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Frequency is not enough: Patterns of use associated with risk of Internet addiction in Portuguese adolescents

ABSTRACT

This paper reports an exploratory analysis of the relation between Internet addiction and patterns of use among Portuguese adolescents ($n = 2617$) from the WHO 2010 Health Behavior in School-aged children study, with a short version of Young's Internet Addiction Test (the brief Internet Addiction Questionnaire – bIAQ) and self-reports on online behaviors and access. Two-Step Cluster analysis identified two clusters of users based on their usage pattern: a minority of high-frequency users, with higher bIAQ scores, and a majority of low-frequency users, with lower bIAQ scores. Regular use of social networks, search engines, and media content, contributes little to this difference; rather, high-frequency use of gaming, blogs, forums, and media content creation, as well as broader access, make high-frequency users particularly distinct from low-frequency users. This converges with previous research showing addiction to aspects of Internet use rather than to the Internet as a whole.

Keywords: adolescents, Internet addiction, Internet use

1. **INTRODUCTION**

The flip side of the growing ubiquity of the Internet in people's lives over the past couple of decades is the emergence of behavioral patterns indicating psychological dependency on the Internet, often called Internet addiction (IA; Chen, Weng, Su, Yu, Wang, 2004; Griffiths, 1996; Young, 1998; for reviews, see Douglas et al., 2008, and Kuss, Griffiths, Karila, and Billieux, 2014). Whether these patterns can be actually classified as an addiction is still a matter of debate. Indeed, they are often referred to as, e.g., compulsive computer use (Black, Belsare, & Schlosser, 1999) or compulsive Internet use (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009), pathological Internet use (Morahan-Martin & Schumacher, 2000), and problematic Internet use (Caplan, 2002; Yellowlees & Marks, 2007). Furthermore, Internet-focused addictive behavior can be either generalized or specific to certain behaviors for which the Internet is merely an accessible medium (Davis, 2001), such as gaming (Griffiths, Kuss, & King, 2013; Liu & Peng, 2009), and porn (Young, 2008). In this paper we assume that intense forms of dependency on online behavior could culminate in addiction, whether this addiction is to the Internet in general, or to specific behaviors online, or even to both. We present a study exploring the relation between diverse patterns of Internet use and risk of Internet addiction among adolescents.

1.1.Internet addiction

Internet addiction is conceived as a behavioral addiction, or a compulsive behavior disorder, on the model of the gambling addiction criteria included in the DSM-IV: salience (thinking about the activity constantly); tolerance (need to increase use just to maintain pleasure), irritability, lack of control, as well as associated behavioral patterns such as lack of sleep, tiredness, apathy, lack of investment in other activities, lying and being unpleasant when asked about the time spent over the Internet, and refusing to admit that a problem exists (Alavi, Ferdosi, Jannatifard, Eslami et al, 2012).

Many of the patterns of Internet addiction are correlated with other mental disorders, such as depressive individual factors. Accordingly, some researchers define IA as an emergent disorder, associated with a variety of other psychiatric disorders. IA can be related to substance abuse (Yen, Ko, Yen, Chen, & Chen, 2009), attention-deficit but not hyperactivity disorder (Yılmaz, Hergüner, Bilgiç, & Işık, 2015), depression, hostility, and social anxiety disorder (Bozkurt, Coskun, Ayaydin, Adak, & Zoroglu, 2013; Lee & Stapinskib, 2012; Lim et al., 2015); and the relationship between IA and depression is mediated by negative life events (Yang et al., 2014). All this suggests that treatment of other psychiatric disorders offers some buffer against IA (Ko, Yen, Yen, Chen, & Chen, 2012).

Like other forms of dependencies, Internet-based addictions to specific behaviors, such as Internet gambling disorder, for example, are related to the pursuit of gratification. People seek go online seeking virtual community, information, aesthetic experience, monetary compensation, diversion, personal status and relationship maintenance (Song, LaRose, Eastin, & Lin, 2004). The pursuit of all these forms of gratification online, where they are reachable literally at one's fingertips, can thus easily lead to loss of control over Internet use. However, the purpose for which the Internet is used is also related to dependency symptoms. A study in Lebanon found that the higher the self-reported risk of addiction, the less the Internet was accessed for information and research, and the more it was used for entertainment (Hawi, 2012).

In sum, a diversity of uses of the Internet can lead to risk of overuse and addiction. However, what is not yet well known is which behaviors are more associated with problematic patterns of Internet use and how these patterns can be identified as such through their association to a greater risk of Internet addiction. It is thus important to understand this association, as well as what sort of frequency of these behaviors is linked to IA.

1.2. Study overview

The current study explores the association between Portuguese young people's risk of Internet addiction and their patterns of Internet use. Early studies targeted undergraduates because at the time Internet access was most prevalent in campuses; however, the currently ubiquity of access makes adolescents the most vulnerable group (Ha et al., 2007). Excessive Internet use can be both a cause and consequence of addictive behavior, and the current study is cross-sectional and therefore does not allow us to test causality. We thus remain agnostic about the main direction of causality. Instead, we focus on exploring different types of Internet use and their relation to risk of addiction. The data were collected as part of a larger survey study on young people's health behaviors, the HBSC (Health Behavior in School-aged Children) a WHO collaborative study (Currie et al, 2004), within the 2010 edition in Portugal (Matos et al, 2011). The Internet-related measures were developed for the Portuguese study only. Because the size of survey questionnaires is limited by the attention-span of participants, and the WHO study already includes a fair amount of questions, we had to develop a short measure of Internet addiction: the brief Internet Addiction Questionnaire (bIAQ), which we based on Young's (1998) Internet Addiction Test, as well as a short measure of Internet behaviors. We call this scale 'questionnaire' rather than 'test' because its purpose is for use in large-scale questionnaires rather than a clinical diagnostic tool. Here we analyze the reliability of the bIAQ measure, and its association with patterns of Internet use (services and place of access) via cluster analysis. This approach enables us: (1) to analyze the structure of Internet addiction and (2) to explore the interrelations of the diverse aspects of this phenomenon, with the underlying goal of contributing to unveil behavioral patterns that may underlie factors in Internet addiction. On the other hand, we examine the utility of bIAQ in the potential classification of different types of Internet users.

2. METHODS

2.1.Participants and procedure

2617 secondary school students from the 2010 wave of the Portuguese Health Behaviour in School-aged Children (HBSC) survey (Matos et al., 2011) participated in this specific study, in which were introduced 9 items measuring Internet addiction and 8 items on frequency of different types of Internet use. The HBSC is a large cross-national collaborative study of the World Health Organization (WHO) Regional Office for Europe (for a description of the program, see Currie, Roberts, Morgan, and Smith, 2004). The survey runs once every four years in more than 40 different countries, and in Portugal it has been conducted since 1998. Schools and classrooms were randomly selected from the official national list, stratified by the 5 Educational regions. The Portuguese sub-sample for the 2010 edition in which Internet items were introduced included students from the 8th (n = 1217; 46.5%) and 10th grade (n = 1400; 53.5%), ranging in age from 12 to 17yrs (*Mage* = 15yrs; *SDage* = 1.12yrs; *female n* = 1442, 55.1%), and is representative of Portuguese 8th and 10th grade students attending state-run schools. The survey was administered during the month of January 2010 in classrooms, during class time, by teachers who had received appropriate training. All head-teachers gave their consent, and written informed consent was previously obtained from both the students and their parents/legal guardians. No refusal was registered. The study was approved by a national ethics committee.

2.2.Measures

Risk of Internet addiction

In order to understand the relation of IA both to behaviors and to other mental disorders, diverse screening instruments have been developed. The most widely used is Young's Internet Addiction Test (IAT; Young, 1998). It is based on the DSM-IV's criteria for pathological gambling, and consists of 20 questions on characteristic addictive behaviors, adapted to Internet use. Although three studies of the internal consistency of the IAT have

identified more than one factor – either six factors (Widyanto & McMurran, 2004) or three (Chang & Law, 2008; Widyanto, Griffiths, & Brundsen, 2011) – most studies have found the IAT to have a good internal reliability as a single-dimension measure of Internet addiction (Jelenchick, Becker, & Moreno, 2012; Khazaal et al., 2008; Korkeila, Kaarlas, Jaaskelainen, Vahlberg, Taiminen, 2010; Milani, Osualdella, & Di Blasio, 2009), including in Portugal (Pontes, Patrão, & Griffith, 2014).

We included eight items from Young's Internet Addiction Test (IAT, Young, 1998) and added one item on the use of digital means to solve social-relational problems at school. Participants were asked to report the extent (1 – rarely; 2 – occasionally; 3 – frequently; 4 – often; 5 – always) to which they felt or behaved in certain ways due to their use of the Internet (see Table 1). We excluded 12 items from the IAT, either for lack of facial validity or for lack of applicability to teenagers, and others due to redundancy with items with better facial validity. In Table 2 we present the logic of exclusion of each of these items. Note that two of the excluded items have meanwhile been found to have low correlations with the other IAT items in a recent IAT validation study in Portugal by Pontes and colleagues (2014). We also included an additional item on use of the Internet to mediate social relations, because a recent study shows that preference for online communication is related to social anxiety and face-to face avoidance, and also to PIU (Lee & Stapinskib, 2012).

Frequency of type of Internet use and of location of Internet access

Participants were asked to report how frequently they used different types of Internet features, such as email, social networks, online gaming, or blogs, and where they get access to the Internet using a 6-point Likert scale (1 – never; 2 – once a week; 3 – two or three times a week; 4 – between four and six times a week; 5 – every day; 6 – several times a day) (see Table 3).

3. **RESULTS**

3.1.Data Analysis Strategy

We first analyzed the structure of the proposed bIAQ measure in order to confirm its uni-dimensionality. We then analyzed the patterns of Internet usage with a 2-step cluster analysis, in order to uncover types of users based on their Internet behaviors. Cluster analysis is a powerful data mining technique and a convenient method for grouping individual actions into patterns of behavior by determining which responses co-occurred (Romero, Gonzalez, Ventura, del Jesus, & Herrera, 2009). A Two-Step Clustering method was chosen first due to its efficacy in analyzing large datasets by automatically determining the optimal number of clusters and by dealing simultaneously with categorical and continuous variables (Zhang et al. 1996). Finally, we tested the difference in bIAQ scores between the clusters found. Descriptive analyses and means comparisons, as well EFA, were conducted on IBM-SPSS 20. CFA was run on AMOS and receiver operating characteristic (ROC) analyses were performed via MedCalc version 15 (MedCalc Software, Mariakerke, Belgium).

3.2.Structure and reliability of the bIAQ

We started by looking at the inter-correlations between the 9 items. Bivariate correlations were all positive and significant, ranging from $r = .31$ to $r = .68$ (i.e., moderate to strong; mean inter-item correlation, $r = .52$). We then ran exploratory principal components analyses (PCA) with oblimin rotations (appropriate to uncover correlated factors, which would be expected given these correlations), with the conventional criterion of eigenvalue > 1 to accept factors. This analysis resulted in single-factor solution. The total bIAQ score was calculated based on the average of all 9 items, ranging from 1 to 5.

In order to confirm the single-dimensional structure of the bIAQ, we carried out a Confirmatory Factor Analysis (CFA). The following indices-of-fit are reported: the Tucker-

Lewis Index (TLI, also known as the Non-Normed Fit Index), the Comparison Fit Index (CFI), the Goodness-of-Fit Index (GFI) and the Root Mean Square Error of Approximation (RMSEA). For each of the first three indices, values range from 0 to 1.0, and values over .9 are considered acceptable. For the RMSEA index, values lower than .05 indicate an ideal fit and lower than .08 indicate a reasonable fit. The chi-square statistic was not considered as it is quite sensitive to sample size. The results indicate an excellent fit of the data to a one-factor solution (TLI = .984; GFI = .987; CFI = .990; RMSEA = .045). A reliability analysis for the use of bIAQ as a single-dimensional scale indicates a very good consistency (α = .906), with all item-total correlations < .50, as recommended by Netemeyer, Bearden and Sharma (2003). Table 4 summarizes the inter-item correlations, item-total correlations, and CFA loadings on the single component for each item.

3.3. Internet usage patterns and Internet addiction

We entered into a cluster analysis fourteen variables: 8 related with the time spent on Internet usage (e.g. "How much time do you spend a week on social networks", "How much time do you spend a week on blogs"), 7 linked to the places of Internet access, and the last one was the bIAQ global score. The log-likelihood distance measure was used, as input variables we used a mixture of continuous and categorical variables, and the Schawrz Bayesian Criterion (BIC) was used for the selection of the optimal number of clusters. Continuous variables were automatically standardized and the noise handling (outlier treatment) was set to 25% (default). Two clusters were found (Figure 1): 16.8% (n= 356) of the records were assigned to the first cluster and 81.4% (n= 1559) to the second, with a ratio of sizes of 4.38. According to Kaufman and Rousseeuw (1990) and as depicted in Figure 2, the overall model quality is "Fair" with an average silhouette of 0.3.

Based on cluster comparison, as depicted in Figure 3, Internet users in cluster 1 perform Internet activities more frequently (several times per day) independently of activity

nature, being associated with higher scores on the bIAQ. The users of cluster 1 have greater access to the internet from home (living room and bedroom), but have similar access outside of the home (public places, school, home of family members) to that of users in cluster 2, as they have the same modal category. Internet users in cluster 2 present a different pattern, showing less Internet activities, with occasional use, and are associated to lower scores on the bIAQ.

The frequency of consumption of multimedia contents, emails, search engines and social networks were the most important predictors of cluster membership, that is, these variables can differentiate very well the 2 clusters found. In order to examine potential differences in bIAQ scores between these clusters, a cluster membership variable was created, and a 2 independent sample t-test based on membership values was performed. Results showed higher bIAQ scores ($M = 2.61$) in cluster 1 (frequent Internet users) than in cluster 2 (occasional internet users) ($M = 1.64$), t (416) = 15.60, $p < .001$, $d = 1.07$. (See Figure 4).

As the bIAQ varies significantly between Clusters, ROC analysis was performed in order to obtain a cut-off score for best discriminating clusters. The optimal criterion for cut-off point selection was the maximum value of the Youden index defined as: J = max [sensitivity c + specificity c − 1] where c ranges over all possible criterion values (Youden, 1950). The Area Under Curve (AUC) was tested using the DeLong's nonparametric approach (DeLong, DeLong & Clarke-Pearson, 1988).

As depicted in the Figure 5, the bIAQ AUC for detection for frequent Internet users was 0.78 (95% confidence interval [0.76; 0.80], $Z = 20.35$ $p < .001$, which reveals a moderate accuracy, above the desirable level (>0.75) (Larner, 2015). Moreover, the best cutoff value of bIAQ to detect users with frequent Internet usage was > 1,77 (Youden's $J = 0.42$), with a sensitivity of 70.5% and a specificity of 71.5% .

4. DISCUSSION

In this study, we were interested in exploring relations between patterns of Internet usage and Internet addiction among adolescents. We developed a short measure of Internet addiction – the brief Internet Addiction Questionnaire (bIAQ) – based on Young's Internet Addiction Test, as well as measures of Internet usage (frequency of different types of usage and of different types of settings of Internet access), as part of a larger study on Portuguese teenagers health behaviors, the 2010 HBSC study. This bIAQ measure showed excellent internal reliability, in particular considering that it is a short measure and reliability analyses are sensitive to number of items. It should be noted, however, that the bIAQ scale was not designed nor should it be used for clinical diagnosis of Internet addiction in individual patients. Rather, it is a measure useful for large-scale surveys with multiple measures, such as this one.

We explored participants' use of the Internet with cluster analysis, and uncovered two clusters, a smaller one of *high-frequency* users, that is, of participants who reported using the Internet more frequently in every domain, and a larger one of *low-frequency* users, who reported using the Internet less frequently. A small number of items made the most contribution to the distinction between these two clusters: high-frequency users, on average, had greater home access to the internet, and engaged very frequently in all types of use of the Internet, whereas low-frequency users engaged moderately in the use of social networks, search engines, and consumption of multimedia, and very little in blogs, forums, online gaming, and production of multimedia, as well as having less home access to the Internet.

We also confirmed the association of Internet addiction to patterns of use of the Internet: high-frequency users had significantly higher average scores on the bIAQ than low-frequency users. Together, these results suggest that there is a common use of the Internet in

which almost all youngsters engaged (including media consumption, social networking, and information seeking) and which does not necessarily entail the risk of Internet addiction, and there is a specific high-frequency use in which a minority of youngsters engaged, which includes the common use, but with greater frequency than do other users, as well as a usage with a more active role, such as blogs and online gaming, and which does entail the risk of internet addiction. Indeed, considering the verbal anchors of the items in the bIAQ (which are the same as those used in the IAT), the mean scores of high-frequency users approximate a situation of risk of addiction, whereas those of low-frequency users do not. This suggests that these two patterns of Internet use – high and low frequency – may be distinct not only behaviorally, but also psychologically, in their association to a risk of Internet addiction. That is, it is possible that users assign different psychological meaning to each of these patterns of use – and that only the latter is psychologically addictive, whereas the former meshes in seamlessly with daily life.

This is an interesting finding, but one which should be approached with caution; the way the Internet is used is changing fast. In particular, increased connectivity and the widespread expansion of smart-phone use means that there is a fast-growing section of the population that has permanent access to the Internet. The proportion of the population that has access to the Internet in general is also continuously expanding. It is to be expected that proportions of the more high-frequency active users would have expanded since 2010, in particular among teenagers, which are the most connected age group in Portugal.

On the other hand, despite the fast-evolving use of the Internet since 2010, when the survey in which this study was integrated was carried out, the pattern of most common use of the internet (i.e. for the majority of users) appears to still be current: in Portugal, despite an overall growth of Internet among the population, the relative importance of different online

activities remains roughly the same: Google (search engine), Facebook (social networking), and YouTube (media content) are the three sites with most visits[1].

However, the more general point, which converges with the results of other recent studies (e.g. Kuss, Griffiths, & Binder, 2013), is that some types of Internet use can be related to risk of Internet addiction, and others not. This suggests that the object of addiction is not the Internet as a whole, but rather contents or social relations that use the Internet as a medium, as has been shown by research, e.g., on online gaming addiction or porn addiction. Studies on the risk of Internet addiction or addiction to certain behaviors online will continue to need to address the evolving nature of patterns of Internet use and of their relation – as both cause and effect – to addiction. The results reported here provide further support to the idea that simple frequency of use may not be a good indicator of addiction or risk of addiction. Rather, specific types of use involving greater active engagement with the medium and its use in creating and sustaining an online social life may be responsible for these phenomena. The fact that 'social networks' appears in the 'common use' dimension should not detract from this, as the most common networks, such as Facebook, are mostly used to either maintain social relations that have an offline basis, or as a multimedia content platform. This idea, however, requires further testing. Indeed, the present study merely points out the need to understand better how patterns of Internet use are related to addiction and risk of addiction to the Internet. More research is needed, and multi-methods approaches with clinical interviews, survey studies, and automatically generated Internet use data should provide better converging evidence to clarify the relation between Internet addiction and use. However, the findings reported here do offer clear support to the idea that specific uses of the Internet, rather than simply time spent online, are particularly addictive. They add to a growing body of evidence pointing in this direction, and which should have a considerable

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[1] Marktest (2014). Bareme Internet 2009-2014.

impact on the formulation of health and education policies, as well as on guidelines for

parental monitoring. The main thrust of this impact is that we should worry less about how

much teenagers are online, and start asking what exactly they are doing online.

Conflicts of interest: None declared.

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