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ORIGINAL ARTICLE

Screening Tools for Technological Addictions: A Proposal for the Strategy of Mental Health

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Abstract The emergence of addictive problems associated with the development of Information and Communication Technologies (ICTs) is a challenge for mental health in modern societies. For this reason, the Spanish Mental Health Strategy, currently in project, includes the problem of "emerging addictions" in young people, in the 14 mental health topics to be analysed. The main objective of this research was to develop three screening tools that can be used by health staff (e.g., psychologists, physicians) to better link early detection with early intervention in the field of technological addictions. In this paper, three kind of technological addictions were selected: Internet/social networks, mobile and video games. Two groups of participants were selected for each technology: a) users of Internet/social network, mobile or video games without psychological problems due to the use of these technologies, and b) people who sought counselling or advice for their addictive problems with some of these technologies. Three screening tools for each technological addiction (Internet/social network, mobile and video games) were developed. These tools consist on the two items of each of the tests which have the highest Positive Predictive Values (PPV) to differentiate between the non-problematic users of technologies and those who have an addictive problem with Internet, mobile or video games. This article shows three screening tools that can be used by health or clinical staff, in the case that the professional supposes that the patient has an addictive problem with any of the three technologies. Then, the screening procedure should be implemented. If the diagnostic of addiction is confirmed, the patient should be treated with psychological treatment based in evidence. Some advices are also proposed for those who do not need any specialized intervention for addiction.

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Addiction is not a problem caused exclusively by drugs; other behavioural patterns can cause addictive problems in the same way that drugs do. This was recognised for pathological gambling, by the American Psychiatric Association (APA) (APA 2013), but it is also relevant to other actions that can result in what have been called behavioural addictions (Grant et al. 2010) or without drugs (Echeburúa 1999). The most recent and characteristic kinds of behavioural addictions are those that are induced by the dysfunctional use of Information and Communication Technologies (ICTs), which have been considered "technological addictions" (Griffiths 1995). The main technological addictions involve the Internet (Tsai and Lin 2003), mobile phones (Choliz 2010), and video games (Griffiths et al. 2012).

With regard to video games, the DSM-5 Task Force and Work Groups accepted Internet Gaming Disorder as a proposed disorder for future research. Nine criteria were proposed, some of which have already been demonstrated, such as withdrawal symptoms when Internet gaming is taken away; loss of a significant relationship, job, educational or career opportunities because of participation in Internet games (Peters and Malesky 2008); unsuccessful attempts to control participation in the Internet games; or loss of interest in previous hobbies as a result of Internet games, among others (APA 2013).

Internet gaming disorder is the only technological addiction that is currently accepted by the APA as a psychological problem in the spectrum of addiction. However, there are many scientific studies and much clinical evidence regarding how the dysfunctional use of social networks or instant messaging (IM) systems for mobile phones can cause some psychological problems that have an addictive nature (Chóliz et al. 2012; Griffiths 2000). In the case of youth and adolescents, the addiction to technology is now one of the problems that characterises our time (Jiménez-Murcia and Farré 2015) and has become a major health challenge (Echeburúa and Corral 2010). There is already considerable empirical evidence about this problem (Echeburúa et al. 2009).

As ICTs have developed, and as their consumption is socially encouraged, some people go on to develop similar problems to the distinctive symptoms of addictive disorders. As in the case of gambling and other addictions, such symptoms are characterised by the following: a) need to use the technology more and more to get the same benefits as in the beginning (tolerance), b) appearance of negative emotional reactions when they cannot use the technology or when they spend a long time without being able to use it (withdrawal symptoms), c) excessive use of technologies that interferes with other major life activities (in the academic or professional area, domestic, family, or social matters), and d) serious difficulties in stopping using the technology, despite recognising that such a pattern of behaviour is inappropriate or is hurting them. Therefore, what characterises these addictions is not excessive behaviour per se, but the dependency relationship established between the person and the behaviour (Echeburúa and Corral 2009), to the point that technological addictions have a clinical symptomatology very similar to that of behavioural addictions (Block 2008).

Today, we have reached a point where this is an emerging health problem that modern society must handle (Jiménez-Murcia and Farré 2015). It is crucial that professionals properly identify the problem in its earliest stages, to properly guide

patients to prevention and, in the cases where the disease is more serious, treat them with appropriate specialised treatment. All of this will result in both better patient health and improvements in the efficiency of the health system itself. Moreover, the early detection of pathologies makes interventions more effective, and the occurrence of more serious disorders can be prevented.

The current Strategy of Mental Health of the Spanish Ministry of Health has selected 14 challenges facing the National Health System in the area of mental health. Among them, one issue that should be addressed is technological addictions in young people. The current research is part of the current National Mental Health Strategy; its main objective was to develop several screening tools that can be used by health staff (e.g., psychologists, physicians) to better link early detection with early intervention in the field of technological addictions. If the diagnostic of addiction is confirmed, the patient should be treated with psychological treatment based in evidence.

Method

Objective

The main objective of this work is to develop several screening tools for technological addictions (Internet/social networks, mobile and video games). These instruments can be used by professionals of health (e.g., psychologists, physicians) in order to early detection of technological addictions. Depending on the results of the screening tests, the own professional could advise to young, or direct them to specialized treatment and assistance centre of addiction.

Participants

Two groups of participants were selected in each case: a) users of technology (i.e., mobile, social networks and video games) without psychological problems with the use of these technologies, and b) people who sought counselling or advice for their addictive problems with some of these technologies in public and private treatment centres.

In the case of Internet, the sample was composed by 139 people younger than 31 years of age (87 women, 52 men): 59 needed help or advice due to their problems with Internet addiction (social networks), whereas the other 80 users had no problem with the use of social networks. For the screening of video games addiction, the participants were 117 people younger than 31 years of age (57 women, 60 men): 40 sought help or advice due to their problems with video game addiction, whereas 77 users had no problem with the use of video games. Finally, 226 people younger than 31 years of age (140 women, 86 men): 96 sought help or advice due to their problem with mobile phone addiction, whereas 130 users had no problem with the use of mobile phones.

Procedure

The methodology used for the three types of technological addictions (Internet/social networks, mobile phone, video games) was identical. First, a diagnostic tool was

selected, depending on both psychometric characteristics (high reliability and validity), and its adaptation to the Spanish youth population. The questionnaires selected, which were developed and validated in a Spanish sample, were: a) Test of Dependence on the Internet (TDI) (Chóliz and Marco 2012), b) Test of Dependence on Mobile Phones (TDM) (Chóliz 2012; Chóliz and Villanueva 2011), and c) Test of Dependence on Video Games (TDV) (Chóliz and Marco 2011). All of the questionnaires have a full-factor structure consistent with the construct of addiction. TDI is composed by 23 items; the Cronbach's alpha = .93 and it contains four factors: a) Abuse; b) Withdrawal syndrome; c) Disturbance and Absence of control; and d) Escape. TDM has 22 items; the Cronbach's alpha = .94; the factorial structure contains four factors: a) Tolerance and Abstinence; b) Lack of control; c) Problems derived from spending; and d) Abuse. Finally, TDV has 24 items; the Cronbach's alpha = .94; TDV has four factors: a) Compulsive gambling; b) Withdrawal; c) Tolerance and Interference with other activities; and d) Problems caused by video games and Escape.

For each technology two groups of young people were selected. Clinical group consisted of young people who sought assistance or advice due to their problems related to dependence on a particular technology. They searched assistance in several treatment and assistance centres for addictions which collaborate with the Research Unit of Technological Addictions at the University of Valencia (Spain). The control group consisted of users of such technology in a non-problematic way. The main objective was to obtain three screening test that could better discriminate between people with addictive problems with some of the three technologies and others who functionally use such technology. Questionnaire data were collected individually in clinical and educational settings, in a paper form.

Analysis

The items selected to serve as screening were those with the highest positive predictive value (PPV) following the procedure of Johnson et al. (1997), which has been used for a screening test for pathological gambling. This indicator takes into account the true positives, the true negatives, the false positives, and the false negatives of each of the items of a diagnostic scale, to calculate the indices of sensitivity and specificity and, subsequently, the PPV coefficient, the values of which range between 0 and 1. This is a criterion in which the effect of the discriminating power of the items is maximised between people with an addiction problem and those without.

Results

Study 1. Screening for Dependence on the Internet

Two groups were compared. On the one hand, 59 young people which needed help or advice due to their problems with Internet/social networks addiction. The other group consisted on 80 users which had no problem with the use of the social networks. Differences in the TDI scores between the users without Internet addiction problems (mean = 27.26, standard deviation [SD] = 15.77) and those with Internet addiction problems (mean = 48.36, SD = 14.13) were statistically significant ($F_{1,137}$ = 66.32,

$p < 0.001$; $\eta^2 = 0.33$). With regard to the sensitivity, specificity, and PPV coefficient, the results obtained for each item are summarised in Table 1. The two items of the TDI that had higher scores in the PPV were items 8 and 21.

Study 2. Screening for Dependence on Video Games

Two other groups composed by different people were compared. One of them was composed by 40 young people sought help or advice due to their problems with video game addiction, whereas in the other group, 77 gamers had no problem with the use of video games. Differences in the TDV scores between the users without video game addiction problems (mean = 9.29, SD = 12.49) and those with video game addiction problems (mean = 44.30, SD = 21.48) were statistically significant ($F_{1,115} = 124.31$,

Table 1 Positive predictive values of items of TDI

		Sensitivity	Specificity	PPV
TDI01	If I do not connect to the Internet at home I try to connect elsewhere.	.68	.56	.61
TDI02	I'm really concerned when I want to connect to the Internet and the network does not work.	.88	.36	.58
TDI03	Every time I remember Internet, I have the need to connect.	.51	.81	.73
TDI04	If I spend some time without the Internet, I feel empty and I do not know what to do.	.47	.79	.69
TDI05	I feel really bad when the Internet does not work well because of the computer or network.	.93	.29	.57
TDI06	It is no longer enough for me to connect the same amount of time as before.	.53	.64	.59
TDI07	I spend less time doing other activities because Internet activity takes me a long time.	.51	.70	.63
TDI08	I'm really obsessed with downloading files, searching links, participating in chats, or uploading photos or videos.	**.42**	**.90**	**.81**
TDI09	I think I use Internet too much.	.81	.50	.62
TDI10	I find it very difficult to leave the social network when my family calls me or if I have to go somewhere.	.54	.79	.72
TDI11	When I'm feeling bad, I seek refuge on the Internet.	.37	.80	.65
TDI12	The first thing I do on the weekends when I get up is connect to the Internet.	.75	.59	.65
TDI13	I have been connected to the Internet for more than 3 h.	.86	.46	.62
TDI14	I have discussed with my parents, relatives, or friends that I spend a lot of time on the Internet.	.51	.79	.71
TDI15	When I'm bored I connect to the Internet.	.96	.25	.56
TDI16	I slept later or I have slept less because of staying online.	.86	.45	.61
TDI17	I access the Internet several times a day to see whether I have mail or messages from my friends.	.91	.28	.56
TDI18	I have often been late (to school or work, hanging out with my friends) because I was connected to the Internet.	.39	.85	.72
TDI19	When I'm connected to the Internet, I lose track of time.	.79	.56	.64
TDI20	The first thing I do when I get home after school or work is connect to the Internet.	.84	.55	.65
TDI21	I have lied to my family or others about the time I've been connected.	**.33**	**.91**	**.79**
TDI22	Even when I'm doing other activities (in class, with my friends, studying), I imagine using the Internet (downloading files, visiting pages, uploading photos or videos).	.26	.93	.78
TDI23	When I have a problem, I connect to the iternet to get distracted.	.46	.70	.60

Items in bold are the selected questions for screening

$p < 0.001$; $\eta^2 = 0.52$). Regarding the sensitivity, specificity, and PPV coefficient, the results obtained for each item are summarised in Table 2. The two items of the TDV that had higher PPV scores were items 17 and 23.

Study 3. Screening for Dependence on Mobile Phones

In the case of mobile, the participants were 226 people: 96 sought help or advice due to their problem with mobile phone addiction, whereas 130 mobile users had no problem with the use of their smartphones. Differences in the TDM scores between users without mobile phone addiction problems (mean = 17.41, SD = 11.52) and those with mobile phone addiction problems (mean = 55.03, SD = 15.82) were statistically significant ($F_{1,224} = 428.06$, $p < 0.001$; $\eta^2 = 0.66$). Regarding the sensitivity, specificity, and PPV coefficient, the results obtained for each item are summarised in Table 3. The two TDM items that had higher scores were items 4 and 11.

Table 2 Positive predictive values of items of TDV

		Sensitivity	Specificity	PPV
TDV01	I play video games much longer than I did when I started.	.58	.87	.81
TDV02	I try to borrow a friend's or relative's PC or game console if mine does not work.	.20	.93	.75
TDV03	I am very distressed when I want to play and the console or video game does not work.	.55	.83	.76
TDV04	Every time video games cross my mind I feel the need to play them.	.35	.92	.82
TDV05	I spend a lot of spare time on video games, even when not playing (reading magazines, talking with friends, drawing game characters).	.53	.96	.93
TDV06	I start to feel empty and helpless if I go a long time without playing.	.28	.99	.95
TDV07	I become irritated when a video game does not work right due to a console or PC malfunction.	.72	.80	.78
TDV08	Playing as long as I used to when I first started is not enough anymore.	.38	.97	.93
TDV09	I spend less time doing other things because video games take up so much of my time.	**.48**	**.97**	**.95**
TDV10	I am obsessed with levelling up, being the best, etc. in video games.	.53	.88	.82
TDV11	If a game does not work, I quickly look for another to continue playing.	.35	.93	.84
TDV12	I feel like I play video games too much.	.68	.95	.93
TDV13	I find it hard to stop once I start playing, even when my friends or parents call me away, or when I have to go somewhere.	.60	.83	.78
TDV14	I use video games as an escape when I feel bad.	.38	.95	.88
TDV15	The first thing I do when I get up on the weekends is play video games.	.55	.97	.95
TDV16	I have played more than three straight hours in the past.	.85	.76	.78
TDV17	I have argued with my parents, relatives, or friends because I spend a lot of time playing my game console or PC.	**.55**	**.99**	**.98**
TDV18	I start playing video games when I get bored.	.85	.72	.75
TDV19	I have gone to bed later or slept less because of staying up playing video games.	.80	.79	.79
TDV20	As soon as I have time, even a moment, I start playing video games.	.60	.93	.90
TDV21	I lose track of time while playing video games.	.75	.84	.83
TDV22	The first thing I do when I get home from school is play video games.	.58	.95	.92
TDV23	I have lied to my family or to others about how much time I spend playing.	.30	.99	.95
TDV24	I think about video games (how to level up, beat a level or puzzle) even when I'm doing other work (in class, with friends, while studying).	.43	.97	.94
TDV25	I start playing video games when faced with a problem to take my mind off it.	.40	.96	.91

Items in bold are the selected questions for screening

Table 3 Positive predictive values of items of TDM

		Sensitivity	Specificity	PPV
TDM01	I have been called on the carpet or warned about using my mobile phone too much.	.71	.80	.78
TDM02	I have put a limit on my mobile phone use and I couldn't stick to it.	.45	.82	.72
TDM03	I have argued with my parents or family members about the cost of my mobile phone.	.43	.77	.65
TDM04	I spend more time than I would like to talking on the mobile phone, sending messages, or using WhatsApp.	**.89**	**.90**	**.90**
TDM05	I have sent more than five messages in one day.	.86	.66	.72
TDM06	I have gone to bed later or slept less because I was using my mobile phone.	.86	.76	.79
TDM07	I spend more money on my mobile phone (calls, message) than I had expected.	.45	.74	.63
TDM08	When I'm bored, I use my mobile phone.	.97	.48	.65
TDM09	I use my mobile phone (calls, SMSs, WhatsApp) in situations where, even though not dangerous, it is not appropriate to do so (eating, while other people talk to me).	.93	.71	.76
TDM10	I have been criticised because of the cost of my mobile phone.	.41	.79	.66
TDM11	When I haven't used my mobile phone for a while, I feel the need to call someone, send a message, or use WhatsApp.	**.89**	**.89**	**.89**
TDM12	Since I got my mobile phone, I have increased the number of calls I make.	.94	.56	.68
TDM13	If my mobile phone was broken for an extended period of time and took a long time to fix, I would feel very bad.	.90	.70	.75
TDM14	I need to use my mobile phone more and more often.	.86	.81	.82
TDM15	If I don't have my mobile phone, I feel bad.	.81	.84	.84
TDM16	When I have my mobile phone with me, I can't stop using it.	.81	.89	.88
TDM17	Since I got my mobile phone, I have increased the number of SMSs I send.	.83	.71	.74
TDM18	As soon as I get up in the morning, the first thing I do is see who has called me on my mobile phone or if someone has sent me a SMS.	.95	.59	.70
TDM19	I spend more money now on my mobile phone now than when I first got it.	.68	.66	.67
TDM20	I don't think I could stand spending a week without a mobile phone.	.88	.79	.80
TDM21	When I feel lonely, I use the mobile phone (calls, SMSs, WhatsApp).	.74	.71	.72
TDM22	I would grab my mobile phone and send a message or make a call right now.	.58	.92	.88

Items in bold are the selected questions for screening

Conclusions and Discussion

Technological addictions (i.e., Internet/social networks, mobile phones, video games) are the new kinds of addictions, which are induced by the excessive and dysfunctional use of ICTs (Chóliz et al. 2012; Echeburúa et al. 2009). An addiction problem is defined as a pool of symptoms characterised by a dependence relationship with a substance or behavior. In the case of technological addictions, this dependence is on the use of ICTs, but they have the same criteria that the other addictions: tolerance (need for more and more use), withdrawal syndromes (intense discomfort when facing a time period without using the technology or when the use is disrupted), excessive use or consumption, desire to stop but to be unable to do so, stop doing other activities, and interference with familiar or social relationships. The continual development of technology applied to ICTs, and the profitable business of technological enterprises, compels the population, especially young people, to use (and abuse) probably more than they need to, and in forms that, for some of them, are dysfunctional.

The novelty of these addictions is a challenge for the mental health systems, because everybody uses the technologies in their daily lives and for many activities, particularly for communication and leisure. It is necessary that, in the case of supposition that the patient has an addiction problem, health staff have adequate screening tools to detect the technological addictions and, if appropriate, direct the patient to specialised resources for addiction.

This work is designed to elaborate a screening protocol to use by part of health or clinical staff when they think that a patient could have an addictive problem with technologies. In such case, the professional asks the screening questions and decides if the patient: a) needs a specialized treatment, or b) he or she can prevent the addiction merely with accurate advices.

The results obtained from this study provide a tool for screening the three technological addictions: Internet/social networks, mobile and video-games. The selected questions had the higher PPVs, a coefficient based on the sensitivity and specificity indexes of the items of standardised tests for technological addictions. The questions were not the same for the three types of technological addictions, which seems reasonable because, in fact, the characteristics and implications of each type of addiction are different (Carli et al. 2013; Winkler et al. 2013).

The screening protocol is as follows:

a. Screening for Internet/social network addiction:

In the case of addiction to Internet/social networks, the items of TDI that better discriminated (had the highest PPVs) between addicts to Internet/social networks and those Internet users that they had no problem with social networks were the following:

- *I'm really obsessed with downloading files, searching links, participating in chats, or uploading photos or videos.*
- *I have lied to my family or others about the time I've been connected.*

These items refer to the enormous relevance of social networks for young people, in one case, because the user is obsessed with the major tools and actions of social networks (photos, likes, followers), and in another because young people have to conceal, or even lie, about their degree of involvement in social networks (Andreassen et al. 2012; Echeburúa and Corral 2010).

b. Screening for video games addiction:

In the case of addiction to video games, many items of TDV had high PPVs, mainly due to the high specificity scores of this questionnaire. The items of TDV that better discriminated between addicts to video games and those gamers that they had no problem with video games were the following:

- *I have argued with my parents, relatives or friends because I spend a lot of time playing my game console or PC.*
- *I spend less time doing other activities because video games take up so much of my time.*

Both questions refer to the problems that the excessive use of video games causes in other important aspects of life (e.g., familial relationships, leisure activities). Therefore, the main clinical criterion implied in addiction to video games that discriminates between gamers who

have addiction problems and those who do not, has to do with the extent to which the excessive use of videogames interferes with other aspects of daily life (Fuster et al. 2012).

c. Screening for mobile addiction:

Finally, in the case of addiction to mobile phones, the items of TDM that better discriminated between young people with and without mobile phone addiction problems were the following:

- *I spend more time than I would like to talking on the mobile phone, sending messages, or using WhatsApp.*
- *When I haven't used my mobile phone for a while, I feel the need to call someone, send a message, or use WhatsApp.*

These two questions refer to the two major dimensions of mobile phone addiction. First, in the case of the excessive use of messaging, new smartphone tools "compel" the use of the mobile phone for communicating continuously, many times compulsively. Second, this pattern of communication has become a need for young people, who feel bad when they have not used their mobile phone for a while (Carbonell et al. 2012).

In sum, if the clinician supposes that any patient is suffering an addictive problem with some of the technologies (Internet/social networks, mobile or video game), it is recommendable to ask the specific screening questions previously described. If the patient answers "yes" to both questions, a diagnostic assessment of technological addiction is required (i.e., TDI, TDM or TDV).

If the diagnostic of addiction is corroborated, then the patient should be treated for the addictive disorder with specific procedures or by specialized staff.

If the patient answers "no:" to any of the questions, it is possible that the patient has not any addictive problem, but he or she can beneficiate or prevent any consequent technological addiction with accurate advices. On this case, the main recommendations involve three dimensions:

a. When to use the technologies, i.e. at what time of the day it should be used WhatsApp, play a video game or connect to a specific social network. He or she should only use the technology at that specific moment (it could be several short periods of time, for example in the case of WhatsApp).
b. How much time it should be used, i.e. specify when he or she should be stop.
c. How to learn to stop. These recommendations should be given in a paper format with specific examples adapted to the user.

This study has some limitations that should be taken into account. First, the PPV is the correct criterion for use in selecting items that have the greater discriminative power based on the sensitivity and specificity of each item. However, the number of items selected in this study (i.e., two) was reasonable, but arbitrary. Other similar screening procedures -in that case for pathological gambling- selected three items, as the Brief Biosocial Gambling Screen (Gebauer et al. 2010), or the NODS-CLiP (Toce-Gerstein et al. 2009) or even four (Volberg et al. 2011). The objective of this research was to provide a screening tool for health staff, mainly psychologists, who do not have specialised in addictive disorders, but they must decide

whether the patient requires further specialised treatment or not. For that reason, selecting many items may be excessive, but it is also possible that only two items are not sufficient for better discrimination. However, the items with the highest PPVs had similar scores, so that in other similar studies with different samples, the order may differ. Thus, it is important to continue to optimise screening tools based on empirical evidence.

The selected tests for this work (TDI, TDM and TDV) can also be used to elaborate some brief questionnaires which can be implemented by part of clinicians in order to have a clinical assessment. In such case, it is very relevant that the obtained questionnaires have the same factorial structure that the original, which it is the actual diagnostic test. These brief questionnaires can also be used by part of researchers or clinicians from different countries, if they have the appropriate psychometric properties. This has already been done in the case of TMD, in a project with researchers from seven countries to elaborate the TMDbrief, a brief scale of mobile addiction (Chóliz et al. 2016).

Compliance with Ethical Standards

Conflict of Interest Mariano Chóliz, Enrique Echeburúa and Francisco Ferre declare that they have no conflict of interest.

Informed Consent All participants took part voluntarily and were informed about the objectives of the study.

Ethical Approval This study was approved by the Spanish Ministry of Health.

Conflict of Interest Mariano Chóliz, Enrique Echeburúa and Francisco Ferre declare that they have no conflict of interest.

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