Problematic Internet Use: A General Perspective

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1 Background

Digitalization brings both benefits and risks for individuals and civil society. For children and adolescents using digital technologies, benefits include opportunities for transitioning from families to wider peer communities, harvesting positive support, expanding social consciousness, gaining new coping mechanisms, and communicating. Challenges include problems balancing time spent online and offline, negative biological, psychological, and sociological impacts, vulnerability to cyberaggression, and other digital risks. While some studies associate the frequency of Internet use with poor mental health, others find associations with positive well-being, with outcomes overall depending not simply on the amount of time spent online but on the specific motivation, quality, and pattern of use (normative vs. "addictive") [1].

Problematic Internet Use (PIU) involves diverse forms of maladaptive online activities. PIU implies diminished control over Internet use or hazardous use patterns that create unfavorable consequences for health and well-being, including neglect of normative behaviors and relationships. Children and adolescents, especially those with vulnerabilities in affective, cognitive, motivational, and interpersonal domains, have immature cognitive control and may be particularly susceptible to, and disproportionately affected by, PIU. The impact of PIU may be particularly damaging to youth by disrupting developmental steps in transition to adulthood [1, 2].

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© The Author(s) 2025
D. A. Christakis, L. Hale (eds.), *Handbook of Children and Screens*,
https://doi.org/10.1007/978-3-031-69362-5_25

2 Current State

2.1 Forms of PIU

PIU involves frequent online activity associated with marked functional impairment and/or distress. Activities can include online gaming, gambling, shopping, video-streaming, cybersex, the use of pornography, and social media [1]. Two main subtypes of PIU, generalized and specific, have been proposed. Some specific forms may be more *impulsive* (online gaming, gambling, buying/shopping, cybersex/online pornography use, social media use, video streaming) and others more compulsive (cyberchondria, cyberstalking, digital hoarding), although there is debate and overlap of addictive, impulsive, and compulsive features [2, 3]. The concept of PIU, however, remains controversial. Some have suggested that the Internet constitutes a channel for problematic or addictive behaviors [4], whereas others propose that digital platforms play active roles [5].

Balancing research evidence with public health needs, the World Health Organization introduced two specific PIU-related diagnoses into the ICD-11 category of Disorders due to Addictive Behaviors; the online forms of Gambling Disorder and Gaming Disorder [6]. Other PIU-related addictive disorders can conditionally be given an ICD-11 diagnosis as Other Specified or Unspecified Disorders due to Addictive Behaviors (sic), with online activity named as a diagnostic specifier. Such specific behaviors may include problematic online pornography viewing, shopping/buying, and social media use [7]. Definitions of other possible PIU-related disorders not yet defined in the ICD-11, such as cyberchondria and cyberbullying, have also been proposed [1].

2.2 Assessment

Recent progress has been made in refining and simplifying assessment instruments, which historically relied upon forms of the Internet Addiction Test (IAT) [8]. The Compulsive Internet Use Scale (CIUS) and its short versions are also up-to-date instruments possessing established psychometric properties validated in many languages [9]. Over 30 screening instruments have additionally been developed to assess problematic online gaming. Among them, the IGDT-10 and the IGDS9-SF present advantages, including reference to an identified nosography, robust psychometric properties, cross-cultural validation, and available cut-off points. Additional WHO efforts are presently active [10].

However, validated assessment instruments for many forms of PIU are lacking and there are methodological concerns with many existing assessment tools, including insufficient attention

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to item-response theory, validation against appropriate measures of functional impairment, and *measurement variance* across different countries and cultures [10].

2.3 Epidemiology

According to a meta-analysis, around 7% of the global population shows signs of PIU [11]. While it is too early to determine if the increased time on the Internet during the COVID-19 pandemic has resulted in a higher global PIU prevalence [12], a greater burden of PIU was found for those living in low/lower–middle-income countries, for whom higher prevalence estimates during the pandemic compared with earlier estimates have been reported [13]. Young people with existing mental health problems and specific neurodevelopmental disorders (e.g., attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD)) show increased vulnerability to PIU, linked not only to increased digital media use, but also to isolation, loneliness, financial hardship, substance misuse, anxiety, and depression, although there is considerable heterogeneity in study findings [1, 12]. However, given the heterogeneity and the relative lack of consistency in terms of the diagnostic criteria for PIU and the diversity of assessment instruments, samples, and sampling designs, prevalence estimates of PIU vary widely across different studies and should be approached with caution [12].

PIU also appears to differ between males and females. Problematic/excessive use and greater severity of *smartphone* use, social media use, and online buying–shopping have generally been associated with the female gender, whereas males may be more prone to problematic online gaming, online gambling, and online pornography use, although heterogeneity exists across studies and jurisdictions [14].

PIU is associated with co-occurring disorders, including among younger and older pediatric samples [15]. ADHD, depression, aggressive behaviors, social anxiety, obsessive-compulsive disorder (OCD), and ASD have been implicated both as candidate predictors and as consequences of PIU [16]. Other associations have variously been reported with *suicidality* [17], self-injurious behaviors [18], somatization, eating disorders, *psychoticism*, poor life skills, poor well-being, poor self-esteem, decreased physical activity and fitness, poor dietary hygiene, problems in family relationships, and loneliness [19, 20]. Problematic use of social media has also been associated with aggression, cyberbullying, fear of missing out (FOMO), and poor sleep [21].

2.4 Underpinning Mechanisms

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model [3] describes potential vulnerabilities driving the risk of PIU, their interactions with urges, impulses, and self-control, and consequences for mental health. Individual and relational factors include neurodevelopmental (ASD, ADHD), mental health (anxiety, depression, OCD, addiction), personality (affect regulation), and inhibitory control (and other executive functions) features. Societal factors include changing communication patterns and platform features, including advertising and regulation policies (e.g., minimum age limits, parental control).

For young people with ADHD and conduct disorders, *impulsivity* and positive reinforcement motivations may represent key factors, while for those with OCD and ASD, attentional inflexibility may result in difficulties disconnecting. For those with internalizing symptoms such as anxiety and depression, online activities (e.g., social media use) may be used to escape from distressing emotions (negative reinforcement motivations). However, fear of failure and body image disturbances generated by exposure to social comparisons may also induce anxiety, depressive symptoms [22], dysmorphophobia, and eating disorders, as well as an increased use (especially during the COVID-19 pandemic) of certain substances such as performance and image-enhancing drugs and related *psychopathology* [23].

Digital platforms may influence PIU via interplays between diverse social factors and types of

human interactions to which young people may be particularly attracted, including socialization, support, and entertainment [2, 4]. This is especially relevant for platforms that provide intermittent positive reinforcement, to which repeated exposure may result in increasingly compulsive online use with negative consequences. Attention-focused designs intended to generate, or possibly exploit, potentially addictive features (e.g., "likes") and conditioned responses (e.g., notifications) alongside powerful algorithm-based technologies may lead youth to stay online longer than either intended or recommended [2, 4]. These "tools" operationalized by digital platform designers may pose risks to a youth's self-management of their online behaviors by influencing/manipulating choices, opinions, or behaviors, potentially exposing them to human rights violations (e.g., risk of addictions, undermining autonomous free will, abuse of minors, trafficking, and connected liberties) [1]. Investigating the interactions of these factors over time should be prioritized to identify potentially causal relationships and risk determinants as a basis for preventative or therapeutic interventions and health and social policy changes [1, 2, 4].

Functional brain mechanisms at cognitive/affective levels, and/or changes in brain structure, may also contribute significantly to the etiology of PIU and to early identification and intervention. A meta-analysis of case-controlled studies of cognition demonstrated that PIU (broadly defined) was associated with significant reductions in inhibitory control, decision-making, and working memory. Age, gender, geographical area of reporting, or the type of predominant online behavior did not significantly moderate the observed relationships [24]. Another meta-analysis of changes in structural brain measures in PIU detected significantly reduced gray matter in the anterior *cingulate cortex* (ACC), dorsolateral prefrontal cortex (DLPFC), and *supplementary motor area* (SMA), regions linked to reward processing, habit learning, and inhibitory control [25]. Data suggests reduced functional connectivity in brain networks involved in cognitive control, executive function, motivation, and reward [26]. Taken together, findings further suggest specific brain structures and functions related to cortical inhibition of the generation and execution of reward-based responses, both in generalized PIU and specific forms like gaming disorder [2].

Because existing studies are largely cross-sectional, it remains uncertain whether these neuro-cognitive features represent a cause or consequence of PIU or both. Longitudinal studies following the progression from vulnerability to full PIU may help identify cognitive and affective risk factors and clarify the extent to which these changes can be used to discriminate against an individual at high risk of PIU, for future screening aids. The scarcity of studies employing robust controls for confounding variables such as psychiatric comorbidities [24, 25] and the limitations of standardization and validation of existing assessment tools and PIU definitions highlight the need for additional research to delineate the contributions of specific variables to the underpinning mechanisms of PIU.

2.5 Effective and Emerging Interventions for PIU

Interventional research is steadily developing but remains at an early stage, with most studies conducted in adults and few in youth. Most studies have focused on problematic gambling and gaming. Various forms of psychotherapy (mainly cognitive behavior therapy [CBT]) and to a lesser extent pharmacotherapy (mainly antidepressants and *stimulants*) have been tested in acute-phase trials, with some promising findings, particularly in relation to the short-term effects of CBT. However, while a recent study demonstrated that CBT may reduce PIU symptom severity among "at-risk" youth, reductions in the incidence of new cases have not been established [27]. Non-invasive *neurostimulation* targeting cortical brain regions involved in cognitive control and craving, using techniques such as *transcranial magnetic stimulation* and *transcranial direct current stimulation*, is also emerging as another promising area of study [28]. Overall,

there is a need for higher-quality research, including large, preregistered, randomized clinical trials, to determine efficacious and cost-effective options in PIU treatment.

3 Future Research

Many important gaps in knowledge about PIU remain outstanding, including a qualitative and quantitative understanding of the scale and impact of PIU on youth health and well-being. Child and adolescent screen time is increasing annually, but the long-term health consequences of this increase remain poorly understood [1]. Several studies associate PIU with negative biological, health, psychological, and sociological outcomes across diverse groups [2]. Reduced general quality of life in adolescence was also found to be "dose dependently" linked to PIU severity [29]. However, an accurate estimation of the global burden of PIU in general or that related to specific internet-use disorders is also sorely lacking. Few longitudinal studies exist, and most identified associations are based on cross-sectional data. As health and well-being issues can be seen as risk factors as well as outcomes of PIU, causal relationships are likely complicated [30]. To bridge existing knowledge gaps, future studies should include improved interpretation of causal relationships (with insight from longitudinal data and investigations of bi-directional relationships), address methodological weaknesses with a more unified approach to the conceptualization and assessment of PIU, include qualitative data and use of convenience sampling, and account for the wide variety of behaviors performed on the Internet.

Other key research goals include improved insight into the dynamics of PIU with reliable methods for early identification of individuals at risk for PIU, a better understanding of the course and evolution of PIU-related problems across different age groups, genders, and specific vulnerable groups, and efficacious and cost-effective preventative and therapeutic interventions that can be successfully implemented at scale.

Considering that PIU occurs within the digital environment and can be captured using digital tools, the ubiquity of smart technology, and the considerable amounts of "real-time" information they may gather through behavioral tracking techniques, which may potentially be used to make Internet use more addictive [31], (and which may also be used in online gambling and gaming disorder research to improve prevention efforts), future research harnessing smart devices is anticipated to hold promise for addressing specific research questions. Given the amount of time spent on smartphones and inaccuracies in recalling personal digital media use, the use of digital technologies to identify PIU may prove of particular benefit to adolescents. By enabling the characterization of "digital phenotypes" underlying one or more forms of PIU (and thereby those individuals at elevated risk), digital technologies may also offer new opportunities for remote interventions at scale.

4 Recommendations

- Given the convergence of changing digital industries, widespread use, and youth vulnerability, it is vital to support the impetus for change to address and prevent online harms through ethical health and social policy changes.
- Developments in diagnostic criteria for PIU should be grounded in reliable data [32].
- Children's and adolescents' well-being should be central to such interventions and strategies, including improved digital literacy programs.
- Dialogue among key players (including the government and technology companies), new policy standards involving increased corporate responsibility, re-evaluation of the business models steering digital services provision, and potential regulation, including that of transnational technology companies, are also needed to ensure a nurturing digital environment.
- Globally, wide variations exist in the range and scope of regulatory, public, and clinical health policies and models. As observed with

other potentially health-harming industries (e.g., gambling), increased regulation or perceived market penetration in some jurisdictions may result in greater commercial exploitation of low- and middle-income countries. Therefore, pragmatic, equitable, and inclusive global solutions are needed.

- Stakeholders have called for governmental regulation underpinned by international law vis-a-vis children's rights in the digital environment, requiring technology companies to ensure age-appropriate design safeguards for all services likely to be accessed by children [33], and including clear criteria for enforcement. While some regulatory initiatives are underway (e.g., the European Commission Digital Services Act), the extent to which young people at risk of PIU can be safeguarded will depend on international standards governing the day-to-day practices of digital service providers, the transparency of corporate behavior, and the effectiveness of available remedies, including digital literacy programming.

Conflict of Interest and Funding Disclosure ZD's contribution was supported by the Hungarian National Research, Development, and Innovation Office (KKP126835). ZD also acknowledges that the University of Gibraltar receives funding from the Gibraltar Gambling Care Foundation, an independent, not-for-profit charity, and the ELTE Eötvös Loránd University receives funding from Szerencsejáték Ltd. (the gambling operator of the Hungarian government) to maintain a telephone helpline service for problematic gambling. NF has held research grants paid to her institution by UK Research and Innovation, UK National Institute for Health Research, COST Action, Orchard, received payment for lecturing from the Global Mental Health Academy and participated as an investigator in a study supported by Compass Pathways.

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