

## Problematic Internet use and physical health

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*Background and aims:* A considerable body of literature has emerged over the past two decades assessing the relationship between problematic or addictive use of the Internet and various indices of psychological well-being. Conversely, comparatively little research has assessed the relationship between problematic or addictive use of the Internet and one's physical health. *Method:* The current study assesses this relationship using a sample of college students ( $N = 133$ ) who responded online to two questionnaires: the Problematic Internet Use Questionnaire (PIUQ; Demetrovics, Szeredi & Rózsa, 2008) and the SF-36v2 Health Survey (Ware et al., 2008). *Results:* The findings indicate that problematic Internet use is associated with poorer physical health. These results are consistent with other data that assessed the relationship between these two variables. Furthermore, this relationship supersedes the influence of the number of hours spent online per day. *Conclusions:* The findings are discussed in terms of the limitations of the study design and conclusions that can be drawn from this preliminary empirical effort.

**Keywords:** problematic Internet use, health, physical health, well-being, Internet addiction

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### INTRODUCTION

The danger to one's psychological and physical health of addiction to a substance such as alcohol, heroin, cocaine, tobacco, and other substances is well documented, and includes serious medical conditions such as cirrhosis of the liver and lung cancer to name just two. In many cases, long-term addiction to a substance can even lead to death, obviously the ultimate health concern.

In more recent years, a growing recognition of the potential for addiction to specific behaviors has been identified (Demetrovics & Griffiths, 2012; Grant, Potenza, Weinstein & Gorelick, 2010; Karim & Chaudhri, 2012). Pathological gambling (McBride & Derevensky, 2012), binge eating (Brownley, Berkman, Sedway, Lohr & Bulik, 2007), hypersexual behavior (Reid, Garos & Fong, 2012), and Internet addiction are just a few examples of a behavioral addiction, which Grant et al. (2010) define as "failure to resist an impulse, drive, or temptation to perform an act that is harmful to the person or to others" (p. 234). Of the behavioral addictions that have been researched, all are associated with one or more psychological health problems, including depression and anxiety; as well as, serious occupational, financial, familial, and social consequences (Grant et al., 2010; Karim & Chaudhri, 2012). The study reported here focuses on the potential physical health consequences of excessive or problematic use of the Internet, typically referred to as an Internet addiction.

Worldwide penetration of the Internet continues on a steady upward path with approximately 74% of the population of developed countries using the Internet in some capacity (International Telecommunications Union, 2012). About two-thirds of Americans have access to the Internet from their residence. Clearly, the availability and use of the Internet has become ubiquitous, and for many people, an essential part of daily living. Very few businesses could survive today without regular use of the Internet.

Apart from work settings, though, concerns continue to be raised concerning excessive use, problematic use, or addiction to the Internet. Bélanger, Akre, Berchtold and Michaud (2011) identified an association between excessive use of the Internet and the mental health of a sample of adolescents. Kelley and Gruber (2010) identified an association between problematic use of the Internet and the physical health concerns of a sample of college students. Young and Rodgers (1998) identified an association between Internet addiction and levels of depression in a sample of adults.

Unfortunately, the literature shows some blending of terms to identify concerns about use of the Internet. Demetrovics et al. (2008), Kelley and Gruber (2010), and Young and Rodgers (1998) all use the terms "problematic Internet use" and "Internet addiction" to describe the same idea; while the focus of the Bélanger et al. (2011) research is on excessive use of the Internet (which they arbitrarily defined as 2 or more hours of Internet use per day). The current study focuses on problematic Internet use as it has been defined by Demetrovics et al. (2008).

Researchers have identified a host of problems associated with problematic use of or addiction to the Internet including depression (Bélanger et al., 2011; Young & Rodgers, 1998), sleep deprivation and lack of exercise (Morahan-Martin & Schumacker, 2000), and neglect of important components of daily living (Kelley & Gruber, 2010; Young, 1998). Conversely, at least one study identified less depression among older users of the Internet (Cotten, Ford, G., Ford, S. & Hale, 2012). In spite of these somewhat mixed findings, however, certainly among younger users (middle school age through the college years), most research supports an ongoing concern about problematic use of or ad-

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diction to the Internet because of its association with social and psychological problems.

Less well studied, however, is the extent to which problematic use of the Internet may be associated with physical health problems. With addiction to a substance, understanding the mechanisms by which one's health becomes compromised is rather straight forward: excessive intake of a substance adversely affects tissue or organ functioning. That is, there is a causal relationship present: ingestion of a substance causes a compromise to healthy functioning.

The mechanisms by which some behavioral addictions could compromise one's physical health, however, are not always as obvious; and, in the case of Internet addiction may not be causal at all. If Internet addiction were a cause of compromised health, it would have to be mediated by other variables. Some potential mediating variables could be: alterations in neural pathways that are caused by the behavioral addiction that then lead to changes in physiology (Grant, Brewer & Potenza, 2006; Potenza, 2001), or neglect of self (i.e., failing to adequately care for oneself because of the obsessive or time-consuming nature of engaging in the behaviors associated with the addiction).

On the other hand, the direction of causation could be the reverse. Perhaps those with compromised physical health are more likely to become addicted to the Internet. This might occur, when for example, a person whose health limits his/her ability to socialize in public utilizes online sources of social contact and engagement to such an extent that he/she develops an addiction to the Internet. If this were the case, the challenge for those with poor health would not be limiting Internet use per se, but how best to enhance or create opportunities for these individuals to socialize in public or in the actual company of others.

Prolonged exposure to or excessive use of the Internet, per se, is not necessarily likely to lead to an addiction to the Internet. Many individuals who spend multiple hours per day in their work environments in online use of the computer do not develop an addiction to the Internet. Thus, the number of hours spent online per day may not be a good predictor of the development of an Internet addiction. Two research teams (Demetrovics et al., 2008; Kelley & Gruber, 2010) reported that levels of problematic Internet usage were not a function of time spent online per se but rather reflect issues associated with its excessive use. Demetrovics et al. (2008) however, did report that, overall, while time spent online is not a factor, time spent online for non-work purposes is a relevant predictor of problematic Internet use.

Wangberg et al. (2007) utilizing a large sample from seven European countries reported some limited information regarding Internet use and a simple, one-question assessment of health ("How is your health in general?") indicating that Internet users reported slightly higher health scores compared to non-Internet users. Note however, that these researchers were not assessing problematic Internet use, just a simple comparison between those who use and do not use the Internet. Also, the assessment of physical health was simplistic, asking only one very general question.

Jenaro, Flores, Gomez-Vela, Gonzalez-Gil and Caballo (2007), utilizing a sample of college students in Spain, also reported some limited information regarding Internet use and health. These researchers used the Spanish version of the General Health Questionnaire (GHQ-28; Goldberg & Williams, 1988). The GHQ primarily assesses psychiatric symptoms, but includes "somatic complaints" as one subscale. Using an assessment of problematic Internet usage

of their own creation, these researchers then divided their sample into "Light" and "Heavy" Internet users and found no association between these two groups and scores on the "somatic complaints" subscale of the GHQ-28.

Niemz, Griffiths and Banyard (2005) utilizing a sample of British college students found no association between any level of Internet usage (no symptoms, limited symptoms, problematic use) and scores obtained on the General Health Questionnaire (GHQ-12).

Bélanger et al. (2011) utilizing a large sample of adolescents in Switzerland found that heavy Internet users (2 or more hours online per day) were at increased risk for somatic health problems, primarily insufficient sleep among girls and excessive weight among boys. Interestingly, among their sample of non-Internet users, boys were also at greater risk for frequent back pain. However, these researchers suspected that this finding may reflect that most non-Internet users in their sample were in apprentice job training programs where access to the Internet was not required and their duties may have been more physically demanding, resulting in more back pain complaints.

Chuang (2006) reported on the presence of online game-induced seizures in a very small sample of just ten cases seen at a clinic in Taiwan. The patients had never had a seizure prior to beginning playing a massively multiplayer online role playing game (MMORPG). All were between 14 and 30 years of age and most responded well to antiseizure medication. Chuang was further able to demonstrate that the seizures experienced by these patients were "not analogous to video game-induced or TV-induced seizures" suggesting that they "may consist of distinct pathophysiological mechanisms" (p. 455). Due to the small sample in this study and the absence of any other workers reporting seizure problems associated with MMORPG, it is possible that the reported cases are outliers.

Kelley and Gruber (2010) utilizing a sample of U.S. college students studied the psychometric properties of the Problematic Internet Use Questionnaire (PIUQ; Demetrovics et al., 2008) and included data from the SF-36v2 Health Survey (Ware et al., 2008). Thus, the data from these researchers included the relationship between problematic Internet use and up to 8 subscales of physical health. A detailed review of both the PIUQ and the SF-36v2 will be provided below. However, for now, we note only that the Kelley and Gruber study found, with just one exception, significant negative correlations between all three subscales of the PIUQ and all eight subscales of the SF-36v2, indicating that increased problematic Internet usage was associated with poorer health status among a sample of U.S. college students.

This admittedly limited body of research suggests that there is reason to suspect that a behavioral addiction such as problematic Internet use may be associated with a compromise to one's physical health and well-being.

The main purpose of the current study is to assess the relationship between problematic Internet usage and several indices of physical health status. In addition, we wish to identify whether or not the hypothesized relationship between problematic Internet usage and physical health status exists independently from the sheer number of hours one spends online. A secondary purpose of this study is to compare the results of our data, which was obtained via an online administration of the PIUQ and the SF-36v2 Health Survey, with a paper and pencil administration of those same scales, as was done by Kelley and Gruber (2010). We also include

an analysis of the possible role age and gender may play in the relationship with problematic Internet usage and physical health.

Thus we specifically assert the following hypotheses: 1) problematic Internet usage is negatively correlated with physical health status; and 2) this relationship is independent of the number of hours one spends online. Additionally, given that evidence suggests that data obtained via online sources is comparable to data obtained in a traditional paper and pencil format; we also assert: 3) acceptance of the null hypothesis that our results will not be significantly different than the results obtained by Kelley and Gruber (2010).

## METHOD

### Participants

The Institutional Review Board at the Pennsylvania State University reviewed and approved the study design. All aspects of the design and execution of the study met the ethical guidelines for use of human subjects in research as promulgated by the American Psychological Association. Of the 259 potential participants, a total of 133 individuals completed all survey instruments online for a 51.4% participation rate. The study participants were undergraduate students (68 men and 65 women) enrolled in introductory psychology classes at two campuses of the Pennsylvania State University. Participants received course credit for participating in the study. Students were given an opportunity to earn equivalent course credit for completing a brief writing project in lieu of participating in this research project. No student chose this option. Ages ranged from 18 to 39 years of age, with a mean of 19.6 years ( $SD = 2.96$ ); the overwhelming majority of the participants, though, were 18–20 years of age (90.2%). Of the students who participated, 78.9% were Caucasian, 3.8% were African American, 4.5% were Latino/a, 11.3% were Asian, and 1.5% indicated other for their racial identification. Because the two campuses attract a number of students who commute to classes, we inquired about their marital or living together status. Nearly all of the participants were single (92.5%), while the remaining were either married (3.8%) or living together with a partner (3.8%).

### Measures

Demographic information including age, gender, marital status, race, and the typical number of hours spent online per week was collected from each participant.

*The Problematic Internet Use Questionnaire*: (PIUQ; Demetrovics et al., 2008) is a self-report, 18-item survey designed to identify key components of Internet addiction and to measure problems associated with excessive Internet usage. Subjects responded to questions on a 5-point scale ranging from *never* (1) to *always* (5). Thus, higher scores indicate greater problems associated with Internet usage for each subscale. The three subscales of the PIUQ are assessed with six questions each. The first subscale was named the *Obsession* scale and is defined as a psychological fixation with the Internet. Subscale questions also inquire about feelings of distress (anxiety, depression, worry, etc.) one might experience when unable to access the Internet. The second subscale was named the *Neglect* subscale and is defined as

failing to adequately attend to one's obligations (work, school, family) or self-care tasks (e.g., eating). The third subscale was named the *Control Disorder* subscale and is defined as an individual's inability to decrease the amount of time one spends on the Internet or a subjective sense of problematically using the Internet excessively. Three studies have confirmed that the PIUQ is a valid and reliable research instrument when administered in an online format (Demetrovics et al., 2008) and when administered in a paper and pencil format (Kelley & Gruber, 2010; Koronczai et al., 2011). Cronbach's alpha's for the current study were: .73 (Obsession subscale); .72 (Neglect subscale); .82 (Control Disorder subscale); and .89 (Total scale).

*The SF-36v2 Health Survey*: (Ware et al., 2008) is a well-established, reliable, and valid instrument for assessing respondents' current physical and mental health status. It measures eight domains of functioning: limitations in physical functioning (called Physical Functioning, PF); the extent to which physical health issues interfere with normal social functioning (called Social Functioning, SF), the extent to which physical health issues interfere with work (or school) functioning (called Role Physical, RP); the extent to which emotional problems interfere with work (or school) functioning (called Role Emotional, RE); the extent to which physical pain interferes with the performance of the activities of daily living (called Bodily Pain, BP); the individuals sense of zest or zeal for life (called Vitality, VT); their perception of their overall health status (called General Health, GH); and their mental health functioning, including feelings of anxiety or depression (called Mental Health, MH). Subjects are asked to respond to a series of questions on Likert-type scales coded such that higher scores always indicate better health status. Tests of reliability reported by Ware et al. (2008) were .80 or above for all eight subscales. Extensive validity tests support use of the SF-36v2 for both research and clinical outcome studies.

Because the current study is exclusively concerned with the association between problematic Internet use and physical health, only two of the eight SF-36v2 subscales were included in the current study. These two subscales (Body Pain and Role Physical) ask specifically and only about physical health. The other six subscales assess either mental health status (Mental Health and Role Emotional), or they assess or clearly imply the extent to which both physical and emotional health concerns affect the respondents functioning (Social Functioning, Physical Functioning, Vitality, General Health). The Cronbach's alphas for the two subscales used in the current study were: .89 (Role Physical, RP), and .85 (Body Pain, BP).

### Procedure

Students were given a password, which in conjunction with their unique, university issued user-ID, enabled them to access a secure website containing the survey instruments. Students were instructed to access the survey and complete all questions during a 3-week time period about mid-way through the semester. Those completing the survey earned extra course credit. Data were then downloaded in SPSS-19.0 for analysis. Data analyses consisted of calculating means and standard deviations for all study variables, calculation of bivariate correlation coefficients and level of significance, and multivariate regression analyses.



RESULTS

Descriptive statistics

Table 1 shows the descriptive statistics (minimum and maximum values, means, and standard deviations) for the three PIUQ subscales, daily number of hours spent online, and the two SF-36v2 Health Survey subscales.

Table 1. Descriptive statistics for the PIUQ, daily hours online, and two SF-36v2 subscales, *N* = 133 for all cells in table

Subscale	Minimum	Maximum	Mean	Std. deviation
PIUQ subscales				
Obsession	6	19	10.14	3.14
Neglect	6	21	11.82	3.43
Control Disorder	6	24	11.59	4.38
Daily number of hours online				
Daily hours online	.14	14.0	2.65	2.01
SF-36v2 subscales				
Body Pain	4.2	12	10.18	1.88
Role Physical	8	20	17.62	3.17

Relationship between the PIUQ and the health variables

Table 2 shows the correlation coefficients obtained with both subscales of the SF-36v2 Health Survey with the three subscales of the PIUQ.

Table 2. Bivariate correlations of the three PIUQ subscales with the two SF-36v2 subscales

	Obsession	Neglect	Control Disorder
Body Pain	n.s.	-.21*	-.21*
Role Physical	-.35**	-.30**	-.31**

\* Significant at *p* < .05; \*\* Significant at *p* < .01; n.s. = not significant.

The daily number of hours each participant spent online significantly correlated with each of the PIUQ subscales as follows: Obsession *r* = .44 (*p* < .01); Neglect *r* = .45 (*p* < .01); and Control Disorder *r* = .45 (*p* < .01). However, daily number of hours spent online was not significantly correlated with either of the two SF-36v2 Health Survey subscales. Finally, neither gender nor age were significantly correlated with any of the PIUQ subscales or with the two Health Survey subscales, with one exception: gender was significantly correlated with Control Disorder (*r* = .21, *p* < .05), indicating that being female was associated with experiencing more Control Disorder.

Two step-wise regression models were tested, one for each SF-36v2 Health Survey subscale as the dependent variable and sex, gender, daily number of hours online, and the three PIUQ subscales as predictors for each model.

The results revealed that the Control Disorder subscale of the PIUQ uniquely predicted the scores on the Body Pain subscale of the SF-36v2 Health Survey (*F*<sub>1,132</sub> = 5.97, *p* < .05). The Beta value for Body Pain was -.21, *p* < .05. Control Disorder contributed 3.6% of the variance in Body Pain scores.

The results also revealed that the Obsession subscale of the PIUQ uniquely predicted the scores on the Role Physical subscale of the SF-36v2 Health Survey (*F*<sub>1,132</sub> = 18.59, *p* < .01). The Beta value for the Role Physical subscale was -.35,

*p* < .01. Obsession contributed 11.8% of the variance in Role Physical scores.

DISCUSSION

We sought first to assess the relationship between problematic Internet use and two indices of physical health status. The data obtained demonstrated that problematic Internet use is significantly correlated with physical health (H<sub>1</sub>).

Those subjects who have a problematic, psychological fixation (Obsession subscale) with the Internet expressed concerns regarding the extent to which their physical health issues interfere with work (or school) functioning (Physical Functioning). Those subjects whose problematic Internet usage results in an inability to decrease the amount of time they spend on the Internet or has a subjective sense of problematically using the Internet excessively (Control Disorder subscale) expressed concerns regarding experiencing more body pain.

These findings are generally in accord with data reported by Kelley & Gruber (2010) but contrary to the findings of Jenaro et al. (2007) and Niemz et al. (2005). Both the Jenaro and Niemz teams found no relationship between problematic Internet usage and the General Health Questionnaire (which includes only a “somatic complaints” subscale) in their samples of college students in Spain and Britain respectively.

The finding that time spent online was not associated with health concerns (H<sub>2</sub>) is consistent with both the Kelley and Gruber (2010) data and the results reported by Demetrovics et al. (2008). “Clearly, the PIUQ instrument is detecting problems that arise from using the Internet that are not a function of time spent online per se but rather reflect issues associated with its excessive use” (Kelley & Gruber, 2010, p. 184).

Finally, regarding our second main purpose in conducting the current study which was to assess the extent to which the data obtained in the current study via an online format are comparable to the data obtained by Kelley and Gruber (2010) who utilized a paper and pencil format. As noted above regarding both the correlations between the PIUQ and the SF-36v2 Health Survey and regarding the finding that time spent online is not confounded with that relationship, our findings are highly consistent with the data reported by Kelley and Gruber (H<sub>3</sub>). This indicates a high degree of robustness in the results given that two different administrative formats with two different samples yielded highly comparable results.

Of course, what cannot be accounted for with our correlational design, as noted from the outset, is the direction of the relationship between these two variables. Does problematic Internet use lead to poor health outcomes; are those with a poorer health status more likely to develop problematic Internet use; or is the relationship between problematic Internet use and health mediated by one or more other variables? Speculation in each of these directions is possible and, unfortunately, our current state of knowledge about the relationship between these two variables is so limited that it does not provide much of a basis for asserting any one of these lines of reasoning. One longitudinal study demonstrated a bi-directional effect between Internet usage and psychological well-being (van den Eijnden, Meerkerk, Vermulst, Spijkerman & Engels, 2008), which still leaves

the question of problematic Internet use and physical well-being unanswered.

It may be appealing to some to conclude that problematic use of or addiction to the Internet is bad for your physical health and well-being, even if mediated by one or more other variables. If that were true, the data reported here would tend to support that conclusion. However, it is equally plausible that those individuals whose physical health status is already compromised may develop online usage patterns that become problematic or even addictive, with or without any mediating variables. If that were true, the data reported here would also tend to support that conclusion.

The possibility of a bi-directional relationship between problematic Internet use and physical health, like that found for psychological well-being by van den Eijnden et al. (2008) raises an interesting third possibility; although the influence of mediating variables would have to be tested. Clearly more research in this area is needed.

While the data presented here do contribute to our growing understanding of the role excessive Internet usage has for an individual's health; it must be acknowledged that these results are preliminary at best. With a generally healthy and robust student sample, one would not anticipate excessive health concerns to be present. This may well account for the relatively low to moderate correlations found between the PIUQ subscales and the health measures. Future research directed at answering questions regarding the relationship between problematic or addictive use of the Internet and physical health should include a more heterogeneous sample, especially in terms of age, occupation (i.e., non-students), and educational level. In addition, future research would benefit from the inclusion of potential mediating variables to assess their contribution to the relationship between problematic use and health status.

At this point, a conclusion that seems more soundly supported by the data reported here, and elsewhere (Kelley & Gruber, 2010; Niemz et al., 2005; Wangberg et al., 2007), is that any relationship between the Internet and physical health occurs only when Internet usage is problematic for the individual, that is, becomes obsessive, results in neglecting self or social ties, or results in loss of control over one's online usage patterns. In other words, mere use of the Internet, per se, even if the daily time spent online is relatively high, is not itself strongly related to any physical health concerns individuals may experience.

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