



Published in final edited form as:

Comput Human Behav. 2016 September ; 62: 475–479. doi:10.1016/j.chb.2016.04.019.

Longitudinal Associations between Anhedonia and Internet-Related Addictive Behaviors in Emerging Adults

Casey R. Guillot, Ph.D.^{a,*}, Mariel S. Bello, B.S.^a, Jennifer Y. Tsai, MPH^a, Jimi Huh, Ph.D.^a, Adam M. Leventhal, Ph.D.^{a,b}, and Steve Sussman, Ph.D., FAAHB, FAPA^{a,b,c}

^aUniversity of Southern California, Department of Preventive Medicine, Los Angeles, CA, USA

^bUniversity of Southern California, Department of Psychology, Los Angeles, CA, USA

^cUniversity of Southern California, School of Social Work, Los Angeles, CA, USA

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.

Keywords

depression; anhedonia; internet addiction; compulsive internet use; video gaming; emerging adults

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,

*Corresponding Author: Casey Guillot, Ph.D., University of Southern California, Department of Preventive Medicine, 2001 North Soto Street, 3rd Floor, Los Angeles, CA 90032-9045, cguillot@usc.edu, Phone: 1-323-442-8218, Fax: 1-323-442-2359.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

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 et al., 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, Yen, Chen, Yang, 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, Yen, Chen, Yang, 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, Yen, Chen, Yeh, & Yen, 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 to 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 minutes 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 .74 [T1] and .78 [T2].

2.2.3 Compulsive Internet Use—This 4-item self-report scale, adapted from the Compulsive Internet Use Scale (Meerkerk, van Den Eijnden, Vermulst, & Garretsen, 2009), included items that asked participants about how often they stayed on the internet longer than planned, used the internet more frequently than they should, had difficulty cutting down on their internet use, and felt that their internet use was out of control. Items were reported with a Likert format (1 = *Never* to 5 = *Always*), with higher sum scores indicating greater levels of compulsive internet use. Cronbach's alphas for this scale were .85 [T1] and .89 [T2].

2.2.4 Internet Addiction (IA)—This author-constructed 3-item self-report scale included items asking participants if they felt they were addicted to three different online activities in the past 30 days: internet browsing (surfing the web), social media (Facebook, Twitter, MySpace, etc.), and online shopping. Items were answered with a dichotomous response

format (Yes = 1, No = 0), with higher sum scores indicating higher levels of addiction to online activities. Cronbach's alphas for this scale were .44 [T1] and .60 [T2].

2.2.5 Video Game Addiction—This author-constructed item asked participants if they felt they were addicted to online or offline video games in the past 30 days, which was answered with a dichotomous response format (Yes = 1, No = 0).

2.3 Data Analysis

Linear regression analyses were used to examine if T1 anhedonia predicted T2 compulsive internet use and IA. Logistic regression analysis was used to examine if T1 anhedonia predicted T2 video game addiction. Regression analyses were simultaneously adjusted for prior substance abuse prevention condition (Sussman, et al., 2012) as well as baseline values on the corresponding criterion variable, gender, race/ethnicity, age, high school graduation status, parental status, residential status, and marital status.

3. Results

Demographic characteristics and descriptive statistics are shown in Table 1. At T1 and T2, 21.4% and 21.8% of participants, respectively, endorsed addiction to at least one of the three online activities that comprise the IA scale (i.e., internet browsing, social media, or online shopping). Regression analyses for anhedonia as a longitudinal predictor of internet-related variables are shown in Table 2. Anhedonia prospectively predicted greater levels of compulsive internet use and IA as well as a greater likelihood of video game addiction. In regard to covariates, both male gender (OR = 3.1, $p = 0.008$) and high school graduation (OR = 3.9, $p = 0.008$) were prospectively associated with video game addiction.

4. Discussion

To the best of our knowledge, this is the first study to examine longitudinal associations between anhedonia and internet-related addictive behaviors. Consistent with our hypotheses, we found that trait anhedonia prospectively predicted greater levels of compulsive internet use and IA as well as a greater likelihood of video game addiction.

Current findings are consistent with two prior longitudinal studies in children and adolescents that found depressive symptoms were predictive of future IA (Cho, et al., 2013; Ko, Yen, Chen, Yeh, et al., 2009) but are seemingly inconsistent with two other longitudinal studies in children and adolescents (Gentile, et al., 2011; van den Eijnden, et al., 2008) and one prospective study in college students (Dong, et al., 2011) that found depressive symptoms were not predictive of internet or video game addiction symptomatology. As stated previously, however, it is possible that measuring depression as a single variable may conceal potential relations between specific facets of depression (e.g., anhedonia) and internet-related addictive behaviors.

This study has some limitations. Because our sample consisted of former attendees of alternative high schools, results may not generalize to other emerging adult populations (e.g., college students or former attendees of regular high schools). Also, we used self-report

measures that either were abbreviated scales (including one with rather low reliability) or consisted of a single item, which may have led to underestimating the strength of anhedonia relations with internet-related addictive behaviors (small effect sizes) and failing to detect further demographic associations with internet-related variables. Lastly, anhedonia was the only component of depression we measured. Hence, researchers conducting longitudinal work of this kind in the future should consider examining other emerging adult populations, utilizing clinician-administered assessments of anhedonia and internet-related addictive behaviors, and using fuller and more reliable self-report scales for multiple facets of depression.

5. Conclusions

Despite limitations, the current study expands the literature by providing prospective evidence which suggests that anhedonia may contribute to the development of internet-related addictive behaviors in emerging adults. Thus, interventions that target anhedonia in emerging adulthood may help prevent or treat IA. For instance, the antidepressant medication bupropion is especially effective at treating symptoms related to anhedonia (Treadway & Zald, 2011) and has shown some initial effectiveness in treating problematic online gamers with and without major depression (Han, Hwang, & Renshaw, 2010; Han & Renshaw, 2012). Also, nascent psychological treatments for IA (Wolfling, Beutel, Dreier, & Muller, 2014) may benefit from adding a behavioral activation therapy component similar to what has been done with smoking cessation treatment for smokers with depressive symptoms (MacPherson et al., 2010).

Acknowledgments

This study was supported by funding from National Institute on Drug Abuse grant R01-DA020138 and National Cancer Institute grant T32-CA009492.

References

- Anderson KJ. Internet use among college students: An exploratory study. *Journal of American College Health*. 2001; 50:21–26. <http://dx.doi.org/10.1080/07448480109595707>. [PubMed: 11534747]
- Block JJ. Issues for DSM-V: internet addiction. *The American Journal of Psychiatry*. 2008; 165:306–307. <http://dx.doi.org/10.1176/appi.ajp.2007.07101556>. [PubMed: 18316427]
- Brunborg GS, Mentzoni RA, Froyland LR. Is video gaming, or video game addiction, associated with depression, academic achievement, heavy episodic drinking, or conduct problems? *Journal of Behavioral Addictions*. 2014; 3:27–32. <http://dx.doi.org/10.1556/JBA.3.2014.002>. [PubMed: 25215212]
- Canan F, Ataoglu A, Ozcetin A, Icmeli C. The association between Internet addiction and dissociation among Turkish college students. *Comprehensive Psychiatry*. 2012; 53:422–426. <http://dx.doi.org/10.1016/j.comppsy.2011.08.006>. [PubMed: 22000475]
- Carli V, Durkee T, Wasserman D, Hadlaczky G, Despalins R, Kramarz E, Kaess M. The association between pathological internet use and comorbid psychopathology: a systematic review. *Psychopathology*. 2013; 46:1–13. <http://dx.doi.org/10.1159/000337971>. [PubMed: 22854219]
- Cho SM, Sung MJ, Shin KM, Lim KY, Shin YM. Does psychopathology in childhood predict internet addiction in male adolescents? *Child Psychiatry and Human Development*. 2013; 44:549–555. <http://dx.doi.org/10.1007/s10578-012-0348-4>. [PubMed: 23242708]
- Dalbudak E, Evren C, Aldemir S, Coskun KS, Ugurlu H, Yildirim FG. Relationship of internet addiction severity with depression, anxiety, and alexithymia, temperament and character in

- university students. *Cyberpsychology, Behavior and Social Networking*. 2013; 16:272–278. <http://dx.doi.org/10.1089/cyber.2012.0390>.
- Dalbudak E, Evren C, Aldemir S, Evren B. The severity of internet addiction risk and its relationship with the severity of borderline personality features, childhood traumas, dissociative experiences, depression and anxiety symptoms among Turkish university students. *Psychiatry Research*. 2014; 219:577–582. <http://dx.doi.org/10.1016/j.psychres.2014.02.032>. [PubMed: 25023365]
- Der-Avakian A, Markou A. The neurobiology of anhedonia and other reward-related deficits. *Trends in Neurosciences*. 2012; 35:68–77. <http://dx.doi.org/10.1016/j.tins.2011.11.005>. [PubMed: 22177980]
- Di Nicola M, De Risio L, Battaglia C, Camardese G, Tedeschi D, Mazza M, Janiri L. Reduced hedonic capacity in euthymic bipolar subjects: a trait-like feature? *Journal of Affective Disorders*. 2013; 147:446–450. <http://dx.doi.org/10.1016/j.jad.2012.10.004>. [PubMed: 23122985]
- Dong G, Lu Q, Zhou H, Zhao X. Precursor or sequela: Pathological disorders in people with Internet addiction disorder. *PloS One*. 2011; 6:e14703. <http://dx.doi.org/10.1371/journal.pone.0014703>. [PubMed: 21358822]
- Gentile DA, Choo H, Liau A, Sim T, Li D, Fung D, Khoo A. Pathological video game use among youths: A two-year longitudinal study. *Pediatrics*. 2011; 127:e319–e329. <http://dx.doi.org/10.1542/peds.2010-1353>. [PubMed: 21242221]
- Ha JH, Yoo HJ, Cho IH, Chin B, Shin D, Kim JH. Psychiatric comorbidity assessed in Korean children and adolescents who screen positive for Internet addiction. *The Journal of Clinical Psychiatry*. 2006; 67:821–826. [PubMed: 16841632]
- Han DH, Hwang JW, Renshaw PF. Bupropion sustained release treatment decreases craving for video games and cue-induced brain activity in patients with Internet video game addiction. *Experimental and Clinical Psychopharmacology*. 2010; 18:297–304. <http://dx.doi.org/10.1037/a0020023>. [PubMed: 20695685]
- Han DH, Renshaw PF. Bupropion in the treatment of problematic online game play in patients with major depressive disorder. *Journal of Psychopharmacology*. 2012; 26:689–696. <http://dx.doi.org/10.1177/0269881111400647>. [PubMed: 21447539]
- Huys QJ, Pizzagalli DA, Bogdan R, Dayan P. Mapping anhedonia onto reinforcement learning: A behavioural meta-analysis. *Biology of Mood & Anxiety Disorders*. 2013; 3:12. <http://dx.doi.org/10.1186/2045-5380-3-12>. [PubMed: 23782813]
- Jiang D, Zhu S, Ye M, Lin C. Cross-sectional survey of prevalence and personality characteristics of college students with internet addiction in Wenzhou, China. *Shanghai Archives of Psychiatry*. 2012; 24:99–107. <http://dx.doi.org/10.3969/j.issn.1002-0829.2012.02.005>. [PubMed: 25324610]
- Keller J, Young CB, Kelley E, Prater K, Levitin DJ, Menon V. Trait anhedonia is associated with reduced reactivity and connectivity of mesolimbic and paralimbic reward pathways. *Journal of Psychiatric Research*. 2013; 47:1319–1328. <http://dx.doi.org/10.1016/j.jpsychires.2013.05.015>. [PubMed: 23791396]
- Kim JE, Son JW, Choi WH, Kim YR, Oh JH, Lee S, Kim JK. Neural responses to various rewards and feedback in the brains of adolescent Internet addicts detected by functional magnetic resonance imaging. *Psychiatry and Clinical Neurosciences*. 2014; 68:463–470. <http://dx.doi.org/10.1111/pcn.12154>. [PubMed: 24920379]
- Ko CH, Liu TL, Wang PW, Chen CS, Yen CF, Yen JY. The exacerbation of depression, hostility, and social anxiety in the course of internet addiction among adolescents: A prospective study. *Comprehensive Psychiatry*. 2014; 55:1377–1384. <http://dx.doi.org/10.1016/j.comppsy.2014.05.003>. [PubMed: 24939704]
- Ko CH, Yen JY, Chen CS, Yeh YC, Yen CF. Predictive values of psychiatric symptoms for internet addiction in adolescents: A 2-year prospective study. *Archives of Pediatrics & Adolescent Medicine*. 2009; 163:937–943. <http://dx.doi.org/10.1001/archpediatrics.2009.159>. [PubMed: 19805713]
- Ko CH, Yen JY, Chen SH, Yang MJ, Lin HC, Yen CF. Proposed diagnostic criteria and the screening and diagnosing tool of Internet addiction in college students. *Comprehensive Psychiatry*. 2009; 50:378–384. <http://dx.doi.org/10.1016/j.comppsy.2007.05.019>. [PubMed: 19486737]

- Lam LT. Risk factors of Internet addiction and the health effect of internet addiction on adolescents: A systematic review of longitudinal and prospective studies. *Current Psychiatry Reports*. 2014; 16:508. <http://dx.doi.org/10.1007/s11920-014-0508-2>. [PubMed: 25212714]
- Leventhal AM, Unger JB, Audrain-McGovern J, Sussman S, Volk HE, Strong DR. Measuring anhedonia in adolescents: A psychometric analysis. *Journal of Personality Assessment*. 2015:1–9. <http://dx.doi.org/10.1080/00223891.2015.1029072>.
- Lin MP, Ko HC, Wu JY. Prevalence and psychosocial risk factors associated with internet addiction in a nationally representative sample of college students in Taiwan. *Cyberpsychology, Behavior and Social Networking*. 2011; 14:741–746. <http://dx.doi.org/10.1089/cyber.2010.0574>.
- Liu T, Potenza MN. Problematic Internet use: clinical implications. *CNS Spectrums*. 2007; 12:453–466. <http://dx.doi.org/10.1017/S1092852900015339>. [PubMed: 17545956]
- Liu WH, Wang LZ, Shang HR, Shen Y, Li Z, Cheung EF, Chan RC. The influence of anhedonia on feedback negativity in major depressive disorder. *Neuropsychologia*. 2014; 53:213–220. <http://dx.doi.org/10.1016/j.neuropsychologia.2013.11.023>. [PubMed: 24316199]
- MacPherson L, Tull MT, Matusiewicz AK, Rodman S, Strong DR, Kahler CW, Lejuez CW. Randomized controlled trial of behavioral activation smoking cessation treatment for smokers with elevated depressive symptoms. *Journal of Consulting and Clinical Psychology*. 2010; 78:55–61. <http://dx.doi.org/10.1037/a0017939>. [PubMed: 20099950]
- Meerkerk GJ, van Den Eijnden RJJM, Vermulst AA, Garretsen HFL. The Compulsive Internet Use Scale (CIUS): Some psychometric properties. *Cyberpsychology & Behavior*. 2009; 12:1–6. <http://dx.doi.org/10.1089/cpb.2008.0181>. [PubMed: 19072079]
- Morahan-Martin J, Schumacher P. Incidence and correlates of pathological Internet use among college students. *Computers in Human Behavior*. 2000; 16:13–29. [http://dx.doi.org/10.1016/S0747-5632\(99\)00049-7](http://dx.doi.org/10.1016/S0747-5632(99)00049-7).
- Moreno MA, Jelenchick L, Cox E, Young H, Christakis DA. Problematic internet use among US youth: A systematic review. *Archives of Pediatrics & Adolescent Medicine*. 2011; 165:797–805. <http://dx.doi.org/10.1001/archpediatrics.2011.58>. [PubMed: 21536950]
- Ni X, Yan H, Chen S, Liu Z. Factors influencing internet addiction in a sample of freshmen university students in China. *Cyberpsychology & Behavior*. 2009; 12:327–330. <http://dx.doi.org/10.1089/cpb.2008.0321>. [PubMed: 19445631]
- Peng W, Liu M. Online gaming dependency: A preliminary study in China. *Cyberpsychology, Behavior and Social Networking*. 2010; 13:329–333. <http://dx.doi.org/10.1089/cyber.2009.0082>.
- Peukert P, Sieslack S, Barth G, Batra A. Phänomenologie, Komorbidität, Ätiologie, Diagnostik und therapeutische Implikationen für Betroffene und Angehörige [Internet- and computer game addiction: Phenomenology, comorbidity, etiology, diagnostics and therapeutic implications for the addicts and their relatives]. *Psychiatrische Praxis*. 2010; 37:219–224. Abstract retrieved from PubMed. <http://dx.doi.org/10.1055/s-0030-1248442>. [PubMed: 20597036]
- Pies R. Should DSM-V Designate "Internet Addiction" a Mental Disorder? *Psychiatry*. 2009; 6:31–37. [PubMed: 19724746]
- Sato T. Internet addiction among students: Prevalence and psychological problems in Japan. *Japan Medical Association Journal*. 2006; 49:279.
- Schrader G. Does anhedonia correlate with depression severity in chronic depression? *Comprehensive Psychiatry*. 1997; 38:260–263. [http://dx.doi.org/10.1016/S0010-440X\(97\)90057-2](http://dx.doi.org/10.1016/S0010-440X(97)90057-2). [PubMed: 9298317]
- Shapira NA, Goldsmith TD, Keck PE Jr, Khosla UM, McElroy SL. Psychiatric features of individuals with problematic internet use. *Journal of Affective Disorders*. 2000; 57:267–272. [http://dx.doi.org/10.1016/S0165-0327\(99\)00107-X](http://dx.doi.org/10.1016/S0165-0327(99)00107-X). [PubMed: 10708842]
- Snaith RP, Hamilton M, Morley S, Humayan A, Hargreaves D, Trigwell P. A scale for the assessment of hedonic tone the Snaith-Hamilton Pleasure Scale. *The British Journal of Psychiatry*. 1995; 167:99–103. <http://dx.doi.org/10.1192/bjp.167.1.99>. [PubMed: 7551619]
- Steele JD, Kumar P, Ebmeier KP. Blunted response to feedback information in depressive illness. *Brain*. 2007; 130:2367–2374. <http://dx.doi.org/10.1093/brain/awm150>. [PubMed: 17586866]
- Sussman S, Sun P, Rohrbach LA, Spruijt-Metz D. One-year outcomes of a drug abuse prevention program for older teens and emerging adults: Evaluating a motivational interviewing booster

- component. *Health Psychology*. 2012; 31:476–485. <http://dx.doi.org/10.1037/a0025756>. [PubMed: 21988096]
- Sussman S, Valente TW, Rohrbach LA, Dent CW, Sun P. Commentary--Project Towards No Drug Abuse: An evidence-based drug abuse prevention program. *The Journal of Primary Prevention*. 2014; 35:233–237. <http://dx.doi.org/10.1007/s10935-014-0353-4>. [PubMed: 24788544]
- Treadway MT, Zald DH. Reconsidering anhedonia in depression: Lessons from translational neuroscience. *Neuroscience and Biobehavioral Reviews*. 2011; 35:537–555. <http://dx.doi.org/10.1016/j.neubiorev.2010.06.006>. [PubMed: 20603146]
- Tsai HF, Cheng SH, Yeh TL, Shih CC, Chen KC, Yang YC, Yang YK. The risk factors of Internet addiction--a survey of university freshmen. *Psychiatry Research*. 2009; 167:294–299. <http://dx.doi.org/10.1016/j.psychres.2008.01.015>. [PubMed: 19395052]
- van den Eijnden RJ, Meerkerk GJ, Vermulst AA, Spijkerman R, Engels RC. Online communication, compulsive Internet use, and psychosocial well-being among adolescents: A longitudinal study. *Developmental Psychology*. 2008; 44:655–665. <http://dx.doi.org/10.1037/0012-1649.44.3.655>. [PubMed: 18473634]
- van Rooij AJ, Schoenmakers TM, van de Eijnden RJ, van de Mheen D. Compulsive internet use: The role of online gaming and other internet applications. *The Journal of Adolescent Health*. 2010; 47:51–57. <http://dx.doi.org/10.1016/j.jadohealth.2009.12.021>. [PubMed: 20547292]
- Wei HT, Chen MH, Huang PC, Bai YM. The association between online gaming, social phobia, and depression: An internet survey. *BMC Psychiatry*. 2012; 12:92. <http://dx.doi.org/10.1186/1471-244X-12-92>. [PubMed: 22839747]
- Wolfling K, Beutel ME, Dreier M, Muller KW. Treatment outcomes in patients with internet addiction: A clinical pilot study on the effects of a cognitive-behavioral therapy program. *BioMed Research International*. 2014; 2014:425924. <http://dx.doi.org/10.1155/2014/425924>. [PubMed: 25097858]
- Yan W, Li Y, Sui N. The relationship between recent stressful life events, personality traits, perceived family functioning and internet addiction among college students. *Stress and Health*. 2014; 30:3–11. <http://dx.doi.org/10.1002/smi.2490>. [PubMed: 23616371]
- Yau YH, Potenza MN, Mayes LC, Crowley MJ. Blunted feedback processing during risk-taking in adolescents with features of problematic Internet use. *Addictive Behaviors*. 2015; 45:156–163. <http://dx.doi.org/10.1016/j.addbeh.2015.01.008>. [PubMed: 25679363]
- Young K. Internet addiction: Diagnosis and treatment considerations. *Journal of Contemporary Psychotherapy*. 2009; 39:241–246. <http://dx.doi.org/10.1007/s10879-009-9120-x>.
- Young KS. Internet addiction: A new clinical phenomenon and its consequences. *American Behavioral Scientist*. 2004; 48:402–415. <http://dx.doi.org/10.1177/0002764204270278>.
- Young KS, Rogers RC. The relationship between depression and internet addiction. *Cyberpsychology & Behavior*. 1998; 1:25–28. <http://dx.doi.org/10.1089/cpb.1998.1.25>.

HIGHLIGHTS

- Prior work related internet addiction (IA) to depression, but not to its facets.
- We studied if one facet, anhedonia, prospectively relates to IA in emerging adults.
- Trait anhedonia predicted IA as indexed by two different measures.
- Trait anhedonia also predicted addiction to online/offline video games.
- Interventions that target anhedonia in emerging adulthood may help with IA.

TABLE 1

Demographic Characteristics and Descriptive Statistics

Variable: M (SD) or %	Time 1 Assessment	Time 2 Assessment
Age	20.8 (0.85)	
Male	47.7	
Race/Ethnicity		
Hispanic	68.4	
White	11.7	
African American	2.6	
Mixed	11.9	
Other	5.4	
High school graduate	73.8	
Living with parents	67.0	
Married	7.4	
Current parent	23.1	
Anhedonia score	5.1 (1.6)	4.8 (1.6)
Compulsive internet use score	7.5 (3.6)	7.9 (3.9)
Internet addiction score	0.28 (0.59)	0.33 (0.69)
Video game addiction	12.4	10.1

Note: $N = 503$. Data in relation to internet addiction and video game addiction was available from 454 and 466 participants, respectively.

TABLE 2

Regression Analyses for Anhedonia as a Longitudinal Predictor of Internet-related Variables

<i>Outcome Variable</i>	β (SE)	OR (95% CI)	<i>p</i>
Compulsive internet use (<i>N</i> = 503)	0.08 (0.04)		0.021
Internet addiction (<i>n</i> = 454)	0.09 (0.04)		0.041
Video game addiction (<i>n</i> = 466)		1.33 (1.11–1.60)	0.003

Note: Analyses adjusted for prior substance abuse prevention condition and baseline values on the corresponding outcome variable, gender, race/ethnicity, age, high school graduation status, parental status, residential status, and marital status. The standardized regression coefficient or odds ratio is reported for each outcome variable.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript