Addictive Behaviors xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mobile phone use

Olatz Lopez-Fernandez

Laboratory for Experimental Psychopathology, Psychological Sciences Research Institute, Université Catholique de Louvain 10, Place du Cardinal Mercier, 1348 Louvain-La-Neuve, Belgium

HIGHLIGHTS

- Smartphone Addiction Scale short version [SAS-SV] is adapted to Spanish and French.
- Both adaptations are characterized with very good reliability factor and construct validity.
- It is estimated 12.5% and 21.5% of potential Spanish and Belgian excessive smartphones users.
- Spanish excessive users presented by order: tolerance, loss of control and withdrawal.
- Belgian excessive users presented by order: withdrawal, loss of control and tolerance.

ARTICLE INFO

Article history:
Received 16 July 2015
Received in revised form 8 October 2015
Accepted 26 November 2015
Available online xxxx

Keywords:
Smartphone addiction
Problematic mobile phone use
Spanish adaptation
French adaptation
Cross-cultural research

ABSTRACT

Research into smartphone addiction has followed the scientific literature on problematic mobile phone use developed during the last decade, with valid screening scales being developed to identify maladaptive behaviour associated with this technology, usually in adolescent populations. This study adapts the short version of the Smartphone Addiction Scale [SAS-SV] into Spanish and into French. The aim of the study was to (i) examine the scale's psychometric properties in both languages, (ii) estimate the prevalence of potential excessive smartphone use among Spanish and Belgian adults, and (iii) compare the addictive symptomatology measured by the SAS-SV between potentially excessive users from both countries. Data were collected via online surveys administered to 281 and 144 voluntary participants from both countries respectively, aged over 18 years and recruited from academic environments. Results indicated that the reliability was excellent (i.e., Cronbach alphas: Spain: .88 and Belgium: .90), and the validity was very good (e.g., unifactoriality with a 49% and 54% of variance explained through explorative factor analysis, respectively). Findings showed that the prevalence of potential excessive smartphone use 12.5% for Spanish and 21.5% for francophone Belgians. The scale showed that at least 60% of excessive users endorsed withdrawal and tolerance symptoms in both countries, although the proposed addictive symptomatology did not cover the entire group of estimated excessive users and cultural differences appeared. This first cross-cultural study discusses the smartphone excessive use construct from its addictive pathway.

1. Introduction

In the behavioural addictions field, technological addictions form a sub-set which is described as covering a heterogeneous spectrum (Laconi, Tricard & Chabrol, 2015) of potentially excessive uses of technologies or online applications (Caplan, 2002; Davis, 2001), regarding generalized use of a device (i.e., a tablet, such as an iPad or Samsung Galaxy Tab) or specific use (i.e., particular types of online applications, such as social networking with Facebook). Similarly, Griffiths and Szabo (2014) distinguished between addictions to the internet (i.e., as a medium), or to a specific online activity (i.e., content). This debate in the internet addiction field is now being held in the field of mobile phone use as well (Lopez-Fernandez, Kuss, Griffiths & Billieux, 2015), because excessive mobile phone use has commonly been treated based on generalised use (e.g., a smartphone, such as an iPhone), and less as specific use (e.g., messaging applications, such as WhatsApp). While the debate continues, the main tradition remains, which is to generate valid instruments to measure potentially generalised mobile phone use, to cover a broader approach to exploring this phenomenon, and as a first step to screening possible cases of addictive behaviours using this technology.

E-mail addresses: olatz.lopez@uclouvain.be, lopez.olatz@gmail.com.

http://dx.doi.org/10.1016/j.addbeh.2015.11.013
0306-4603/

Problematic mobile phone use (PMPU) is a phenomenon related to maladaptive mobile phone use, which could present a pattern of dependency involving negative consequences (e.g., using the mobile phone excessively during daily activities ignoring consequences or harm, being unable to maintain concentration in a task or in an interpersonal relationship due to the need to check mobile phone notifications constantly). The investigation of this topic started a decade ago (e.g., Bianchi & Phillips, 2005), and since then, estimated PMPU prevalence has varied between 0% and 38% (Pedrero Pérez, Rodríguez Monje, & Ruiz Sánchez De León, 2012) due to the use of different scales with their own methods for extracting cut-off points to classify users (Lopez-Fernandez, Honrubia-Serrano & Freixa-Blanxart, 2012). Also another problem has been detected in this new research field: Billieux (2012) has pointed out that we have no solid theoretical framework to understand how PMPU develops and why it persists; the excessive involvement observed is possible for different alternative psychological pathways (i.e., impulsivity, maintenance of relationships, extraversion or addiction). Recently, Billieux, Maurage, Lopez-Fernandez, Kuss and Griffiths (2015) have argued for studies that show behavioural and neurobiological similarities between mobile phone addiction and other types of addictive behaviours (e.g., drug addictions) to provide evidence for the dependency pathway.

A few researchers and clinicians have researched the addictive symptomatology of PMPU. Yen et al. (2009) have established that obtaining at least four of seven symptoms facilitated the detection of PMPU (e.g., withdrawal, tolerance, and use for a longer period than intended). Moreover, Billieux et al. (2015) have highlighted that although withdrawal seems to be one of the main symptoms reported in epidemiological studies (e.g., Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart & Gibson, 2014), research was based on community samples only (rather than clinical samples). However, this criticism does not imply that mobile phone addiction does not exist. On the contrary, the authors are looking for different evidence that relates to other methodological approaches, pools of participants, and new mobile technological devices, among potentially addictive factors.

Currently, PMPU could be referred to here as smartphone problematic use (SPU) if the phone contains internet access among its respective applications. Studies have already been conducted on smartphone dependency (Chae & Lee, 2011; Km, Park & Lee, 2011), but researchers still need to make provisions for cultural diversity and develop and validate scales with cut-off points that can guarantee comparability. In South Korea, a group of clinicians and researchers have developed a self-diagnostic scale to distinguish “smartphone addicts” (SAS; Kwon, Lee, Won, Park, Min, et al., 2013), that has been reduced to create a valid short version (SAS-SV; Kwon, Kim, Cho & Yang, 2013). Next to these, only a couple of tools have been developed and validated: the Chinese Smartphone Addiction Inventory (SPAI; Lin et al. 2014) and the Korean Smartphone Addiction Proneness Scale (SAPS; Kim, Lee, Lee, Nam & Chung, 2014).

At present, no cross-cultural research has been developed to measure SPU; only a couple of studies that measure mobile phone use without an addiction approach have been published (Baron & Segerstad, 2010; Westlund, 2011). Therefore, this paper has three aims: to (i) examine the psychometric properties of SAS-SV in both Spanish and French populations, (ii) to estimate the prevalence of potential excessive smartphone use among Spanish and Belgian adults, and (iii) to compare the addictive symptomatology measured by the SAS-SV between the potentially excessive users from both countries.

2. Material and methods

2.1. Participants and procedure

The study surveyed two convenience samples online, one from the University of Barcelona (UB, Spain; $N = 281$), and the other from the Catholic University of Louvain (UCL, Belgium; $N = 144$). These comprised university students and staff that voluntarily accepted to be part of the study, after an electronic invitation: at UB invitations were sent via virtual learning environments (e.g., Platform Moodle: https://campusvirtual2.ub.edu/?lang=en); and at UCL invitations were sent via the UCL students' portal (http://www.uclouvain.be/etudiant.html), UCL Psychological Sciences Research Institute (IPSY: https://www.uclouvain.be/364770.html) or virtual learning environments (Platform Claroline: http://icampus.uclouvain.be/).

Confidentiality and anonymity were assured, and permission to participate in the study was obtained. In Spain 51.31% (n = 117) successfully completed all the SAS-SV items, while in Belgium the rate was higher: 91.7% (n = 79).

The participants in Spain were aged between 18 and 68 years, with a mean (M) of 25.61 and a standard deviation (SD) of 11.65, and in Belgium between 18 and 73 years, with a mean of 29.11 (SD = 15.33). In both samples, gender was unbalanced: in Spain three quarters were females (n = 225: 80.1%), while in Belgium around two thirds (n = 99: 68.8%).

2.2. Measures

The online survey comprised three sections: (a) socio-demographics, (b) mobile phone usage patterns, and (c) the SAS-SV adapted into Spanish or French respectively, with the translation–back translation method supported by researchers from Spain and Belgium, plus external linguistic expert translators from these respective languages to English. These professionals coming from two fields (i.e., addiction research and clinics; linguistics and translators) acted as expert judges doing a qualitative assessment of each item in order to achieve a consensus about its final version. A pre-test phase was conducted only for the French version by other Belgian researchers from the IPSY (UCL).

The variables examined in the socio-demographic section included: gender, age, civil status (i.e., single, in couple/in legal cohabitation/married, separated/divorced, widow/er, others), children (i.e., yes, no), education level (i.e., primary, secondary, and higher education), and profession (i.e., student, worker, unemployment, retired, housewife/husband, self-employed, others).

The patterns of smartphone use measured were: possessing a mobile phone with internet access (smartphone) or without internet access; average minutes per day spent on their mobile phone/smartphone (outside the activities related to work/study) on a typical weekday; and days of mobile phone/smartphone use to perform leisure online activities per typical week.

The SAS-SV is a validated scale originally constructed in South Korea, but published in English (Kwon, Kim, et al., 2013). It contains ten items rated on a dimensional scale (1 “strongly disagree” to 6 “strongly agree”). The total score ranges from 10 to 60, with the highest score being the maximum presence of “Smartphone addiction” in the past year. The original SAS-SV showed content and concurrent validity and internal consistency (Cronbach's alpha: 0.91).

2.3. Analysis

2.3.1. Psychometric properties of the SAS-SV in Spain and in Belgium

Some participants did not have smartphones or did not respond properly to the survey; however, the sample sizes were sufficient to do the psychometrics, because of the SAS-SV, which includes ten items, at least 100 participants per country were tested (Nunnally, 1978).

The validity was assessed using Exploratory Factor Analyses (EFA) through the Principal Component method (PC) in each sample, with the Kaiser–Mayer–Olkin index (KMO) and Bartlett's test of sphericity, respectively. This selection of methods was due: (i) to the absence of prior systematic results about the factor structure of the SAS-SV, (ii) the lack of a solid theoretical framework for SPU as PMPU, and (iii)

Please cite this article as: Lopez-Fernandez, O., Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mo..., *Addictive Behaviors* (2015), http://dx.doi.org/10.1016/j.addbeh.2015.11.013

because it was the first time exploring the factor solution in both adaptations and this method explains the most of the variance observed (Izquierdo, Olea & Abad, 2014; Pérez & Medrano, 2010). According to Kaiser's criterion, one factor was retained (with eigenvalues above 1, factor loadings above 0.4 that explained part of the variance). Moreover, for validation purposes, Pearson correlations between the total SAS-SV score with time indicators (time per typical weekday in minutes, weekly frequency per day, and age) were applied.

Item analysis was carried out to observe how well the different statements performed, as well as Cronbach's alpha to estimate the scale's internal consistency.

2.3.2. Prevalence of smartphone users with addictive symptoms

The prevalence was estimated using Kwon and colleagues' proposal (2013) for cut-off points by gender: 31 and of 33 (out of 60) to classify "excessive smartphone male and female users" respectively were selected. Statistical differences between the two groups were calculated with the t-tests and Mann–Whitney's U; and among more than two groups with an ANOVA.

2.3.3. SAS-SV symptoms

The symptoms measured through the SAS-SV were analysed in both samples only with participants categorised as potentially "excessive users", in order to check symptomatology, a procedure previously used in problematic internet use studies (i.e., Lopez-Fernandez, Honrubia-Serrano, Gibson & Griffiths, 2014; Tao, Huang, Wang, Zhang, Zhang & Li, 2010). Symptoms were measured by one or two items each. For symptom measures consisting of two items, the average of both items was calculated as the score for the respective symptom; lastly, as the score was between 1 and 6, a rating of 4 or higher for each symptom was considered to signify the presence of this specific symptom (a similar procedure used by Phillips, Saling & Blaszczynski, 2008).

From this author's point of view, the scale covers the following six addictive symptoms (based on substance dependence and pathological gambling disorders proposed in DSM-IV; APA, 1994): loss of control, disruption of family or schooling, disregard for consequences, withdrawal, preoccupation and tolerance (see Table 1). Each item is associated with an addictive symptom, except four item clusters: items 1 and 8 (both assessing "loss of control"), items 2 and 10 ("disruptions"), items 3 and 7 ("disregard for consequences") and items 4 and 5 ("withdrawal").

2.3.4. Statistical software

All statistical analyses were performed using IBM SPSS Statistics 21 and a significance level of .05 was adopted throughout.

3. Results

3.1. Socio-demographics and descriptives of mobile phone use patterns

The majority of the initial sample in Spain was single (80.1%; only 16.7% were couples/in legal cohabitation/married, 2.1% separated/divorced, 0.4% widow/er), without children (only 6.8% have progeny); their maximum education level was between secondary (39.9%) and higher education (56.9%); their profession was being a student (51.2%) or employee (23.1%). In Belgium 52.3% were single and 38.6% had a partner (only 8.3% separated/divorced and 0.8% other situations), and without children (77.3%). Their maximum education level was secondary (53%) and higher education (45.5%); similarly, their profession was being a student (68.2%) or employee (13.6%).

The Spanish had a mobile phone without internet access (10%) or a smartphone (89.7%); average minutes per day spent using the mobile phone was around 3.5 h(M = 220.58 (SD = 256.15)) on a typical weekday, and the smartphone was used to perform leisure online activities on 6 out of 7 days (M = 6.45 (SD = 1.76)) in a typical week. The Belgians had a mobile phone (32.6%) or a smartphone (65.2%), used it for around 1.5 h (M = 93.65 (SD = 179.72)) on a typical weekday, and to perform leisure online activities on 5 out of 7 days (M = 5.01(SD = 3.12)) in a typical week.

3.2. SAS-SV psychometrics in Spanish and Belgian adults

3.2.1. Construct validity

The results obtained through the EFA with the PC were almost equal in both countries (Spain: KMO = .852; Bartlett's test: $\chi^2_{(45)} = 532.37$; $p < .001$; Belgium: KMO = .868; Bartlett's test: $\chi^2_{(105)} = 445.96$; $p < .001$) and yielded one factor: "smartphone excessive usage" explained 49.3% of the total variance in Spain and 54.3% in Belgium. Furthermore, associations with indicators and SAS-SV total score strengthen the validity of both adaptations. In this regard, all time variables were significantly positively associated in both countries, with higher SAS-SV scores associated with more days per week leisure smartphone use (Spain: $r = .49$, $p < .001$, $r^2 = .24$; Belgium: $r = .51$, $p < .001$, $r^2 = .26$), and a greater mean time per weekday (Spain: $r = .35$, $p < .001$, $r^2 = .12$; Belgium: $r = .41$, $p < .001$, $r^2 = .17$). However, age was significantly inversely associated with SAS-SV score (Spain: $r = -.31$, $p < .01$, $r^2 = .09$; Belgium: $r = -.24$, $p < .05$, $r^2 = .06$).

3.2.2. Item analysis and internal consistency

Table 1 shows the scores and the analysis of each item per country. In Spain, Item 9 (tolerance) was the most prevalent, whereas in Belgium Items 4 (withdrawal) and 9 were most prevalent. In Spain, Items 6 and 7 (preoccupation and disregard for consequences, respectively) were the least prevalent with lower variability, whereas in Belgium, the least endorsed was Item 3 (disregard for consequences). In regard to their factor loading, in both countries the items were above .5. The SAS-SV achieved excellent reliability for a 10-item test, with $\alpha = .88$ [95% CI: .84, .91] for Spain, and $\alpha = .90$ [95% CI: .87, .93] for Belgium. Lastly, the total score for the Spanish sub-sample was mean of 21.10 (SD = 9.13); while in the Belgian sub-sample it was mean of 24 (SD = 12).

3.3. Estimation of the prevalence of "excessive smartphone use"

Following Kwon, Kim, et al. (2013) suggested cut-off points per gender to classify problem smartphone users, their mean (scoring 32 of 60) was selected as cut-off for both genders, because no statistical difference was found between the SAS-SV total score per gender (Spain: $t_{(115)} = .135$, $p = .89$; Belgium: $t_{(77)} = .365$, $p = .72$). In the Spanish sample, there were 15 (out of 117) "excessive users" (12.8%: 15.2% males and 10.2% females) and 17 in Belgium (out of 79) (21.5%: 20% males and 22% females).

Regarding the SAS-SV scores obtained in the two types of users (i.e., excessive versus non-excessive) statistical differences were found between their scores in both countries. In Spain, the non-excessive users had a mean SAS-SV score of 18.54 (SD = 6.31), whereas excessive users had a M of 38.53 (SD = 5.44) ($t_{(115)} = 11.55$, $p < .001$); with similarities found in Belgium (non-excessive users: M = 18.9 (SD = 6.5); excessive users M = 42.59 (SD = 8.54); $t_{(77)} = 12.41$, $p < .001$).

In relation to patterns of smartphone use, only a slight significant difference was observed in types of users with minutes per weekday (Spain: non-excessive users: M = 221.9 (SD = 240.79); excessive users M = 478.16 (SD = 343.63); $t_{(110)} = 3.52$, $p < .01$; Belgium: non-excessive users: M = 83.65 (SD = 146.47); excessive users: M = 304.71 (SD = 329.59); U: $Z = 3.71$, $p < .001$).

According to the socio-demographics and the SAS-SV scores, almost no other relationships were detected in these variables (except in Spain, where the unemployed group (M (SD): 39.67 (5.13)) scored significantly higher on the SAS-SV ($F_{(3)} = 7.99$, $p < .001$) than students (M = 21.98 (SD = 8.73)), employees (M = 17.23 (SD = 7.77)) and self-employed (M = 14 (SD = 5.23))).

Please cite this article as: Lopez-Fernandez, O., Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mo..., *Addictive Behaviors* (2015), http://dx.doi.org/10.1016/j.addbeh.2015.11.013

Table 1
Item analysis and internal consistency in SAS-SV for Spanish and Belgian adults (N = 196) (item number, its statement in English, French and Spanish; its factor and proposed symptom; and mean (M) and standard deviation (SD) per country, item factor loading, corrected item-total correlation, and Cronbach's alpha if item is deleted).

SAS-SV Scale items		Spain (n = 117)					Belgium (n = 79)				
n.	Original statement in English (ENG); "adaptation in French (FR)"; "adaptation in Spanish (ESP)" [original factor associated; "proposed addictive symptom"]	Score		Item factor load	Corrected item-total *r*	α if item deleted	Score		Item factor load	Corrected item-total *r*	α if item deleted
		M	SD				M	SD			
1	ENG: Missing planned work due to smartphone use; FR: "J'utilise mon smartphone de telle manière à ce que cela entraîne un impact négatif sur ma productivité/mon travail"; ESP: " Debido al uso del smartphone he perdido tareas/actividades/trabajos/etc. previamente planificados" [daily-life disturbance; "loss of control"]	1.68	1.23	.66	.59	.87	2.23	1.58	.67	.60	.90
2	ENG: Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use; FR: "J'ai du mal à me concentrer en classe, durant mes devoirs, ou durant le travail à cause du smartphone"; ESP: "Debido al uso del smartphone he tenido problemas de concentración (en clase, en el trabajo, etc.), mientras hacía mis tareas (deberes, etc.) o mientras trabajaba" [daily-life disturbance; "schooling/working disruption"]	2.88	1.65	.76	.71	.86	2.52	1.65	.58	.51	.90
3	ENG: Feeling pain in the wrists or at the back of the neck while using a smartphone; FR: "Je ressens de la douleur aux poignets ou à la nuque quand j'utilise mon smartphone"; ESP: "Debido al uso del smartphone he sentido dolor en alguna de mis muñecas o detrás del cuello (por ejemplo, en la nuca), etc." [daily-life disturbance; "disregard for the physical or psychological consequences"]	2.15	1.41	.53	.46	.88	1.70	1.41	.64	.57	.90
4	ENG: Won't be able to stand not having a smartphone; FR: "Je ne supporte pas le fait de ne pas avoir mon smartphone"; ESP: "No puedo estar sin mi smartphone" [withdrawal; "withdrawal"]	2.21	1.42	.75	.66	.86	3.03	1.85	.76	.68	.89
5	ENG: Feeling impatient and fretful when I am not holding; FR: "Je ressens de l'impatience et de l'irritation lorsque je n'ai pas mon smartphone" ESP : "Me siento impaciente e inquieto cuando no tengo mi smartphone" [withdrawal; "withdrawal"]	1.99	1.23	.75	.66	.86	2.49	1.78	.80	.73	.89
6	ENG: Having my smartphone in my mind even when I am not using it; FR: "Je suis préoccupé par l'utilisation de mon smartphone, même lorsque je ne l'utilise pas" ESP: "Tengo mi smartphone en mente incluso cuando no lo uso" [withdrawal; "preoccupation"]	1.53	.94	.73	.63	.87	2.06	1.47	.88	.82	.88
7	ENG: I will never give up using my smartphone even when my daily life is already greatly affected by it; FR: "Je n'arrêterai jamais d'utiliser mon smartphone, même si son utilisation entraîne des conséquences négatives importantes dans ma vie quotidienne" ESP: "No dejaré de usar mi smartphone incluso si mi vida cotidiana está realmente afectada por éste" [withdrawal; "disregard for the physical or psychological consequences"]	1.47	.91	.67	.57	.87	2.09	1.55	.73	.64	.89
8	ENG: Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook; FR: "Je surveille en permanence mon smartphone de manière à ne manquer aucune conversation (par ex. sur Twitter ou Facebook)" ESP: "Estoy comprobando constantemente mi smartphone para no perderme conversas con otras personas en las redes sociales (como Twitter, Facebook, etc.)" [cyberspace oriented relationship; "loss of control"]	2.44	1.53	.74	.66	.86	2.56	1.78	.76	.69	.89
9	ENG: Using my smartphone longer than I had intended; FR: "J'utilise mon smartphone plus longtemps que je ne l'avais prévu" ESP: "Uso mi smartphone más de lo que había previsto inicialmente" [overuse; "tolerance"]	3.15	1.62	.71	.62	.87	3.14	1.78	.72	.62	.90
10	ENG: The people around me tell me that I use my smartphone too much; FR: "Mes proches me disent que j'utilise trop mon smartphone" ESP: "La gente de mi alrededor me dice que uso demasiado mi smartphone" [tolerance; "family/schooling disruption"]	1.61	1.03	.69	.58	.87	2.19	1.50	.80	.74	.89

Note 1: "Instructions: in relation with your smartphone, please answer each of the following questions on a scale from 1 to 6, corresponding to: 1 = strongly disagree, and 6 = strongly agree. Answer these.
Note 2: Spain: total-test alpha = 0.88; Belgium: total-test alpha = 0.90.

3.4. SAS-SV symptoms

The frequency and percentage of incidence per symptom were calculated for potentially excessive smartphone users (see Table 2). The most prevalent were "tolerance" (93.9%) for Spaniards and "withdrawal" (100%) for Belgians, and the least prevalent was "disregard for consequences" (13.3% and 64.7%, respectively). The great part of excessive users reported withdrawal and tolerance as main symptoms.

4. Discussion and conclusions

The purpose of this study was to adapt and re-examine the SAS-SV in two countries to estimate the prevalence of excessive smartphone use in Spanish and francophone Belgian participants, and their respective symptomatology.

Factor analyses of both versions verified the scale's unidimensionality (such as Akin, Altundag, Turan & Akin, 2014) with a considerable variance explained (49% and 54%, respectively) for a short scale (Reckase, 1979), and construct validity was also achieved through associations with daily smartphone use duration and weekly usage frequency (such as Lin et al., 2015). Reliability measures achieved were excellent and almost equal across samples ($\alpha_{Spain} = .88$ and $\alpha_{Belgium} = .90$), similar to those obtained by previous studies using the SAS-SV (South Korea $\alpha = .91$, Kwon, Kim, et al., 2013; Turkey $\alpha = .88$, Akin et al., 2014), and other smartphone scales (SPAI in China $\alpha = .94$, Lin et al., 2014; SAPS in South Korea $\alpha = .88$, Kim et al., 2014). The corrected item–total correlations ranged (Nunnally & Bernstein, 1994) from .46 to .71 in Spain and from 0.62 to 0.74 in Belgium, similar to comparable studies using the SAS-SV (e.g., 0.50 to .80 in the original study by Kwon, Kim, et al., 2013; 0.43 to .76 in the Turkish version by Akin et al., 2014).

The present item analysis of the SAS-SV contributes to the suggestion that the cut-off point should be increased, because although both countries are in the top 30 for Information and Communication Technologies (ICT) use (28 and 25 respectively in the ICT Development Index; International Telecommunication Union, 2014), their SPU prevalence seems relatively high, however it is still in the range of PMPU (Pedrero Pérez et al., 2012). One reason could be that it has been used as a cut-off point as proposed by Kwon, Kim, et al. (2013), who sampled South Korean adolescents, a different population compared with European adults. Cultural differences may have furthermore contributed to the high prevalence because the prevalence of excessive technology use in Asia is usually higher than in the West, as has been detected in a review of Internet addiction studies (Kuss, Griffiths, Karila, & Billieux, 2014).

Table 2
Symptom analysis in SAS-SV for Spanish and Belgian potentially excessive smartphone users (N = 32) (frequency of incidence for each symptom proposed and in combinations).

Countries (sub-samples of excessive users)	Spain (n = 15)	Belgium (n = 17)
Symptom/s (number and name; combination)	n (%)	n (%)
1. Loss of control	10 (66.7)	16 (94.1%)
2. Disruption	7 (46.7)	13 (76.5%)
3. Disregard	2 (13.3)	11 (64.7%)
4. Withdrawal	9 (60)	17 (100%)
5. Preoccupation	6 (40)	12 (70.6%)
6. Tolerance	14 (93.9)	15 (88.2%)
Symptoms 4 and 6 simultaneously	9 (60)	15 (88.2%)
Symptoms 4, 6 and 1 simultaneously	6 (40)	14 (82.4%)
Symptoms 4, 6 and 2 simultaneously	3 (20)	11 (64.7%)
Symptoms 4, 6 and 3 simultaneously	2 (13.3)	10 (58.8%)
Symptoms 4, 6 and 5 simultaneously	5 (33.3)	11 (64.7%)
From two to five symptoms simultaneously	9 (60)	
From four to six symptoms simultaneously		16 (94.1)

The descriptive findings show, in relation with socio-demographics, that age was inversely associated with SAS-SV score and no differences were found in total score per gender. Moreover, in Spain, only the unemployed group scored higher than the other job categories, which could indicate a potential risk factor for SPU. Other slight cultural differences are related with smartphone use patterns and the addictive components. The Spanish have more smartphones and use their smartphones three times longer on average compared with Belgians; however, potentially excessive Belgian users tend to use smartphones more addictively compared with Spanish ones. In relation to the addictive symptoms endorsed, all excessive Belgian users presented withdrawal, followed by loss of control and tolerance, while almost all the Spanish excessive users presented tolerance, followed by loss of control and withdrawal. The least endorsed symptom was "disregard for the physical or psychological consequences", although with different proportions across countries. In comparison with other SAS studies that have explored addictive symptomatology within a community sample, the present findings show considerable agreement concerning the most endorsed symptoms, which are "tolerance" and "withdrawal" (i.e., Kim et al., 2014; Lin et al., 2014). Moreover, potential excessive users did not cover at least half of the proposed addictive symptoms (Yen et al., 2009); they have endorsed fewer symptoms as expected, particularly the Spanish. More attention should be paid to this aspect, because maybe the extracted groups are better classified in other pathways (such as the extraversion one), and not exclusively in the addictive one (Billieux, 2012).

Limitations in this study relate to conceptual and methodological aspects. First, smartphones are evolving quickly, which includes smartwatches, suggesting that they are used as tools in our daily lives (e.g., as alarm clocks; Montag et al. (2015) found that wearing an analogue watch could be a protective factor for addiction). The routine character of these mobile devices could facilitate excessive use or, on the contrary, could improve self-management skills, such as learning and social self-efficacy (Chiu, 2014). Second, classical exploratory techniques have been used to validate both versions due to adapting the scale for the first time with adequate sample sizes, although the Belgian sample was small and both were community samples from the academic context; however, other methods instead of the PC could be used (e.g., principal axes, maximum likelihood, screen test, parallel analysis) that are more appropriate. A future study needs to perform a confirmatory factor analysis. Third, due to the nature of smartphones, future research could include other scales with their multifactorial nature, in addition to new indicators and techniques; for example, a recent similar SAS created for measuring the experiences of nursing students distracted by smartphones (Cho & Lee, 2015) has reported better psychometric properties with a multifactorial tool (with 91% of the variance in mobile phone addiction explained), in comparison with this scale. Interestingly construct validity has been also measured through associations with non-time variables, like distraction and attitudes related to its uses in a clinical setting. Similarly, the SPAI used associations with phantom vibration and ringing syndrome (with very low correlation detected), and yielded four factors: compulsive behaviour, functional impairment, withdrawal and tolerance (Lin et al., 2014). This is similar to the SAPS with its four-factor structure: disturbance of adaptive functions, virtual life orientation, withdrawal and tolerance (Kim et al. 2014).

Accordingly, for future research, individual feelings (e.g., phantom feelings syndrome), contextual (e.g., use smartphone during class), and the main application/s most commonly used in a maladaptive way (e.g., WhatsApp or Facebook) could be factors to consider when assessing excessive and SPU, paying special attention to the addictive components, and separating it from other possible pathways suggested by Billieux (2012) and Billieux et al. (2015), because the pathways are not exclusive. Another improvement for validity issues could be to invite participants to be followed by an App, in order to register objective time variables, because Lin et al. (2015) discovered that self-reported time was significantly lower than the time recorded by the App. Finally,

Please cite this article as: Lopez-Fernandez, O., Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mo..., *Addictive Behaviors* (2015), http://dx.doi.org/10.1016/j.addbeh.2015.11.013

based on the evidence presented here, it could perhaps be argued that a new cut-off point must be calculated, probably with an increased score that categorises real excessive users better, and avoids false positives; similar to comparable epidemiological procedures used by Kwon, Kim, et al. (2013) and other well-known Asian researchers (Ko et al., 2009; Tao et al., 2010) for Western populations. The main problem in the European countries that have been studied is that very few clinicians treat behavioural addictive problems, and future research must take them into account to ensure accurate classifications.

To the author's knowledge, this is the first cross-cultural exploration of SPU symptomatology. The findings suggest that although we have two more SAS-SV adaptations that work well psychometrically and that could be used in a range of Spanish-speaking and francophone countries, excessive smartphone use is not clearly linked to addictive symptomatology, and at the same time, the criteria are slightly different for the cultures studied here, although Spaniards and Belgians have similarly high levels of ICT usage because they are geographically quite close in Europe. It is suggested that researchers in SPU and PMPU, as well as in other potential "technological addictions", should use more and new indicators in addition to the ones proposed here, to assess problematic mobile phone use in order to facilitate the comparability across cultures that use mobile phones or smartphones in similar populations.

Role of funding sources

Olatz Lopez-Fernandez is funded by the European Commission with the Marie Curie Intra-European Fellowship for Career to research on the problematic usage of information and communication technologies ("Tech Use Disorders"; Grant ID: FP7-PEOPLE-2013-IEF-627999).

Acknowledgements

The author would like to thank people involved in both Universities. Thanks go to University of Barcelona (UB), the "Serveis Linguistics UB", teachers of Research Designs and the University of Experience, as well as their students. To the Catholic University of Louvain (UCL), to William De Bueger, Aurélien Cornil and Jory Deleuze; Professor Didier Lambert Nadine Didier, teachers from Psychology, students from Research Methods and Professor Joël Billieux (UCL).

References

Akin, A., Altundag, Y., Turan, M.E., & Akin, U. (2014). The validity and reliability of the Turkish version of the smart phone addictions scale-short form for adolescents. *Procedia — Social and Behavioral Sciences*, *152*, 74–77.

American Psychiatric Association [APA] (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington, DC: Author.

Baron, N.S., & Segerstad, Y.H. (2010). Cross-cultural patterns in mobile-phone use: Public space and reachability in Sweden, the USA and Japan. *New Media & Society*, *12*, 13–34.

Bianchi, A., & Phillips, J. (2005). Psychological predictors of problem mobile phone use. *Cyberpsychology & Behavior*, *8*, 39–51.

Billieux, J. (2012). Problematic use of the mobile phone: A literature review and a pathways model. *Current Psychiatry Reviews*, *8*, 299–307.

Billieux, J., Maurage, P., Lopez-Fernandez, O., Kuss, D.J., & Griffiths, M.D. (2015). Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Current Addiction Reports*, *2*, 156–162.

Caplan, S.E. (2002). Problematic internet use and psychosocial well-being: Development of a theory-based cognitive–behavioral measurement instrument. *Computers in Human Behavior*, *18*, 553–575.

Chae, S.W., & Lee, K.C. (2011). An empirical analysis of the effect of smartphone use on addiction: Usage and gratification approach. *Information — An International Interdisciplinary Journal*, *14*, 3113–3126.

Chiu, S. -I. (2014). The relationship between life stress and smartphone addiction on Taiwanese university student: A mediation model of learning self-efficacy and social self-efficacy. *Computers in Human Behavior*, *34*, 49–57.

Cho, S., & Lee, E. (2015). Development of a brief instrument to measure smartphones addiction among nursing students. *CIN — Computers Informatics Nursing*, *33*(5), 216–224.

Davis, R.A. (2001). A cognitive behavioral model of pathological internet use. *Computers in Human Behavior*, *17*, 187–195.

Griffiths, M.D., & Szabo, A. (2014). Is excessive online usage a function of medium or activity? An empirical pilot study. *Journal of Behavioral Addictions*, *3*(1), 74–77.

International Telecommunication Union [ITU] (2014). *Measuring the Information Society Report 2014.* Geneva: Author (Retrieved 05/07/15: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf).

Izquierdo, I., Olea, J., & Abad, F.J. (2014). Exploratory factor analysis in validation studies: Uses and recommendations. *Psicothema*, *26*(3), 395–400.

Km, W., Park, B. -W., & Lee, K.C. (2011). Measuring smartphone dependence: A first step with emphasis on factor analytic evidence. *Information — An International Interdisciplinary Journal*, *14*, 3031–3047.

Kim, D., Lee, Y., Lee, J., Nam, J.K., & Chung, Y. (2014). Development of Korean Smartphone Addiction Proneness Scale for Youth. *PloS One*, *9*(5), e97920.

Ko, C., Yen, J., Chen, S., Yang, M., Lin, H., & Yen, C. (2009). Proposed diagnostic criteria and the screening and diagnosing tool of internet addiction in college students. *Comprehensive Psychiatry*, *50*, 378–384.

Kwon, M., Lee, J. -Y., Won, W. -Y., Park, J. -W., Min, J. -A., ... Kim, D. -J. (2013). Development and validation of a Smartphone Addiction Scale (SAS). *PloS One*, *8*(2), e56936.

Kwon, M., Kim, D. -J., Cho, H., & Yang, S. (2013). The Smartphone Addiction Scale: Development and validation of a short version for adolescents. *PloS One*, *8*(12), e83558.

Kuss, D.J., Griffiths, M.D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design*, *20*(25), 4026–4052.

Laconi, S., Tricard, N., & Chabrol, H. (2015). Differences between specific and generalized problematic internet uses according to gender, age, time spent online and psychopathological symptoms. *Computers in Human Behavior*, *48*, 236–244.

Lin, Y. -H., Chang, L. -R., Lee, Y. -H., Tseng, H. -W., Kuo, T.B.J., & Chen, S. -H. (2014). Development and validation of the Smartphone Addiction Inventory (SPAI). *PloS One*, *6*, e98312.

Lin, Y. -H., Lin, Y. -C., Lee, Y. -H., Lin, P. -H., Lin, S. -H., ... Kuo, T.B.J. (2015). Time distortion associated with smartphone addiction: Identifying smartphone addiction via a mobile application (App). *Journal of Psychiatric Research*, *65*, 139–145.

Lopez-Fernandez, O., Kuss, D.J., Griffiths, M.D., & Billieux, J. (2015). The conceptualization and assessment of problematic mobile phone use. In Z. Yan (Ed.), *Encyclopedia of mobile phone behavior*, *vol. 2*. (pp. 591–606). Hershey, PA: IGI Global.

Lopez-Fernandez, O., Honrubia-Serrano, M.L., & Freixa-Blanxart, M. (2012). Spanish adaptation of the "Mobile Phone Problem Use Scale" for adolescent population. *Adicciones*, *24*, 123–130.

Lopez-Fernandez, O., Honrubia-Serrano, M.L., Freixa-Blanxart, M., & Gibson, W. (2014). Prevalence of problematic mobile phone use in British adolescents. *CyberPsychology, Behavior & Social Networking*, *17*, 91–98.

Lopez-Fernandez, O., Honrubia-Serrano, M.L., Gibson, W., & Griffiths, M.D. (2014). Problematic internet use in British adolescents: An exploration of the addictive symptomatology. *Computers in Human Behavior*, *35*, 224–233.

Montag, C., Kannen, C., Lachmann, B., Sariska, R., Duke, E., ... Markowetz, A. (2015). The importance of analogue zeitgebers to reduce digital addictive tendencies in the 21st century. *Addictive Behaviors Reports*, *2*, 23–27.

Nunnally, M.J. (1978). *Psychometric theory.* New York, NY: Mc Graw-Hill.

Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGrawHill.

Pedrero Pérez, E., Rodríguez Monje, M., & Ruiz Sánchez De León, J. (2012). Adicción o abuso del teléfono móvil. Revisión de la literatura. *Adicciones*, *24*, 139–152.

Pérez, E.R., & Medrano, L. (2010). Análisis factorial exploratorio: Bases conceptuales y metodológicas. *Revista Argentina de Ciencias del Comportamiento*, *2*(1), 58–66.

Phillips, J.G., Saling, L., & Blaszczynski, A. (2008). Psychology of mobile phone use and misuse. In A.C. Harper, & R.V. Buress (Eds.), *Mobile telephones: Networks, applications, and performance* (pp. 191–210). New York, NY: Nova.

Reckase, M. (1979). Unifactor latent trait models applied to multifactor tests: Results and implications. *Journal of Educational Statistics*, *4*, 207–230.

Tao, R., Huang, X., Wang, J., Zhang, H., Zhang, Y., & Li, M. (2010). Proposed diagnostic criteria for internet addiction. *Addiction*, *105*, 556–564.

Westlund, O. (2011). New(s) functions for the mobile: A cross-cultural study. *New Media & Society*, *12*, 91–108.

Yen, C. -H., Tang, T. -C., Yen, J. -Y., Lin, H. -C., Huang, C. -F., Liu, S. -C., & Ho, C. -H. (2009). Symptoms of problematic cellular phone use, functional impairment and its association with depression among adolescents in Southern Taiwan. *Journal of Adolescence*, *32*, 863–873.

Please cite this article as: Lopez-Fernandez, O., Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mo..., *Addictive Behaviors* (2015), http://dx.doi.org/10.1016/j.addbeh.2015.11.013