grade of elementary school). The parents of all participants were also recruited.

The Institutional Review Board of the Tri-Service General Hospital approved the informed consent procedures. The investigator explained the purpose of the study, obtained their parents' signed informed consent forms, and thereafter family members of the students filled out the modified SAPS-Chinese version and the Swanson, Nolan and Pelham, Version IV Scale (SNAP-IV)[24] with the help of elementary school teachers. We further verified the diagnosis of ADHD with the criteria listed in both the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) and total score of SNAP-IV above the 95th percentile, according to grade groups and gender of the 70 ADHD students recruited from the outpatient clinic. Nine students who did not meet the above criteria were excluded from the ADHD group. Students recruited from the elementary school were in the non-ADHD group. Eight students with response bias or incomplete responses were excluded from the non-ADHD group. The study population thus consisted of a total of 302 children: 61 children in the ADHD group and 241 children in the non-ADHD group.

2.3. Measures

Statistical analyses were performed using SPSS for Windows version 23 (IBM, Armonk, NY, USA). Item analysis was performed to evaluate the consistency and homogeneity of the modified SAPS-Chinese version items. The 85th percentile of the modified SAPS-Chinese version scores in the community group were individuals whose score was ≥40. These were defined as the PSU group. Those scoring <40 were defined as the non-PSU group. For the purpose of item analysis, participants were divided on the basis of their scores into low (score < 27th percentile) and high (score > 73th percentile) score groups. Independent *t* test was performed to investigate the significance of differences between groups. The value of Cronbach's α was calculated for reliability of the modified SAPS-Chinese version. Principle axis factors and direct oblique rotation were performed for exploratory factor analysis. Pearson's correlation coefficient was calculated to examine the relation between the score in the modified SAPS-Chinese version and the DSM-5 research criteria of Internet gaming disorder (meeting five or more of the nine symptoms).

3. RESULTS

3.1. Participants' disposition and characteristics

Analysis was performed on data collected on 302 students, 164 (54.3%) boys and 138 (45.7%) girls, with a mean age of 10.99 ± 0.88 years. Of these, 61 students were classified into the ADHD group. Among the 61 students diagnosed with ADHD, 7 had comorbid tic disorder, 3 had disruptive mood dysregulation disorder, 4 had autism spectrum disorder, 3 had developmental coordination disorder, and 1 each with oppositional defiant disorder and speech sound disorder. Demographic characteristics of the students are summarized in Table 1.

3.2. Item analysis

Results of item analysis are presented in Table 2. Item analysis was performed for every item in the questionnaire. *T*-test analysis suggested significant differences between the high (n = 94) and low (n = 89) score groups ($p < 0.001$). Correlation coefficient, calculated to identify association between variables, indicated high correlation between all items ($r = 0.37$-0.79).

3.3. Validity

Factor analysis results are shown in Table 3. The Kaiser-Meyer-Olkin (KMO) was equal to 0.94, and Bartlett's test of Sphericity was significant ($p < 0.001$), which suggest that the data could be considered suitable for exploratory factorial analysis. Two factors were identified, one explained 47.61% of total variance and the other explained 3.60% of total variance. The first factor reflected problematic use–associated behaviors and the second factor reflected impaired daily functions.

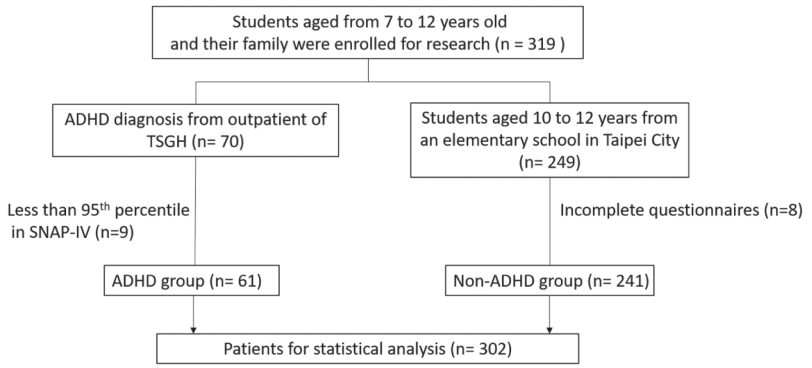

Figure The recruitment procedure of the study.

Table 1

Demographic characteristics of the students

Characteristic	ADHD (n = 61)	Non-ADHD (n = 241)	Total (n = 302)	*p*
Gender				
Boy, n (%)	50 (82.0)	114 (47.3)	164 (54.3)	<0.001
Girl, n (%)	11 (18.0)	127 (52.7)	138 (45.7)	...
Parents' educational level				
Graduate school, n (%)	10 (16.4)	69 (28.6)	79 (26.2)	0.036
Junior college, n (%)	21 (34.4)	93 (38.6)	114 (37.7)	...
High school or under, n (%)	30 (49.2)	79 (32.8)	109 (36.1)	...
Age (y), mean (SD)	10.64 (1.00)	11.08 (0.81)	10.99 (0.88)	0.003

ADHD = attention-deficit/hyperactivity disorder.

3.4. Reliability

Cronbach's α for the total score of modified SAPS-Chinese version was 0.93 (0.92 for subscore of problematic use–associated behaviors and 0.80 for the subscore of impaired daily functions). Parents of 25 of 61 students with ADHD who agreed to be interviewed on the DSM-5 diagnostic criteria of Internet gaming disorder were recruited for criterion-referenced tests. Nine of these students (36%) were diagnosed with PSU based on the diagnostic interview. This result was highly correlated with the result of the modified SAPS-Chinese version (r = 0.77, p < 0.001), supporting the validity of the reported results from the parents.

3.5. Problematic smartphone use

The comparison of impacts of smartphone use between PSU and non-PSU group among the ADHD and non-ADHD group is shown in Table 4. The modified SAPS-Chinese version was validated by the impacts of PSU on the children's behaviors "quarrels with family" and "irritable mood more than once a week." In ADHD group, 20 of 21 (95.2%) students with PSU and 15 of 40 (37.5%) students with non-PSU had quarrels with family (p < 0.001). In non-ADHD group, 29 of 37 (78.4%) students with PSU and 71 of 204 (35.0%) students with non-PSU had quarrels with family (p < 0.001). There were higher rates of "quarrels with family" and "irritable mood more than once a week" in the PSU group, within both ADHD and non-ADHD groups.

The comparison of PSU between the ADHD group and the non-ADHD group is shown in the Table 5. The prevalence rate of PSU was significantly higher in the ADHD group (34.4% vs 15.4%, p < 0.001). In addition, the ADHD group had a higher total score of SAPS (35.59 ± 9.48 vs 31.36 ± 8.91, p = 0.001) than the non-ADHD group including the subscore of associated behaviors (21.75 ± 6.74 vs 18.71 ± 5.95, p = 0.001) and of impaired daily function (13.84 ± 3.36 vs 12.66 ± 3.53, p = 0.019).

4. DISCUSSION

In this study, the mean participants' age was 10.99. Item analysis for every item in modified SAPS-Chinese version showed significant differences in t values (p < 0.001) and high correlation among all items (Table 2). The modified SAPS-Chinese version's item analysis showed that the high score group had significant higher scores in every item when compared with the low score group. The ADHD group consistently had significantly higher scores in modified SAPS-Chinese version when compared with the non-ADHD group. The results suggest that the modified SAPS-Chinese version has discriminative validity.

Cronbach's α of the original SAPS was 0.88, indicating great reliability. The scale was structured out of four subdomains, including adaptive functions, withdrawal, tolerance, and virtual life orientation in smartphone addiction.[22] In the modified SAPS-Chinese version, the KMO was 0.94 and Bartlett's test of Sphericity was significant (p < 0.001) from item analysis. Cronbach's α for the modified SAPS-Chinese version was 0.93, with a factor of 0.92 for symptoms of problematic use–associated behaviors and a factor of 0.80 for impaired daily functions. Our results show that the modified SAPS-Chinese version might be a useful instrument for screening out high-risk children, either in clinical settings or in the community, with good reliability and validity.

Previous studies devoted great efforts to investigating problematic Internet and smartphone use. CIAS was developed in Taiwan in 2003 to study Internet addiction among adolescents and young adults in the community by using the diagnostic criteria of Internet addiction.[9] They recruited 1360 individuals with mean age of 20.47 years. Their scale contains five subscales of Internet-related problems, including compulsive use, withdrawal, tolerance, problems in interpersonal relationships, and health/time management. SPAI, a self-administered screening tool to identify smartphone addiction with great reliability and validity, was developed in 2013 in Taiwan. It recruited 283 young adults with mean age of 22.9 years[21] and yielded four factors, including compulsive behavior, functional impairment, withdrawal, and tolerance. Unlike such previous scales, which identify a variety of factors, including withdrawal and tolerance in problematic use, in our study we identified two factors in the modified SAPS-Chinese version: associated behaviors and impaired daily functions. The recruited individuals in our

Table 2

Item analysis between high-score and low-score group using Chinese version of the modified SAPS

Item		Low score Mean (SD)	High score Mean (SD)	*t*	*r*
1.	People frequently comment on my child's excessive smartphone use.	1.22 (0.44)	2.86 (0.75)	–18.19*	0.68
2.	Using a smartphone is more enjoyable than spending time with family or friends for my child.	1.45 (0.60)	2.84 (0.77)	–13.37*	0.65
3.	When my child cannot use a smartphone, he/she feels like he/she has lost the entire world.	1.07 (0.25)	2.64 (0.77)	–17.58*	0.76
4.	It would be painful if my child is not allowed to use a smartphone.	1.33 (0.60)	3.01 (0.66)	–17.18*	0.74
5.	My child gets restless and nervous when he/she is without a smartphone.	1.08 (0.27)	2.59 (0.67)	–19.19*	0.79
6.	My child is not anxious even when he/she is without a smartphone. (R)	1.55 (1.07)	2.59 (0.68)	–7.70*	0.43
7.	My child panics when he/she cannot use his/her smartphone.	1.05 (0.21)	2.35 (0.60)	–19.02*	0.72
8.	My child tries cutting his/her smartphone usage time, but he/she fails.	1.14 (0.34)	2.69 (0.66)	–20.04*	0.74
9.	My child can control his/her smartphone usage time. (R)	1.72 (0.83)	2.91 (0.67)	–10.60*	0.53
10.	Even when my child think he/she should stop, he/she continues to use his/her smartphone too much.	1.52 (0.68)	2.93 (0.62)	–14.41*	0.61
11.	Spending a lot of time on his smartphone has become a habit.	1.13 (0.42)	2.85 (0.63)	–21.56*	0.76
12.	My child has a hard time doing what he/she has planned (study, does homework, or goes to afterschool classes) due to using smartphone.	1.08 (0.27)	2.63 (0.77)	–17.89*	0.68
13.	My child's smartphone does not distract him/her from his/her studies. (R)	2.13 (1.06)	3.02 (0.67)	–5.99*	0.37
14.	My child's school grades dropped due to excessive smartphone use.	1.26 (0.51)	2.47 (0.66)	–13.55*	0.61
15.	My child would more easily quarrel with family members due to smartphone use. (A)	1.22 (0.50)	2.80 (0.74)	–16.18*	0.66
16.	My child more easily gets angry and flies into rage when cannot use the smartphone. (A)	1.05 (0.21)	2.37 (0.72)	–16.33*	0.69

SAPS = Smartphone Addiction Proneness Scale; (R) = reverse-coded items; (A) = added-on question by this study; *r* = correlation coefficient.
*$p < 0.001$.

Table 3

Factor analysis of the modified SAPS

Item		Factors 1	2
5.	My child gets restless and nervous when he/she is without a smartphone.	0.90	0.61
3.	When my child cannot use a smartphone, he/she feels like he/she has lost the entire world.	0.81	0.62
11.	Spending a lot of time on his smartphone has become a habit.	0.81	0.63
7.	My child panics when he/she cannot use his/her smartphone.	0.77	0.61
4.	It would be painful if my child is not allowed to use a smartphone.	0.77	0.67
8.	My child tries cutting his/her smartphone usage time, but he/she fails.	0.72	0.71
1.	People frequently comment on my child's excessive smartphone use.	0.72	0.56
16.	My child more easily gets angry and flies into rage when cannot use the smartphone. (A)	0.69	0.63
2.	Using a smartphone is more enjoyable than spending time with family or friends for my child.	0.63	0.62
6.	My child is not anxious even when he/she is without a smartphone. (R)	0.47	0.30
10.	Even when my child think he/she should stop, he/she continues to use his/her smartphone too much.	0.53	0.72
12.	My child has a hard time doing what he/she has planned (study, does homework, or goes to afterschool classes) due to using smartphone.	0.63	0.70
15.	My child would more easily quarrel with family members due to smartphone use. (A)	0.63	0.68
14.	My child's school grades dropped due to excessive smartphone use.	0.54	0.64
9.	My child can control his/her smartphone usage time. (R)	0.44	0.61
13.	My child's smartphone does not distract him/her from his/her studies. (R)	0.31	0.46
Eigenvalue		8.06	1.12
Expl. Var (%)		47.61	3.60

SAPS = Smartphone Addiction Proneness Scale; (A) = added-on question by this study; (R) = reverse-coded items.

Table 4

Comparison of impacts of smartphone use between the ADHD and non-ADHD group

Impacts of smartphone use	ADHD (n = 61) PSU (n = 21)	ADHD (n = 61) Non-PSU (n = 40)	*p*	Non-ADHD (n = 241) PSU (n = 37)	Non-ADHD (n = 241) Non-PSU (n = 204)	*p*
Quarrels with family, n (%)	20 (95.2)	15 (37.5)	<0.001	29 (78.4)	71 (35.0)	<0.001
Irritable mood more than once a week, n (%)	9 (42.9)	3 (7.5)	0.002*	21(61.8)	4 (2.0)	<0.001*

ADHD = attention-deficit/hyperactivity disorder; PSU = problematic smartphone use.
The modified SAPS-Chinese version was validated by impacts of daily functions: quarrels with family and irritable mood more than once a week.
*Fisher's exact test.

Table 5

Comparison of PSU between students in the ADHD and non-ADHD group

	ADHD (n = 61)		Non-ADHD (n = 241)			
Variable	**n**	**%**	**n**	**%**	**χ^2**	***p***
Subgroup						
PSU	21	34.4	37	15.4	11.41**	0.001
Non-PSU	40	65.6	204	84.6	...	...
SAPS	Mean ± SD		Mean ± SD		*t*	
Total scores	35.59 ± 9.48		31.36 ± 8.91		−3.27**	0.001
Associated behaviors subscore	21.75 ± 6.74		18.71 ± 5.95		−3.48**	0.001
Impaired daily functions subscore	13.84 ± 3.36		12.66 ± 3.53		−2.36*	0.019

ADHD = attention-deficit/ hyperactivity disorder; PSU = problematic smartphone use.
*$p < 0.05$; **$p < 0.01$.

research might have been too young to develop tolerance or withdrawal symptoms due to the relatively short time of smartphone use, but the impact on daily functions had already developed by this age.

For early detection of PSU signs in children, the modified SAPS-Chinese version was further validated by studying the impacts of daily functions. Quarrels with family and irritable mood were the two major signs and impacts identified in children with PSU. Therefore, inquiring about the experience of arguments with the family, irritability, emotion dysregulation, and anger might be critical to detecting possibly PSU in children. Furthermore, it might help in early detection of at-risk children, who are prone to develop psychiatric comorbidities.

With the evolution of technology, possession of a smartphone has increased in society, even among children.[12] Increased use of smartphones is associated with the emergence of problems. However, little is known about its impact on children's early life. From a cross-sectional research of university students in Turkey, students who got their first mobile phone at a younger age had greater probability of developing PSU, especially at an age younger than 13 years.[25,26] Our study was the first to investigate PSU among the young population in Taiwan. With knowledge of the results among the young participants in our study, we can monitor early signs of PSU and help expand mental health policy in terms of guidelines development for prevention or intervention in PSU among children.

The smartphone offers novelty, immediate response, on-hand assistance with memory, repeated positive reinforcement, and aversion to delayed reward. A year-long study in the United States suggested that addicted smartphone users spend twice as much time on their phones and launched applications at nearly double the frequency when compared with nonaddicted people.[27] We suggest that clinicians need to carefully monitor patterns of smartphone use and their impacts in terms of functional impairment, especially when it comes to family relationships. Clinicians should also stress the importance of parenting skills related to smartphone use.

PSU is also associated with mental disorders, including depression, anxiety, nonoptimal sleep quality, and impulsivity.[13,28–30] Based on the DSM-5,[31] irritable mood is one of the diagnostic criteria for children and adolescents with depressive disorder. It is important not to underestimate the relations between emotional dysregulation and major mental disorders. Excessive reassurance seeking is a feature of depression[32] and anxiety.[33,34] Some mechanisms explaining how overuse and problematic use may lead to chronic stress and mood symptoms have been elucidated. These, however, continue to lead to sleep problems. Increase in work demands due to smartphone use causes stress, and blue light emission interferes with sleep.[25,35]

It remains uncertain what are the possible mechanisms that govern how PSU leads to maladaptive behaviors. Smartphones are *accessible* to children in modern societies, fulfilling the urge of addicts and decreasing reaction time and level of inhibition.[36] In addition, people deflect aversive emotional content to the smartphone as an avoidance strategy, which weakens planning and coping skills.[37] People might develop maladaptive behaviors to alleviate the urgency and negative emotions arising from frequent smartphone use.

The results of our study might be limited by the small sample size. In addition, most of our subjects were recruited from a metropolitan area in Taipei. Furthermore, the subjects aged 10 to 12 years might have been too young for detecting their habitual behaviors. Still, we considered it essential to identify young high-risk problematic smartphone users so as to make it possible to provide intervention as well as prevent future consequences.

In conclusion, the modified SAPS-Chinese version is reliable, valid, and suitable for clinical and research uses, with satisfactory properties. Associated behaviors and impaired daily functions are the two factors that PSU identified, with irritability and conflicts with family being their early signs. The modified SAPS-Chinese version can be applied to early detection of PSU.

REFERENCES

1. National Chiao Tung University. *Survey for Internet use among students in Taiwan*. Taiwan: Ministry of Education thesis; 2017.
2. Marks I. Behavioural (non-chemical) addictions. *Br J Addict* 1990;**85**:1389–94.
3. Griffiths M. A 'components' model of addiction within a biopsychosocial framework. *J Subst Use* 2005;**10**:191–7.
4. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-4)*. Washington: American Psychiatric Association; 1994.
5. Holden C. 'Behavioral' addictions: do they exist? *Science* 2001;**294**:980–2.
6. Grant JE, Brewer JA, Potenza MN. The neurobiology of substance and behavioral addictions. *CNS Spectr* 2006;**11**:924–30.
7. Billieux J, Schimmenti A, Khazaal Y, Maurage P, Heeren A. Are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. *J Behav Addict* 2015;**4**:119–23.
8. Young KS. Internet addiction: the emergence of a new clinical disorder. *CyberPsychol Behav* 1998;**1**:237–44.
9. Chen SH, Weng LJ, Su YJ, Wu HM, Yang PF. Development of a Chinese Internet Addiction Scale and its psychometric study. *Chinese J Psychol* 2003;**45**:279–94.
10. Schou Andreassen C, Billieux J, Griffiths MD, Kuss DJ, Demetrovics Z, Mazzoni E, et al. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: a large-scale cross-sectional study. *Psychol Addict Behav* 2016;**30**:252–62.
11. Billieux J. Problematic use of the mobile phone: a literature review and a pathways model. *Current Psychiatry Reviews* 2012;**8**:299–307.
12. Long J, Liu TQ, Liao YH, Qi C, He HY, Chen SB, et al. Prevalence and correlates of problematic smartphone use in a large random sample of Chinese undergraduates. *BMC Psychiatry* 2016;**16**:408.
13. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. *J Behav Addict* 2015;**4**:85–92.
14. Thomée S, Härenstam A, Hagberg M. Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults—a prospective cohort study. *BMC Public Health* 2011;**11**:66.
15. Yoo HJ, Cho SC, Ha J, Yune SK, Kim SJ, Hwang J, et al. Attention deficit hyperactivity symptoms and Internet addiction. *Psychiatry Clin Neurosci* 2004;**58**:487–94.
16. Yen JY, Yen CF, Chen CS, Tang TC, Ko CH. The association between adult ADHD symptoms and Internet addiction among college students: the gender difference. *Cyberpsychol Behav* 2009;**12**:187–91.
17. Bozkurt H, Coskun M, Ayaydin H, Adak I, Zoroglu SS. Prevalence and patterns of psychiatric disorders in referred adolescents with Internet addiction. *Psychiatry Clin Neurosci* 2013;**67**:352–9.
18. Kim DI, Chung YJ, Lee EA, Kim DM, Cho YM. Development of Internet Addiction Proneness Scale-Short Form (KS scale). *Korean J Counseling* 2008;**94**:1703–22.

19. Billieux J, Van der Linden, M, Rochat L. The role of impulsivity in actual and problematic use of the mobile phone. *Appl Cognit Psychol* 2008;**22**:1195–210.
20. Kwon M, Kim DJ, Cho H, Yang S. The Smartphone Addiction Scale: development and validation of a short version for adolescents. *PLoS One* 2013;**8**:e83558.
21. Lin YH, Chang LR, Lee YH, Tseng HW, Kuo TB, Chen SH. Development and validation of the Smartphone Addiction Inventory (SPAI). *PLoS One* 2014;**9**:e98312.
22. Kim D, Lee Y, Lee J, Nam JK, Chung Y. Development of Korean Smartphone Addiction Proneness Scale for youth. *PLoS One* 2014;**9**:e97920.
23. De-Sola J, Talledo H, Rubio G, de Fonseca FR. Development of a Mobile Phone Addiction Craving Scale and its validation in a Spanish adult population. *Front Psychiatry* 2017;**8**:90.
24. Liu YC, Liu SK, Shang CY, Lin CH, Tu C, Gau SF. Norm of the Chinese version of the Swanson, Nolan and Pelham, version IV scale for ADHD. *Taiwanese J Psychiatry* 2006;**20**:290–304.
25. Sahin S, Ozdemir K, Unsal A, Temiz N. Evaluation of mobile phone addiction level and sleep quality in university students. *Pak J Med Sci* 2013;**29**:913–8.
26. De-Sola Gutiérrez J, Rodríguez de Fonseca F, Rubio G. Cell-phone addiction: a review. *Front Psychiatry* 2016;**7**:175.
27. Tossell C, Kortum P, Shepard C, Rahmati A, Zhong L. Exploring smartphone addiction: insights from long-term telemetric behavioral measures. *iJIM* 2015;**9**:37–43.
28. Jiang Z, Shi M. Prevalence and co-occurrence of compulsive buying, problematic Internet and mobile phone use in college students in Yantai, China: relevance of self-traits. *BMC Public Health* 2016;**16**:1211.
29. Elhai JD, Dvorak RD, Levine JC, Hall BJ. Problematic smartphone use: a conceptual overview and systematic review of relations with anxiety and depression psychopathology. *J Affect Disord* 2017;**207**:251–9.
30. Chen B, Liu F, Ding S, Ying X, Wang L, Wen Y. Gender differences in factors associated with smartphone addiction: a cross-sectional study among medical college students. *BMC Psychiatry* 2017;**17**:341.
31. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*. Washington: American Psychiatric Association; 2013.
32. Evraire LE, Dozois DJ. An integrative model of excessive reassurance seeking and negative feedback seeking in the development and maintenance of depression. *Clin Psychol Rev* 2011;**31**:1291–303.
33. Rector NA, Kamkar K, Cassin SE, Ayearst LE, Laposa JM. Assessing excessive reassurance seeking in the anxiety disorders. *J Anxiety Disord* 2011;**25**:911–7.
34. Cougle JR, Fitch KE, Fincham FD, Riccardi CJ, Keough ME, Timpano KR. Excessive reassurance seeking and anxiety pathology: tests of incremental associations and directionality. *J Anxiety Disord* 2012;**26**:117–25.
35. Oh JH, Yoo H, Park HK, Do YR. Analysis of circadian properties and healthy levels of blue light from smartphones at night. *Sci Rep* 2015;**5**:11325.
36. Choi SW, Kim DJ, Choi JS, Ahn H, Choi EJ, Song WY, et al. Comparison of risk and protective factors associated with smartphone addiction and Internet addiction. *J Behav Addict* 2015;**4**:308–14.
37. Machell KA, Goodman FR, Kashdan TB. Experiential avoidance and well-being: a daily diary analysis. *Cogn Emot* 2015;**29**:351–9.