

# Problematic interactive media use in teens: comorbidities, assessment, and treatment

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**Abstract:** Problematic Interactive Media Use (PIMU), aka internet or video game addiction, is increasingly presenting to pediatricians for care. The majority of youth now use mobile media almost constantly to communicate, learn, and entertain themselves, but for some, uncontrolled video gaming, social media use, pornography viewing, and information-bingeing on short videos or websites contribute to functional impairment. PIMU can result in academic failure, social withdrawal, behavioral problems, family conflict, and physical and mental health problems. There is no formal diagnosis to describe the spectrum of PIMU behaviors and therefore no standardized therapeutic interventions. Anticipatory guidance will help identify youth at risk and empower parents to recognize and prevent problems. In addition, epidemiology and etiology indicate that Attention-Deficit/Hyperactivity Disorder (ADHD), affective disorders, and Autism Spectrum Disorder (ASD) may predispose to and, in some cases, result from PIMU, offering opportunities for effective treatment by addressing underlying pathology that is manifesting itself in the interactive media environment. Efforts to establish evidence-based diagnoses, develop and evaluate therapeutic strategies, and to train clinicians in recognition and care of PIMU are reviewed.

**Keywords:** addictive behavior, adolescent health, internet, dialectical behavior therapy, mental health

## Introduction

In today's digital age, the growing use of interactive screen media such as smartphones, computers, video games, and internet for both work and pleasure has led to the development of a variety of physical and psychological health outcomes. It is important to understand all aspects of the problematic use of technology and to identify strategies for evaluation and treatment of the growing number of youth suffering from this issue. In this narrative mini-review, we summarize some of the most relevant issues and research on the topic of Problematic Interactive Media Use (PIMU).

## Methodology

We performed a broad literature search in three academic databases: MEDLINE, PsycINFO, and CINAHL. We used various combinations of keyword and keyword truncation searching, using terms that focus on the behavior, including "addiction", "problematic," "compulsive", "pathological," and "obsessive." We paired these keywords with terms that focused on the technology, such as "internet," "video gaming," "social media," "smartphone," "mobile device," and more. We also built searches using each database's controlled vocabulary. While we placed an emphasis

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on selecting articles published within the last 10 years that focus on original research investigations, we also included a small amount of older articles, as well as review articles, as we deemed necessary. Additional articles were identified by reviewing article references, and we also searched for grey literature online. As this was a narrative review, we selected articles that fit the focus of our article.

## Defining the issue

PIMU refers to the uncontrolled use of interactive screen media that results in negative consequences affecting an individual's functioning. Like other behavioral addictions, someone suffering from PIMU may experience an increased tolerance to media use and negative reactions when forced to restrict their use. As a result of the increasing clinical evidence related to PIMU, the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, 5th ed. (DSM-5), published in 2013, classified Internet Gaming Disorder (IGD) in an appendix of conditions requiring further research to be considered as potential diagnoses.<sup>1</sup> In 2018, the World Health Organization, recognizing that problematic gaming can occur offline as well as online, established Gaming Disorder as a mental health diagnosis in the International Classification of Diseases, 11th edition.<sup>2</sup> While these are positive steps toward raising awareness about PIMU, they exclude other problematic interactive media use that requires further research and clinical conceptualization. Recognizing the historical variations in nomenclature applied to this problem, we will discuss this disorder as PIMU, but in reviewing the research literature, we will use the nomenclature investigated by the original investigators.

Although clinical presentation may vary, at least four prominent subtypes of PIMU have been presented for clinical care: gaming, including excessive online or offline video game play on a computer, console, or mobile device; social media use, including compulsive online interactions that lead to distress, anxiety, and depression; pornography viewing, in which sexual needs are met through pornography use that results in sexual dysfunction; and information-bingeing, including spending hours of time on other online activities such as binge-watching videos.<sup>3</sup>

Children and adolescents are particularly vulnerable to PIMU; the adolescent prefrontal cortex, which is responsible for executive functions such as judgment, decision making, and problem-solving, does not fully mature until the mid-20s.<sup>4</sup> Symptoms of internet addiction have been associated with poor executive function,<sup>5</sup> much like other behavioral addictions. While evaluation and treatment

models exist for other behavioral issues, the availability of such tools for PIMU is still limited, putting youth at further risk of experiencing challenges with academic performance, social-emotional development, nutrition, sleep, physical health, and interpersonal relationships.

## Epidemiology

Interactive media use has become ubiquitous among adolescents. In 2018, 88% of children ages 13–17 had access to a home computer and 84% had a game console.<sup>6</sup> Adolescent ownership and access to smartphones rapidly increased from 73% in 2014<sup>7</sup> to 95% in 2018.<sup>6</sup> Additionally, adolescents' frequency of screen media use has increased dramatically in the last four years. In 2014, 24% of adolescents used the internet "almost constantly,"<sup>7</sup> and that percentage nearly doubled to 45% in 2018.<sup>6</sup> Most adolescents (97% of boys and 83% of girls) play video games and 97% are on social media sites such as YouTube (85%), Instagram (72%), and Snapchat (69%).<sup>6</sup> In 2016, the average time spent with screen media each day was 8 hrs and 56 mins for adolescents and 5 hrs and 55 mins for children between the ages of 8 and 12.<sup>8</sup> Children under 8 used an average of 2 hrs and 19 mins of screen media per day,<sup>9</sup> and by age 3, many are using a mobile device daily without parental assistance.<sup>10</sup> While these numbers illustrate that screen use durations are high among American children and adolescents, without a measure of impairment, it is difficult to determine how many are actually struggling with PIMU.

Prevalence estimates of "internet addicted" youth range from 0.8% in Italy<sup>11</sup> to 14% in China<sup>12</sup> and as high as 26.7% in Hong Kong.<sup>13</sup> Sussman et al (2018)<sup>14</sup> estimate IGD prevalence to be as high as 9.4% in the United States. The broad range of reported prevalence demonstrates a diversity of definitions and criteria for this condition as well as cultural differences in media use and behavioral norms.<sup>3</sup> Quantifying prevalence of PIMU is difficult due to the lack of standardized nomenclature and characterization of the problem. Researchers from different clinical disciplines have used a variety of screening tools and diagnostic measures to identify problems of interactive media use. Lack of diagnostic standardization, a myriad of media devices and applications, and countless interactive behaviors have yielded more than 50 different descriptions of problems with interactive media use from Internet Addiction (IA)<sup>15</sup> to pathological video gaming<sup>16</sup> to Facebook addiction<sup>17</sup> to compulsive pornography use.<sup>18</sup>

## Comorbidities & risk factors

Uncontrolled use of digital media has been associated with other psychiatric conditions. The mental health effects of excessive use continue to be studied long term, but current research suggests that depression and attention-deficit/hyperactivity disorder (ADHD) are prevalent among young people struggling with PIMU.<sup>19</sup> Co-morbid and pre-existing anxiety, sleep disorders, and autism spectrum disorder (ASD) are also common with those struggling with excessive media use.<sup>19</sup>

## Depression

Researchers are currently working to better understand the relationship between internet use and adolescent depression.<sup>20</sup> Although studies are not conclusive,<sup>21</sup> many reveal that children who spend more time online are more likely to be depressed.<sup>22</sup> Research from as early as 2003 shows that increased online shopping, gaming, and research were associated with increased depression among adolescents.<sup>23</sup> Social media can lead youth who feel lonely to compensate by engaging in passive internet use, such as scrolling through other people's accounts, leading to increased feelings of inadequacy.<sup>24</sup> It is plausible that depression can cause children to overuse the internet in order to cope with their feelings.<sup>25</sup>

## ADHD

ADHD affects up to 10% of children worldwide, and they may be more likely to engage in problematic media use habits.<sup>26</sup> Because ADHD is linked to issues of attention, impulsivity, and hyperactivity, youth who suffer with this disorder are often drawn to the comparatively manageable domain of the internet and may struggle to regulate their use.<sup>27</sup> Some children with ADHD cope with diminished social abilities or academic difficulties by distracting and soothing themselves with interactive media.<sup>28</sup> As a result, ADHD is one of the most prevalent comorbidities of PIMU.<sup>29</sup> Children with attention problems commonly gravitate toward excessive gaming,<sup>30</sup> and those with impulsive or hyperactive tendencies are more likely than neurotypical children to react in anger, crying, or violence when asked to stop playing.<sup>31</sup> Recent research has raised the concern that interactivity and reflexive reactivity on mobile media may contribute to the development of ADHD symptoms among adolescents.<sup>32</sup>

## Social anxiety disorders

Children may avoid experiencing strong emotions such as anxiety or depression by immersing themselves in interactive

media.<sup>33</sup> Youth with social anxiety disorders may be particularly vulnerable and have been shown to engage in PIMU.<sup>34</sup> Digital communication through text or social media presents socially anxious adolescents with a more "arm's length" form of interaction, and anxious children may develop problematic use habits due to feeling more comfortable and in control of these online, nonverbal conversations.<sup>35</sup> Gaming and social media specifically seem to offer effective methods of emotional escape because they allow youth to share their negative emotions and experiences with others online, whereas they might not be as comfortable sharing this information with peers face-to-face.<sup>36</sup> This form of coping has the potential to affect real-life social interactions.<sup>37</sup> Socially anxious youth who are online may struggle with building and keeping relationships, academic performance, or cyberbullying.<sup>3</sup>

## Sleep disorders

Sleep deprivation and disturbances are often the first symptom of problematic, pathological, or even general computer use, across age, gender, nationality, and PIMU subtype.<sup>38–40</sup> Nocturnal interactive media use has been shown to affect the sleep habits of adolescents as increased screen time contributes to insomnia, including an inability to fall and stay asleep.<sup>41–44</sup> Research has indicated a bidirectional relationship, with sleep disturbances predicting screen media overuse, and screen media overuse predicting sleep disturbances.<sup>42,44</sup> One study from 2014 indicates that gaming at night leads children to struggle with sleep onset, duration, and efficiency.<sup>45</sup> Another from 2018 suggests that excessive internet use, social messaging, television, and gaming are all linked to problematic sleeping, which in turn increases vulnerability to emotion dysregulation and can result in depressive symptoms.<sup>46</sup> Adolescents might experience fewer hours of sleep when they stay up later to communicate via text or social media and keep their phones at their bedside to receive and respond to messages.<sup>47</sup>

## ASD

Youth with ASD typically spend more time using digital media than those without; one survey found that adolescents with ASD spent at least 4.5 hrs per day on screens, compared to their typically developing siblings who spent 3.1 hrs per day on screens.<sup>48</sup> Children with ASD game for an hour more on average than neurotypical children, and similar to those with ADHD, youth with ASD may struggle to control their time engaging with digital media, responding angrily or emotionally when asked to stop.<sup>49,50</sup>

Autistic girls and boys can display a unique aptitude for technology, which has been used effectively in education and intervention.<sup>51</sup> Due to possible social skill deficits such as the inability to make eye contact, children with ASD often find in-person socialization difficult, yet 64% do not use digital media for social interaction.<sup>50</sup> They often have interest in interpersonal connection, but may lack the ability to effectively socialize, putting them at risk for PIMU as online chatting and gaming might provide a less threatening way to socialize.

## Assessment and treatment

Mental health providers have been encouraged to assess their patients' media habits in general exams,<sup>52</sup> and the American Academy of Pediatrics (AAP) has recommended screening pediatric patients for media use since the 1990s.<sup>53</sup> However, limiting screen use is not as straightforward as it was when the AAP recommended maximum of 2 hrs television viewing per day.<sup>54</sup> As educational technology has replaced traditional print textbooks, limiting children to a certain amount of "quality educational screen time" is becoming more difficult-to-quantify. A key to early intervention is the involvement of informed providers, clinicians, educators, and parents who remain current on their knowledge of these emerging issues.<sup>52</sup> Clinicians have to identify, assess, and care for patients struggling with PIMU, but medical and mental health communities at large have not yet come to a consensus on concrete diagnostic criteria.

Teaching medical and mental health providers how to identify PIMU is valuable to make appropriate referrals for therapy by a knowledgeable and experienced mental health professional as well as to treat patients under their care. While limited intervention research has been conducted, effective treatment can address both dysfunctional interactive media behaviors and underlying conditions that gave rise to those behaviors.<sup>55</sup> One way to treat adolescents suffering from PIMU is to help increase patients' coping skills in order to manage their emotional dysregulation. The ultimate objective is for children and adolescents who have struggled with PIMU to resume their developmental trajectory toward physical health, psychosocial stability, and cognitive productivity.

## Cognitive behavioral therapy (CBT)

CBT is one of the first empirically validated treatment interventions that has been adapted to target problematic internet use in the United States.<sup>56</sup> CBT was originally

developed on the foundation that "thoughts determine feelings," and aims to help patients monitor and control their behaviors.<sup>57,58</sup> CBT teaches patients both how to identify and avoid their triggers and to learn new coping strategies so they can begin to limit unhealthy habits and emotions.<sup>59</sup>

Technology has become integral to individuals' daily lives; CBT encourages behavior change to teach moderate internet use instead of abstinence.<sup>60</sup> A recent meta-analysis highlighted that CBT can be effectively delivered in either an individual or group format for those adolescents struggling with gaming issues.<sup>61</sup> Preliminary results from a 2013 assessment of psychiatric treatments for internet overuse reveal that CBT is most effective for decreasing depression and screen time.<sup>62</sup> The versatility of the intervention is reinforced with the success of CBT use over 15 group sessions<sup>63</sup> and eight individual sessions,<sup>64,65</sup> where all found significant improvements in symptoms related to IA. Another individual study of 30 male adolescents in Spain with online gaming problems reported fewer symptoms and less diagnostic criteria for IGD after undergoing CBT.<sup>66</sup> The study split the participants into two groups where one involved psychoeducation for the patients' parents. In that subgroup, drop-out rates were significantly lower during the treatment, suggesting that family involvement will yield a more successful outcome in therapy. In the work by Santos et al (2016),<sup>67</sup> adult patients with comorbid IA and anxiety underwent CBT and in a follow-up, showed significantly reduced anxiety symptoms. In a 2016 study, a virtual reality therapy (VRT) program for online gaming addiction was found to be similar to CBT in reducing the severity of online gaming addiction.<sup>68</sup> Resting-state functional magnetic resonance imaging (rsfMRI) has also shown that CBT is effective. One study of 26 IGD subjects who received rsfMRI scans and clinical assessments after undergoing CBT showed that the time spent gaming weekly was significantly shorter, concluding that CBT could regulate the abnormal low-frequency fluctuations in prefrontal-striatal regions in IGD subjects and could improve IGD-related symptoms.<sup>69</sup>

## CBT-IA

A revised form of CBT known as CBT-IA developed by Dr. Kimberly Young has been created specifically for "Internet Addiction" (IA). CBT-IA involves a three-step process of Behavioral Modification, Cognitive Restructuring, and Harm Reduction Therapy (HRT). This variation of CBT helps patients identify and control internet habits, change



mentalities that may lead to or permit IA, and treat possible underlying mental health issues.<sup>57</sup> In a 2013 trial of CBT-IA, 95% of participants who received 12 weeks of therapy could effectively manage their internet use immediately afterward, and 78% continued to regulate their internet use for at least six months.<sup>65</sup> Although CBT-IA was designed for IA and suggests that internet use is addictive, this approach addresses the various symptoms associated with excessive interactive media use.

## Dialectical behavior therapy (DBT)

DBT is a comprehensive form of CBT originally formulated to treat Borderline Personality Disorder, a disorder of emotional dysregulation. The theoretical basis for DBT is that patients develop symptoms because of both patient-specific biological susceptibility traits, such as impairments in self-regulation, and repeated exposure to invalidating environments. DBT helps target disorders that occur when emotional issues are exacerbated by external factors.<sup>70</sup> Because many engaging in PIMU do so to manage or avoid strong emotions, DBT may be a viable treatment option. More specifically, those youth who struggle with PIMU due to emotional dysregulation combined with outside “invalidation” may be particularly good candidates for DBT.<sup>71</sup> Practical research on the effect of DBT on PIMU has yet to be conducted, but anecdotal evidence suggests promise.

Certain skill modules of DBT to help with PIMU include Mindfulness Skills, aimed at increasing the patient’s ability to be conscious of experienced feelings, thoughts, and urges, thus allowing the patient to make decisions effectively; Distress Tolerance Skills, which provide alternative coping strategies and encourage reduction in media use; Interpersonal Effectiveness Skills to increase self-respect and assertiveness and to reduce conflict; Emotion Regulation Skills, teaching patients to observe and identify a wide range of emotions, to understand the function of emotions, to increase positive emotions, and to let go of unwanted emotions; and Dialectics Walking the Middle Path, which teaches the patient to think and act dialectically, avoid black-and-white thinking, and find a “middle path” or a balance between acceptance and change.

## Group therapy

Group therapy can also be an effective treatment for PIMU, especially for teens. A group setting improves interpersonal communication skills, enhances social engagement, and creates a support network that leads individuals to be motivated by their peers.<sup>68,72,73</sup>

According to a 2017 meta-analysis of IA treatment methods for Korean adolescents, group sizes of 9–12 people usually result in the most favorable outcomes.<sup>74</sup> It is easier for them to open up and change their behaviors when they feel support from both the group leader and group members.<sup>72</sup> A Chinese study of group therapy for adolescents aged 12–17 struggling with IA showed that while internet use decreased in both the intervention group and control group, the intervention group also experienced significant changes in common symptoms of PIMU, decreases in anxiety and hyperactive and inattentive behaviors, and realized improvements in emotion regulation and peer relationships.<sup>75</sup> This study included parent training in how to recognize and meet their children’s psychological needs, communicate more effectively, and manage adolescents with PIMU.<sup>75</sup>

Parent training is an important part of the multi-modal intervention because family dynamics, specifically parenting style, influence the development of PIMU.<sup>76,77</sup> Interviewing caregivers of teens also often reveals critical information about a youth’s online behavior and the family’s technology policies.<sup>52</sup> Multi-family group therapy has been shown to significantly reduce internet addiction for adolescents compared to those who do not receive this treatment.<sup>78</sup> Improved parent–child communication and need satisfaction were both associated with the decrease in IA in adolescents aged 12–18.<sup>78</sup> In a Hong Kong study of IA treatment, family therapy was used as a part of a multidimensional treatment approach in both early (ages 11–15) and late adolescence (ages 16–18).<sup>79</sup> Results showed that treatment for IA that involves family-based counseling can lead to a reduction in symptoms, improved family functioning, and increased ability of the adolescent to deal with their own problems.<sup>79</sup>

## Multidimensional treatment

As with many behavioral disorders, a combination of therapeutic strategies, along with motivational enhancement, medication, and addressing educational accommodations and social influences optimizes effectiveness in treating PIMU. PIMU patients frequently struggle with emotional dysregulation due to anxiety, depression, or other mental health issues. One study in Korea used a group therapy format with CBT to treat 17 students who overused internet. Mean internet daily usage before the program was 4.75 hrs; after the program, it was 2.77 hrs.<sup>80</sup> A study in Brazil found effective treatment of anxiety disorder and IA with a combination of CBT and medication.<sup>67</sup> Multidimensional treatment

with MI and family therapy was shown to decrease over-active media use among Chinese patients.<sup>79</sup>

## Discussion

Primary care providers, mental health providers, educators, and parents are responsible for managing youth use of interactive media without evidence-based guidelines, making prevention and early intervention so important. Because screen use is now so ubiquitous, it is easy to miss the early warning signs of PIMU and to seek treatment only when media use has disrupted an adolescent's ability to engage in typical daily life. Clinicians can rely on the evidence presented throughout this review in order to identify some of the more common signs and symptoms of adolescent patients who might be struggling with their media use, assessing patients using a detailed clinical interview with the patient and caregiver(s) (when appropriate). Clinicians can also take into consideration any previous mental health and educational assessments, the impact of the media use on the patient's daily life, family functioning, social functioning, school functioning, physical functioning, and past or current treatment. Additionally, an important part of the evaluation is to assess for co-morbid emotional, behavioral, or learning problems that may contribute to the development or ongoing experience of PIMU. See Table 1 for a summary guide to the assessment of PIMU in adolescents.

Once the clinician evaluates all of these data, it is useful to develop a comprehensive formulation that includes any appropriate categorical diagnoses as defined by the DSM-5, a dimensional understanding of the patient's strengths and difficulties, and a biopsychosocial formulation of the PIMU process. While pharmacological treatment may be a part of a PIMU patient's treatment plan, DBT and CBT have proven to have the ability to target underlying behaviors and thoughts of PIMU that cause distress or harm. On a similar note, CBT may also be more equipped to address comorbid conditions as depression, attention deficits, anxiety, and sleep disorders.

## Conclusion

PIMU is an environmental health condition of the Digital Age. Problematic use of interactive media – games, social media, pornography, or endless visual and textual information – can affect any child or adolescent, potentially impairing their physical, mental, and/or social health in profound ways. PIMU may be prevented through introducing and monitoring the use of interactive media so that children and adolescents use them mindfully, in balanced ways, and remain present

**Table 1** Assessment of adolescent with problematic interactive media use disorder

<p><b>History of present illness</b></p> <ul style="list-style-type: none"> <li>• Define the specific behavior, duration, intensity, and frequency</li> <li>• Identify symptoms of current behavior and how it is interfering in functioning</li> <li>• Identify specific areas of functioning that are impacted by screen media use including: interpersonal, family relationships, sleep, academic performance, physical health, isolation and mood lability</li> </ul>
<p><b>Past mental health/physical health history</b></p> <ul style="list-style-type: none"> <li>• Review all former and current symptoms, diagnoses, and treatments</li> </ul>
<p><b>Social and developmental history</b></p> <ul style="list-style-type: none"> <li>• Review developmental milestones</li> <li>• Review academic history including 504 plans</li> <li>• Review social history</li> <li>• Review family history</li> </ul>
<p><b>Function of the behavior</b></p> <ul style="list-style-type: none"> <li>• Identify what the function of the behavior is for the patient</li> <li>• Avoidance, boredom, negative affect management, emotion regulation, and socialization</li> </ul>

with family, friends, and the rich diversity of experience that life offers. Identification, assessment and treatment for PIMU are essential in helping to restore young people to healthy developmental trajectories.

We still have much to learn about PIMU, in part because of the ever-changing convergence and divergence of the dynamic systems of child, technology, and human behavior. Academic medical centers are actively working to characterize problematic screen media use issues, to develop and evaluate treatment strategies, to educate the public about prevention, and to train clinicians to recognize and care for PIMU. With the appropriate research and training, providers will develop the skills to manage PIMU and other health challenges of the digital age. Although this paper was limited to comorbidities, assessment, and treatment, future directions may include systematic reviews focused on identifying cognitive and personality risk factors that contribute to the development of PIMU. In addition, future research is needed to elucidate the impact of PIMU across the developmental lifespan and the long-term sequelae.

## Disclosure

Emily Pluhar, Jill R Kavanaugh and Michael Rich are all affiliated with the Clinic for Interactive Media and Internet Disorders (CIMAID) at Boston Children's Hospital. The authors report no other conflicts of interest in this work.

## References

- American Psychiatric Association. *Internet gaming disorder*. Washington, D.C.: American Psychiatric Association; 2013. Available from: [https://www.psychiatry.org/File%20Library/Psychiatrists/Practice/DSM/APA\\_DSM-5-Internet-Gaming-Disorder.pdf](https://www.psychiatry.org/File%20Library/Psychiatrists/Practice/DSM/APA_DSM-5-Internet-Gaming-Disorder.pdf). Accessed March 13, 2019.
- World Health Organization. Gaming disorder. [cited January 1, 2018]. Available from: <http://www.who.int/features/qa/gaming-disorder/en/>. Accessed March 13, 2019.
- Rich M, Tsappis M, Kavanaugh JR. Problematic interactive media use among children and adolescents: addiction, compulsion, or syndrome? In: Young K, Nabuco de Abreu C, editors. *Internet Addiction in Children and Adolescents: Risk Factors, Assessment, and Treatment*. New York (NY): Springer Publishing Company, LLC; 2017:3–28.
- National Institute of Mental Health (NIMH). Brain basics. [cited April 1, 2012]. Available from: <https://newsinhealth.nih.gov/2012/04/brain-basics>. Accessed March 13, 2019.
- Brand M, Young KS, Laier C. Prefrontal control and internet addiction: a theoretical model and review of neuropsychological and neuroimaging findings. *Front Hum Neurosci*. 2014;8:375–388. doi:10.3389/fnhum.2014.00375
- Anderson M, Jiang J. *Teens, social media & technology 2018*. Washington, D.C.: Pew Research Center; 2018. Available from: [http://www.pewinternet.org/wp-content/uploads/sites/9/2018/05/PI\\_2018.05.31\\_TeensTech\\_FINAL.pdf](http://www.pewinternet.org/wp-content/uploads/sites/9/2018/05/PI_2018.05.31_TeensTech_FINAL.pdf). Accessed March 13, 2019.
- Lenhart A. *Teens, social media & technology overview 2015*. Washington, D.C.: Pew Research Center; 2015. Available from: [http://www.pewresearch.org/wp-content/uploads/sites/9/2015/04/PI\\_TeensandTech\\_Update2015\\_0409151.pdf](http://www.pewresearch.org/wp-content/uploads/sites/9/2015/04/PI_TeensandTech_Update2015_0409151.pdf). Accessed March 13, 2019.
- Rideout V. *The common sense census: media use by tweens and teens*. Common Sense Media; 2015. Available from: [https://www.common SenseMedia.org/sites/default/files/uploads/research/census\\_researchreport.pdf](https://www.common SenseMedia.org/sites/default/files/uploads/research/census_researchreport.pdf). Accessed March 13, 2019.
- Common Sense Media. *The common sense census: media use by kids age zero to eight*. San Francisco: Common Sense Media; 2016. Available from: [https://www.common SenseMedia.org/sites/default/files/uploads/research/csm\\_zerotoeight\\_fullreport\\_release\\_2.pdf](https://www.common SenseMedia.org/sites/default/files/uploads/research/csm_zerotoeight_fullreport_release_2.pdf). Accessed October 18, 2018.
- Kabali HK, Irigoyen MM, Nunez-Davis R, et al. Exposure and use of mobile media devices by young children. *Pediatrics*. 2015;136(6):1044–1050. doi:10.1542/peds.2015-2151
- Poli R, Agrimi E. Internet addiction disorder: prevalence in an Italian student population. *Nord J Psychiatry*. 2012;66(1):55–59. doi:10.3109/08039488.2011.605169
- Wu X, Chen X, Han J, et al. Prevalence and factors of addictive internet use among adolescents in Wuhan, China: interactions of parental relationship with age and hyperactivity-impulsivity. *PLoS One*. 2013;8(4):e61782. doi:10.1371/journal.pone.0061782
- Shek DTL, Yu L. Adolescent internet addiction in Hong Kong: prevalence, change, and correlates. *J Pediatr Adolesc Gynecol*. 2016;29(Suppl 1):S22–S30. doi:10.1016/j.jpag.2015.10.005
- Sussman CJ, Harper JM, Stahl JL, Weigle P. Internet and video game addictions: diagnosis, epidemiology, and neurobiology. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):307–326. doi:10.1016/j.chc.2017.11.015
- Young KS. Internet addiction: the emergence of a new clinical disorder. *Cyberpsychol Behav*. 1998;1(3):237–244. doi:10.1007/s10899-011-9287-4
- King DL, Haagsma MC, Delfabbro PH, Gradisar M, Griffiths MD. Toward a consensus definition of pathological video-gaming: a systematic review of psychometric assessment tools. *Clin Psychol Rev*. 2013;33(3):331–342. doi:10.1016/j.cpr.2013.01.002
- Andreassen CS, Torsheim T, Brunborg GS, Pallesen S. Development of a Facebook addiction scale. *Psychol Rep*. 2012;110(2):501–517. doi:10.2466/02.09.18.PR0.110.2.501-517
- Kraus SW, Meshberg-Cohen S, Martino S, Quinones LJ, Potenza MN. Treatment of compulsive pornography use with Naltrexone: a case report. *Am J Psychiatry*. 2015;172(12):1260–1261. doi:10.1176/appi.ajp.2015.15060843
- World Health Organization. *Public health implications of excessive use of the internet, computers, smartphones and similar electronic devices: meeting report*. Geneva: World Health Organisation; 2014. Available from: [http://apps.who.int/iris/bitstream/handle/10665/184264/9789241509367\\_eng.pdf?sequence=1&isAllowed=y](http://apps.who.int/iris/bitstream/handle/10665/184264/9789241509367_eng.pdf?sequence=1&isAllowed=y). Accessed March 13, 2019.
- Gundogar A, Bakim B, Ozer OA, Karamustafalioglu O. P-32 – the association between internet addiction, depression and ADHD among high school students. *Eur Psychiatry*. 2012;27(Suppl1):1–2. doi:10.1016/S0924-9338(12)74199-8
- Thom RP, Bickham DS, Rich M. Internet use, depression, and anxiety in a healthy adolescent population. *JMIR Mhealth Uhealth*. 2018;6(5):e116. doi:10.2196/mhealth.8471
- Leménager T, Hoffmann S, Dieter J, Reinhard I, Mann K, Kiefer F. The links between healthy, problematic, and addicted internet use regarding comorbidities and self-concept-related characteristics. *J Behav Addict*. 2018;7(1):31–43. doi:10.1556/2006.7.2018.13
- Morgan C, Cotten SR. The relationship between internet activities and depressive symptoms in a sample of college freshmen. *Cyberpsychol Behav*. 2003;6(2):133–142. doi:10.1089/109493103321640329
- Belfort EL, Miller L. Relationship between adolescent suicidality, self-injury, and media habits. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):159–169. doi:10.1016/j.chc.2017.11.004
- McNicol ML, Thorsteinsson EB. Internet addiction, psychological distress, and coping responses among adolescents and adults. *Cyberpsychol Behav Soc Netw*. 2017;20(5):296–304. doi:10.1089/cyber.2016.0669
- Ceranoglu TA. Inattention to problematic media use habits: interaction between digital media use and attention-deficit/hyperactivity disorder. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):183–191. doi:10.1016/j.chc.2017.11.009
- Kietglaiwansiri T, Chonchaiya W. Pattern of video game use in children with ADHD and typical development. *Pediatr Int*. 2018;60(6):523–528. doi:10.1111/ped.13564
- Peeters M, Koning I, van Den Eijnden R. Predicting internet gaming disorder symptoms in young adolescents: a one-year follow-up study. *Comput Human Behav*. 2018;80:255–261. doi:10.1016/j.chb.2017.11.008
- Bozkurt H, Coskun M, Ayaydin H, Adak I, Zoroglu SS. Prevalence and patterns of psychiatric disorders in referred adolescents with internet addiction. *Psychiatry Clin Neurosci*. 2013;67(5):352–359. doi:10.1111/pcn.12065
- Chou WJ, Liu TL, Yang P, Yen CF, Hu HF. Multi-dimensional correlates of internet addiction symptoms in adolescents with attention-deficit/hyperactivity disorder. *Psychiatry Res*. 2015;225(1–2):122–128. doi:10.1016/j.psychres.2014.11.003
- Bioulac S, Arfi L, Bouvard MP. Attention deficit/hyperactivity disorder and video games: a comparative study of hyperactive and control children. *Eur Psychiatry*. 2008;23(2):134–141. doi:10.1016/j.eurpsy.2007.11.002
- Ra CK, Cho J, Stone MD, et al. Association of digital media use with subsequent symptoms of attention-deficit/hyperactivity disorder among adolescents. *Jama*. 2018;320(3):255–263. doi:10.1001/jama.2018.8931
- Glover J, Fritsch SL. #kidsanxiety and social media: a review. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):171–182. doi:10.1016/j.chc.2017.11.005
- Prizant-Passal S, Shechner T, Aderka IM. Social anxiety and internet use – a meta-analysis: what do we know? What are we missing?. *Comput Human Behav*. 2016;62:221–229. doi:10.1016/j.chb.2016.04.003



35. Lee-Won RJ, Herzog L, Park SG. Hooked on facebook: the role of social anxiety and need for social assurance in problematic use of Facebook. *Cyberpsychol Behav Soc Netw*. 2015;18(10):567–574. doi:10.1089/cyber.2015.0002
36. Laghi F, Schneider BH, Vitoroulis I, et al. Knowing when not to use the internet: shyness and adolescents' on-line and off-line interactions with friends. *Comput Human Behav*. 2013;29(1):51–57. doi:10.1016/j.chb.2012.07.015
37. Caplan SE. Relations among loneliness, social anxiety, and problematic internet use. *Cyberpsychol Behav*. 2007;10(2):234–242. doi:10.1089/cpb.2006.9963
38. An J, Sun Y, Wan Y, Chen J, Wang X, Tao F. Associations between problematic internet use and adolescents' physical and psychological symptoms: possible role of sleep quality. *J Addict Med*. 2014;8(4):282–287. doi:10.1097/ADM.0000000000000026
39. King DL, Delfabbro PH, Zwaans T, Kaptzis D. Sleep interference effects of pathological electronic media use during adolescence. *Int J Ment Health Addict*. 2014;12(1):21–35. doi:10.1007/s11469-013-9461-2
40. Nuutinen T, Roos E, Ray C, et al. Computer use, sleep duration and health symptoms: a cross-sectional study of 15-year olds in three countries. *Int J Public Health*. 2014;59(4):619–628. doi:10.1007/s00038-014-0561-y
41. Hale L, Kirschen GW, LeBourgeois MK, et al. Youth screen media habits and sleep: sleep-friendly screen behavior recommendations for clinicians, educators, and parents. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):229–245. doi:10.1016/j.chc.2017.11.014
42. Chen YL, Gau SSF. Sleep problems and internet addiction among children and adolescents: a longitudinal study. *J Sleep Res*. 2016;25(4):458–465. doi:10.1111/jsr.12388
43. Drescher AA, Goodwin JL, Silva GE, Quan SF. Caffeine and screen time in adolescence: associations with short sleep and obesity. *J Clin Sleep Med*. 2011;7(4):337–342. doi:10.5664/JCSM.1182
44. Choi K, Son H, Park M, et al. Internet overuse and excessive daytime sleepiness in adolescents. *Psychiatry Clin Neurosci*. 2009;63(4):455–462. doi:10.1111/j.1440-1819.2009.01925.x
45. Ceranoglu TA. Video games and sleep: an overlooked challenge. *Adolesc Psychiatry*. 2014;4(2):104–108. doi:10.2174/221067660402140709121827
46. Li XS, Buxton OM, Lee S, Chang A, Berger LM, Hale L. 0803 Insomnia symptoms and sleep duration mediate the association between adolescent screen time and depressive symptoms. *Sleep*. 2018;41(Suppl1):A298–A298. doi:10.1093/sleep/zsy061.802
47. Fuller C, Lehman E, Hicks S, Novick MB. Bedtime use of technology and associated sleep problems in children. *Glob Pediatr Health*. 2017;4:2333794X17736972. doi:10.1177/2333794X17736972
48. Gwynette MF, Sidhu SS, Ceranoglu TA. Electronic screen media use in youth with autism spectrum disorder. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):203–219. doi:10.1016/j.chc.2017.11.013
49. Healy S, Haegele JA, Grenier M, Garcia JM. Physical activity, screen-time behavior, and obesity among 13-year olds in Ireland with and without autism spectrum disorder. *J Autism Dev Disord*. 2017;47(1):49–57. doi:10.1007/s10803-016-2920-4
50. Mazurek MO, Wenstrup C. Television, video game and social media use among children with ASD and typically developing siblings. *J Autism Dev Disord*. 2013;43(6):1258–1271. doi:10.1007/s10803-012-1659-9
51. Grynspan O, Weiss PL, Perez-Diaz F, Gal E. Innovative technology-based interventions for autism spectrum disorders: a meta-analysis. *Autism*. 2014;18(4):346–361. doi:10.1177/1362361313476767
52. Carson NJ, Gansner M, Khang J. Assessment of digital media use in the adolescent psychiatric evaluation. *Child Adolesc Psychiatr Clin N Am*. 2018;27(2):133–143. doi:10.1016/j.chc.2017.11.003
53. Committee on Public Education. Media education. *Pediatrics*. 1999;104(2):341–343.
54. Committee on Communications. Children, adolescents, and television. *Pediatrics*. 1995;96(4):786–787. doi:10.1542/peds.107.2.423
55. Pezoa-Jares R, Espinoza-Luna I, Vasquez-Medina J. Internet addiction: a review. *J Addict Res Ther*. 2012;S6(004). doi:10.4172/2155-6105.S6-004
56. Ladika S. Technology addiction. *CQ Researcher*. 2018;28:341–364.
57. Young KS. Cbt-ia: the first treatment model for internet addiction. *J Cogn Psychother*. 2011;25(4):304–312.
58. Beck JS. *Cognitive Behavior Therapy: Basics and Beyond*. New York and London: Guilford; 2011.
59. Hollon SD, Beck AT. Cognitive and cognitive-behavioral therapies. In: *Handbook of Psychotherapy and Behavior Change*. 4th ed. Oxford and England: John Wiley & Sons; 1994:428–466.
60. Davis RA. A cognitive-behavioral model of pathological internet use. *Comput Human Behav*. 2001;17(2):187–195. doi:10.1016/S0747-5632(00)00041-8
61. Stevens MWR, King DL, Dorstyn D, Delfabbro PH. Cognitive-behavioral therapy for internet gaming disorder: a systematic review and meta-analysis. *Clin Psychol Psychother*. 2019;26(2):191–203. doi:10.1002/cpp.2341
62. Winkler A, Dorsing B, Rief W, Shen Y, Glombiewski JA. Treatment of internet addiction: a meta-analysis. *Clin Psychol Rev*. 2013;33(2):317–329. doi:10.1016/j.cpr.2012.12.005
63. 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 Res Int*. 2014;2014:425924. doi:10.1155/2014/425924
64. Young KS. Cognitive behavior therapy with internet addicts: treatment outcomes and implications. *Cyberpsychol Behav*. 2007;10(5):671–679. doi:10.1089/cpb.2007.9971
65. Young KS. Treatment outcomes using CBT-IA- with internet-addicted patients. *J Behav Addict*. 2013;2(4):209–215. doi:10.1556/JBA.2.2013.4.3
66. González-Bueso V, Santamaría JJ, Fernández D, et al. Internet gaming disorder in adolescents: personality, psychopathology and evaluation of a psychological intervention combined with parent psychoeducation. *Front Psychiatry*. 2018;9:787. doi:10.3389/fpsyg.2018.00787
67. Santos VA, Freire R, Zugliani M, et al. Treatment of internet addiction with anxiety disorders: treatment protocol and preliminary before-after results involving pharmacotherapy and modified cognitive behavioral therapy. *JMIR Res Protoc*. 2016;5(1):e46. doi:10.2196/resprot.5278
68. Park SY, Kim SM, Roh S, et al. The effects of a virtual reality treatment program for online gaming addiction. *Comput Methods Programs Biomed*. 2016;129:99–108. doi:10.1016/j.cmpb.2016.01.015
69. Han X, Wang Y, Jiang W, et al. Resting-state activity of prefrontal-striatal circuits in internet gaming disorder: changes with cognitive behavior therapy and predictors of treatment response. *Front Psychiatry*. 2018;9:341. doi:10.3389/fpsyg.2018.00341
70. Linehan M. *Cognitive-Behavioral Treatment of Borderline Personality Disorder*. New York (NY): Guilford press; 1993.
71. Miller AL, Rathus JH, DuBose AP, Dexter-Mazza ET, Goldklang AR. Dialectical behavior therapy for adolescents. In: Dimeff L, Koerner K, editors. *Dialectical Behavior Therapy in Clinical Practice: Applications across Disorders and Settings*. New York (NY): The Guilford Press; 2007:245–263.
72. Kim J-U. The effect of a R/T group counseling program on the internet addiction level and self-esteem of internet addiction university students. *Int J Real Ther*. 2008;27(2):4–12.
73. Liu J, Nie J, Wang Y. Effects of group counseling programs, cognitive behavioral therapy, and sports intervention on internet addiction in East Asia: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2017;14(12). doi:10.3390/ijerph14121470



74. Chun J, Shim H, Kim S. A meta-analysis of treatment interventions for internet addiction among Korean adolescents. *Cyberpsychol Behav Soc Netw*. 2017;20(4):225–231. doi:10.1089/cyber.2016.0188
75. Du Y-S, Jiang W, Vance A. Longer term effect of randomized, controlled group cognitive behavioural therapy for internet addiction in adolescent students in Shanghai. *Aust N Z J Psychiatry*. 2010;44(2):129–134. doi:10.3109/00048670903282725
76. Xiuqin H, Huimin Z, Mengchen L, Jinan W, Ying Z, Ran T. Mental health, personality, and parental rearing styles of adolescents with internet addiction disorder. *Cyberpsychol Behav Soc Netw*. 2010;13(4):401–406. doi:10.1089/cyber.2009.0222
77. Yen JY, Yen CF, Chen CC, Chen SH, Ko CH. Family factors of internet addiction and substance use experience in Taiwanese adolescents. *Cyberpsychol Behav*. 2007;10(3):323–329. doi:10.1089/cpb.2006.9948
78. Liu QX, Fang XY, Yan N, et al. Multi-family group therapy for adolescent internet addiction: exploring the underlying mechanisms. *Addict Behav*. 2015;42:1–8. doi:10.1016/j.addbeh.2014.10.021
79. Shek DT, Tang VM, Lo CY. Evaluation of an internet addiction treatment program for Chinese adolescents in Hong Kong. *Adolescence*. 2009;44(174):359–373.
80. Sang-Hyun K, Hyeon-Woo Y, Sun-Jin J, Kyu-In J, Kina L, Min-Hyeon P. The effects of group cognitive behavioral therapy on the improvement of depression and anxiety in adolescents with problematic internet use. *J Korean Acad Child Adolesc Psychiatry*. 2018;29(2):73–79.

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