Research report

Longitudinal associations between anhedonia and internet-related addictive behaviors in emerging adults

Casey R. Guillot [a, *], Mariel S. Bello [a], Jennifer Y. Tsai [a], Jimi Huh [a], Adam M. Leventhal [a, b], Steve Sussman [a, b, c]

[a] University of Southern California, Department of Preventive Medicine, Los Angeles, CA, USA
[b] University of Southern California, Department of Psychology, Los Angeles, CA, USA
[c] University of Southern California, School of Social Work, Los Angeles, CA, USA

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ABSTRACT

Internet addiction (including online gaming) has been associated with depression. However, most prior research relating internet addiction symptomatology to depressive symptoms has been cross-sectional, conducted with children and adolescents, and only examined depressive symptoms as a broad construct. The purpose of the current study was to examine potential longitudinal associations between anhedonia (i.e., difficulty experiencing pleasure, a key facet of depression) and internet-related addictive behaviors in 503 at-risk emerging adults (former attendees of alternative high schools). Participants completed surveys at baseline and approximately one year later (9—18 months later). Results indicated that trait anhedonia prospectively predicted greater levels of compulsive internet use and addiction to online activities as well as a greater likelihood of addiction to online/offline video games. These findings suggest that anhedonia may contribute to the development of internet-related addictive behaviors in the emerging adult population. Thus, interventions that target anhedonia in emerging adulthood (e.g., bupropion treatment or behavioral activation therapy) may help prevent or treat internet addiction.

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1. Introduction

Internet addiction (IA) is an emergent disorder that has been broadly defined as a person's inability to control their internet use, which typically results in marked distress and/or significant impairment in their social life, job performance, financial situation, or other important areas of functioning (e.g., academic; Ha et al., 2006; Liu & Potenza, 2007; Pies, 2009; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000). Although there is an ongoing debate about whether IA should be recognized as an established disorder (Lam, 2014), some studies have supported that IA meets the criteria for being a compulsive-impulsive spectrum disorder comprised of four maladaptive behaviors often considered hallmarks of an addiction disorder: According to this view, an individual with IA may experience strong urges to engage in internet use (*compulsive use*) that lead to neglect of basic drives, distorted sense of time, and

the need for additional computer equipment and software, as well as increased hours of internet use (*buildup of tolerance*), which may result in *withdrawal symptoms* (e.g., tension, depression, and anger) upon cessation of use and *negative repercussions* such as fatigue and deceitfulness or violent arguments when asked to cut back on or quit using the internet (Block, 2008; Young, 2009).

Existing research has focused primarily on IA symptomatology in children and adolescents; however, relatively sparse research has assessed problems associated with IA in emerging adults (i.e., individuals who are 18—25 years old), a population in which problematic internet use is becoming increasingly concerning (Ni, Yan, Chen, & Liu, 2009; Tsai et al., 2009; Young, 2004). Most prevalence estimates for the college student population (which largely consists of emerging adults) have indicated that approximately 6—25% of college students are dependent on their internet use (Canan, Ataoglu, Ozcetin, & Icmeli, 2012; Jiang, Zhu, Ye, & Lin, 2012; Lin, Ko, & Wu, 2011; Moreno, Jelenchick, Cox, Young, & Christakis, 2011; Sato, 2006). Many of these internet-dependent college students suffer from poor study habits and grades and academic dismissal or failure (Anderson, 2001; Ko, Yen, Chen, Yang, et al., 2009; Ko, Yen, Chen, Yeh, & Yen, 2009; Young, 2004) as

well as a multitude of mental and physical health complications, such as difficulty maintaining real-life interpersonal relationships, declines in everyday activities, mood disturbances, sleep problems, and loneliness or decreased social involvement (Anderson, 2001; Ko et al., 2009; Morahan-Martin & Schumacher, 2000). In addition to greater health and adaptation problems experienced by emerging adults with mild IA symptomatology, those with severe IA symptomatology also report having lower family functioning and more stressful life events (Yan, Li, & Sui, 2014). Hence, it is imperative to investigate psychological problems that may precede and predict symptoms of IA in order to illuminate potential etiological factors for the disorder, develop IA interventions, and ultimately, reduce the public health burden of IA in emerging adult populations. In particular, IA may be relatively high among at-risk youth, such as former attendees of alternative high schools, which involve youth who have difficulties achieving sufficient credits to stay in the regular school system (e.g., due to addictive behaviors; Sussman, Valente, Rohrbach, Dent, & Sun, 2014).

One potential risk factor for IA in emerging adults is depression. Notably, a systematic review of the literature on IA and psychopathology reported robust associations with depressive symptoms and found depression to be the most closely related to IA among all psychiatric disorders (Carli et al., 2013). In fact, depressive symptoms are strongly associated with both IA in general (Dalbudak et al., 2013; Dalbudak, Evren, Aldemir, & Evren, 2014; Young & Rogers, 1998) and addiction to video games in particular (often played online and closely tied to problematic internet use; Brunborg, Mentzoni, & Froyland, 2014; Ko et al., 2009; Peng & Liu, 2010; Peukert, Sieslack, Barth, & Batra, 2010; van Rooij, Schoenmakers, van de Eijnden, & van de Mheen, 2010; Wei, Chen, Huang, & Bai, 2012). Therefore, it appears that depression is an important correlate of internet-related addictive behaviors that may help shed light on possible underlying mechanisms involved in the development of those behaviors in emerging adults.

However, some critical issues need to be addressed in order to meaningfully extend the scant literature on depressive symptoms and internet-related addictive behaviors in emerging adults. First, the vast majority of studies conducted on IA and psychopathology thus far have been cross-sectional, whereas longitudinal research is scarcely available yet urgently needed to assess causal influences (Carli et al., 2013). Second, most prior longitudinal studies relating depressive symptoms to internet or video game addiction have been conducted with children and adolescents (Brunborg et al., 2014; Cho, Sung, Shin, Lim, & Shin, 2013; Gentile et al., 2011; Ko et al., 2014; Ko et al., 2009; van den Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, 2008), whereas limited longitudinal research has investigated depressive symptoms and internet-related addictive behaviors in emerging adults (Dong, Lu, Zhou, & Zhao, 2011). Finally, longitudinal studies have only observed the relationship between internet-related addictive behaviors and depressive symptoms in general without considering particular facets such as sadness or anhedonia (i.e., diminished pleasure in normally enjoyable activities). As such, examining depressive symptoms as a broad construct may obscure more specific factors (e.g., anhedonia) that may contribute to IA symptomatology, whereas uncovering such factors may suggest narrower targets for IA interventions.

Prior research indicates that anhedonia may be particularly relevant to the etiology of IA. Anhedonia has been associated with lower sensitivity to reward (Huys, Pizzagalli, Bogdan, & Dayan, 2013; Liu et al., 2014) and less activation in the ventral striatum in response to pleasant or rewarding stimuli (Der-Avakian & Markou, 2012; Keller et al., 2013; Steele, Kumar, & Ebmeier, 2007), and in studies that have not severely limited the presence of depressive symptoms, IA has also been associated with lower

sensitivity to reward (Kim et al., 2014; Yau, Potenza, Mayes, & Crowley, 2015), which is apparently tied to decrements in the reward-related subcortical system (Kim et al., 2014). Furthermore, anhedonia is not only a symptom of depression but has been conceptualized and evidenced as a trait vulnerability to depression (Di Nicola et al., 2013; Schrader, 1997), and it is therefore possible that trait anhedonia may also increase susceptibility to IA. Theoretically, individuals with higher levels of trait anhedonia may be prone to compulsively use the internet, which offers an abundance of sources of reward at minimal cost (Yau et al., 2015) as a means to offset deficits in hedonic experience.

The current study tested this possibility by investigating whether trait anhedonia levels predict internet-related addictive behaviors approximately one year later (9–18 months later) in an at-risk emerging adult sample. We hypothesized that anhedonia will be positively associated with compulsive internet use, addiction to online activities (subsequently referred to as internet addiction or IA), and addiction to online/offline video games (subsequently referred to as video game addiction).

2. Method

2.1. Participants and procedure

Self-report survey data were collected from emerging adults (19–24 years old) who previously had participated in a larger longitudinal study conducted to test the efficacy of a school-based substance abuse prevention program (Sussman, Sun, Rohrbach, & Spruijt-Metz, 2012). These emerging adults had attended one of 24 alternative high schools in four counties in southern California. Informed consent was obtained from all participants prior to data collection that occurred between May 2011 and February 2014 during the two most recent waves of the larger longitudinal study, which we will refer to as T1 (baseline) and T2 (9–18 months later). A total of 503 participants completed surveys at T1 and T2. Surveys took about 20–30 min to complete and were administered by trained researchers either over the phone or in person at the participant's home, or they were left with the participant at home or mailed to them with instructions for completing the survey and returning it by mail. All study procedures were approved by the University of Southern California's Institutional Review Board.

2.2. Measures

2.2.1. Demographics

Self-report items assessed age, gender, race/ethnicity (5 categories using dummy coding), marital status (0 = not married; 1 = married), educational attainment (0 = non-graduate; 1 = graduate), if the participant was a parent (0 = non-parent; 1 = parent), and residential status (0 = living apart from parents; 1 = living with parents).

2.2.2. Anhedonia

This 3-item self-report scale (Leventhal et al., 2015), adapted from the Snaith-Hamilton Pleasure Scale (Snaith et al., 1995), included items that inquired about experiencing pleasure or enjoyment from small things ("a bright sunny day or a telephone call from a friend"), nature ("a beautiful landscape or view"), and receiving praise from others. Items were answered with a Likert format (1 = *Strongly Agree* to 4 = *Strongly Disagree*), with higher sum scores indicating greater levels of trait anhedonia. Cronbach's alphas for this scale were 0.74 [T1] and 0.78 [T2].

2.2.3. Compulsive internet use

This 4-item self-report scale, adapted from the Compulsive