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Non-substance Addictive Behaviors in Youth: Pathological Gambling and Problematic Internet Use

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Introduction

Despite differences with respect to their respective histories, gambling and internet use may share similarities with respect to representing two behaviors in which adolescents routinely participate. This manuscript will review youth participation in gambling and internet use, describe when such participation may become problematic, and summarize current prevention and treatment strategies for pathological gambling (PG) and problematic internet use (PIU) in youth.

Definitions

Gambling and internet use exist as a spectrum of behaviors ranging from abstinence to recreational participation to problematic engagement, with the extreme end including the disorders of PG and PIU. How PG and PIU are defined in adolescents has significant implications for prevalence estimates in this group. Currently, there exists variability across studies that measure the prevalence of these disorders in youth, with differences in how these problems are defined and measured thought to contribute to the observed variability. There exist formal diagnostic criteria for PG in the DSM-IV-TR that states an individual with PG must have at least five inclusionary criteria reflective of impaired control over gambling behaviors that are associated with significant life disruption and/or negative psychosocial impact (American Psychiatric Association). PG typically involves strong motivations to engage in gambling, with elements of withdrawal and craving representing similarities with substance dependence reflected in the diagnostic criteria for the disorders. Researchers have proposed a number of subtypes of problem gambling based on a pathways

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model that identifies individuals as behaviorally conditioned, emotionally vulnerable, or antisocial impulsive¹. These proposed adult-based definitions may not necessarily apply to adolescents with PG given differences in adolescents and adults. As adults and adolescents have different roles and life experiences, PG may present and impact these groups in different ways². A recent study attempting to validate this model with adolescents yielded some mixed results³.

Arguably the most commonly used definition of PIU is based on the DSM-IV-TR definition of PG. The following definition suggests that PIU shares many features with impulse control disorders and substance dependence; PIU reflects impaired control over the “use of the internet that leads to significant psychosocial and functional impairments, and this pattern of use is not better accounted for by a primary psychiatric disorder such as mania or the physiological effects of a substance”^{4,5}. It is important to distinguish PIU from normal internet use, other Axis I disorders and compulsive-impulsive behaviors⁶. This process may prove difficult, however, as PIU may involve online gambling, internet-enabled sexual behavior, and online gaming—behaviors that exist on a spectrum from innocuous to pathological and may themselves constitute impulse control disorders. For this reason, some have described the internet as an “electronic needle” that provides an anonymous, socially connected, novel media⁷ to allow participation in impulse control disorders. It has been proposed that PIU may be sub-typed based on specific behaviors forming the focus of the PIU⁸, although systematic studies describing potential differences in the clinical characteristics of individuals with PIU segregated by these behaviors are currently lacking. There exist clinical characteristics that all forms of PIU seem to share that help to identify them as one general disorder with different manifestations. These characteristics were developed from observations largely derived from case reports of individuals with PIU, and the extent to which they represent generalizable clinically meaningful criteria warrants further investigation. The clinical characteristics include: time spent on internet exceeding 35hrs/week and longer than initially intended and planned, time distortion, compulsive behaviors, unsuccessful attempts with cessation or controlling use, deception about extent of use, utilization of the internet behavior to cope or escape problems, and preoccupation with the internet when offline^{5,6,9,10}. These PIU behaviors have been proposed to be representative of a “technological addiction” and fall under the larger category of “behavioral” addictions, which has been proposed to include PG^{11,12}. However, disorders considered “behavioral” or non-substance addictions are currently categorized in the DSM-IV-TR as impulse control disorders not elsewhere classified. The DSM-IV-TR does not currently define specific diagnostic criteria for PIU but the disorder can be diagnosed as an impulse control disorder not otherwise specified.

Forms of PG and PIU and Their Addictive Potentials

Adolescents engage in multiple forms of regulated and non-regulated gambling including cards, bets with friends, sports betting, lottery purchases, and poker playing. The forms of gambling in which individuals participate may often be dependent upon the individual’s gender, age, cultural and ethnic background, availability and accessibility. It has been proposed that forms of gambling that are continuous in nature and require an element of skill may have a stronger association with PG¹³, although others have proposed that non-strategic forms of gambling like electronic gambling (slot) machines may be more “addictive”¹⁴. Some individuals have proposed that features of electronic gambling machines (potential for rapid gambling, relatively high event frequencies, intermittent reinforcement schedules) as well as ancillary features (sounds, music, and lights) may keep people, especially adolescents, entertained and engaged^{13,15,16}. The fact that many of these machines incorporate video game technology may add to their appeal. However, a growing body of data do not uniformly indicate that specific forms of gambling have greater

addictive potential, including among adolescents^{14, 17}. While many regulated forms of gambling legally restrict minors from participation, adolescents often acknowledge gambling on both regulated and non-regulated activities for their age group^{18, 19}.

Adolescents with PIU engage in a number of internet behaviors, with common forms being gambling, internet enabled sexual behavior, and online gaming. Several large-scale studies exist for problematic online gambling and suggest that online gamblers may be more likely to have PG than offline gamblers²⁰. The internet may provide access for adolescents and young adults^{21, 22} as one study found that 25% of college students have wagered on the internet²³. It is difficult to determine the prevalence and extent of internet enabled sexual behavior (IESB), but internet pornography grosses over \$1 billion per year⁴. Online gaming may provide a social and interactive environment for adolescents, and adolescents and young adults may devote substantial time to massive multiplayer online games to the extent of neglecting important areas of life functioning⁴.

Prevalence

Although the prevalence estimates of PG and PIU are not precisely known, the disorders are believed to occur internationally and affect all ages, genders, and ethnic groups. It has been estimated that the prevalence of PG and serious problem gambling is two to four-fold higher in youth aged 12-17 years, than the prevalence in the adult population, with an additional 10-14% of adolescents considered “at risk” for developing PG later in life^{24, 25}. Studies have estimated adult prevalence of PG at 1-2%, while estimating the adolescent PG rates at 3-8%²⁶. The prevalence of gambling participation in teens may also be increasing over time with some researchers noting increases from 45% to 66%²⁷⁻²⁹, and others estimating even higher prevalences of juvenile gambling ranging up to 91% participation^{30, 31}. Some researchers contend these estimates are accurate²⁶, and others suggest these rates may be inflated and that the trajectory of prevalence estimates over time are relatively stable³². Data in support of this notion that early estimates might be inflated come from recent studies in adults in which diagnostic assessments of PG were obtained rather than relying on screening instruments (which by design are developed to over-identify possible cases minimizing the risks of false negatives) to ascertain prevalence estimates. Several large, well-controlled studies using diagnostic assessments have estimated past-year PG to range from 0.1% to 0.3%, with lifetime estimates two- to three-fold higher³³⁻³⁵. However, as subsyndromal levels of gambling have been associated with adverse measures of functioning in both adolescents and adults^{36, 37}, more research is needed to investigate the precise prevalence and clinical implications of both syndromal and subsyndromal PG.

The prevalence of PIU in adolescents is also not precisely known and may be more difficult to determine than that for PG. Inconsistent assessment instruments, lack of formal diagnostic criteria, a focus primarily on young populations, and sampling of sections of the general population complicate conclusions that can be drawn regarding the prevalence and impact of PIU. Current assessment tools include the Diagnostic Questionnaire⁵ and Internet Addiction Test³⁸, instruments whose reliability and validity have been preliminarily tested, and many other instruments whose validity and reliability have yet to be empirically validated. These tools, while helpful in identifying individuals with PIU, may not replace a formal diagnostic clinical interview^{4, 39}. Large scale offline community studies in Finland, Norway, and South Korea estimate a prevalence of PIU of 2% in adolescents^{4, 40}, and PIU is believed to represent a serious public health issue, particularly in regions of Asia including South Korea, Taiwan, and China⁴¹. Arguably the best current estimate of the prevalence of PIU comes from a study that used 4 positive indicators for internet overuse as a screening tool for PIU⁴². Aboujaoude et al. found that in a population of individuals 18yrs and older, that 0.7% had 4 positive indicators, with 3.7-13.7% having 1-3 positive indicators. The study

was interpreted to suggest that approximately 1% of the adult population may have narrow or “severe” PIU with another 4-14% possibly having problems with internet overuse. The precise estimates in adolescents warrant direct examination, and given changes in internet technologies and usage over time, longitudinal studies appear warranted.

Factors that may influence prevalence

Environmental Factors

The interaction of the environment with individual differences factors may influence the likelihood of developing PG or PIU. Some studies have suggested a link between the availability and accessibility of gambling and rates of gambling and PG^{18,43}. Some investigators have proposed that there has been an increase in overall gambling rates in conjunction with increasing gambling availability⁴⁴. In addition, new technological forms, for example internet gambling, allow for solitary and unsupervised gambling. Advertising campaigns for gambling may target youth directly or indirectly, encouraging gambling participation while utilizing names and characters popular with adolescents¹⁸. Some have predicted that internet gambling may increase ten-fold in the near future⁴⁵. The extent to which PIU, particularly amongst youth, may become more prevalent over time is difficult to predict, and direct investigation of PIU, in conjunction with factors that may be hypothesized to influence PIU, is indicated.

Social, Demographic, and Cultural Factors

Family and Peer Influences—Familial factors may significantly influence adolescent behavior¹³. There may be a widespread perception that gambling is acceptable and normal, and youths’ initial experiences with gambling may often occur within their homes⁴⁶. Parental and older sibling attitudes towards gambling may impact youth involvement, and adolescents with gambling problems are more likely to have parents who are perceived to gamble excessively, have other addictive behaviors, or participate in illegal activities^{30,47,48}. Adolescents with parents who are ambivalent about youth gambling appear to have an approximately 50% greater probability of significant gambling problems⁴³. In a recent Canadian national study, it was found that parents rated gambling least problematic among 13 potential adolescent behaviors (e.g., alcohol, drug and cigarette smoking, use, unprotected sex, etc.)⁴⁹. Peer influence also warrants consideration. Up to 44% of adolescents report having gambled because of the influence of friends⁵⁰, and, as children age, a significant venue of choice for gambling may be in their homes with friends⁴⁶. Social factors appear particularly relevant in adolescent gambling, perhaps even more so than other factors (e.g., gambling to win money) that may be more salient for older age groups⁵¹. Gambling has been reported to give children the perception of feeling older and a way to show their skills to friends⁵² and there exists a strong social learning component involved in some gambling behaviors⁵³. Overall, adolescents often view gambling as benign and less harmful than alcohol, drugs, and cigarettes⁵⁴, and youth attitudes and behavior may predict patterns of gambling in adulthood⁴⁵. Little data are available regarding family and peer influences on PIU and future studies are needed to elucidate their influence on internet behaviors.

Gender Differences—Among youth, the ratio of males to females with PG is approximately 3-5:1²⁴. Boys as compared with girls typically report higher gross wagers and increased risk taking behavior and begin gambling earlier, on more games and more often, commit more time and money to gambling, and experience more gambling related problems^{24,55}. Some have proposed this pattern to result from parents encouraging boys to participate in gambling more than girls⁵⁶, creating an environment where gambling is a significant part of male culture⁵⁷. However, gambling amongst girls is more closely linked

to symptoms of depression that amongst boys³⁷, perhaps because boys may tend to use gambling as a form of avoidance coping and an escape strategy more so than girls do⁵⁸. Amongst adults with gambling problems, men tend to have problems with “face-to-face” forms of gambling (poker, blackjack) and substance abuse problems and criminal behaviors while women have tend to develop problems with less personally interactive forms of gambling (bingo, electronic gambling machines) and are more likely to receive non-gambling related mental health services⁵⁹.

Like in PG, there is a male preponderance for PIU in adolescents. Boys as compared to girls tend to engage in computer activities associated with strong emotional-motivational states and are more likely to take part in the activities common in PIU including online games, cybersex, and gambling^{40, 60}. The gender-related differences in these behavioral syndromes suggest that there may exist different underlying motivations for participation that ultimately may require different prevention and treatment strategies.

Cultural Differences—Cultural and ethnic backgrounds have been shown to influence gambling behaviors. A study in Minnesota high-school students demonstrated that American Indians (30%) and Mexican Americans and African Americans (22%) gamble at greater weekly and daily rates than Asian and Caucasian Americans (4-5%)¹⁹. Additional studies have similarly found that Hispanic Americans, African Americans, and American Indian adolescents gamble at greater rates than Caucasian Americans^{61, 62}. Although existing studies have not directly examined cultural and ethnic differences in adolescents with respect to PIU, numerous studies and clinical reports have suggested that PIU may be a significant public health concern among specific Asian cultures.

Physiological and Personality Factors—There is evidence to suggest that individual physiological and personality characteristics may predispose some individuals to PG. Adolescents with PG have been found to have increased physiological resting states, greater sensation seeking, and greater arousability and excitability related to gambling¹. Youth with PG also tend to dissociate more frequently while they participate in gambling behaviors^{28, 30, 63}. Specific personality features suggest adolescent gamblers have been found to display more risk-taking behaviors^{1, 13} and score higher on measures of impulsivity⁴⁶, extroversion, and state and trait anxiety⁶⁴. They may also exhibit more self-blaming, guilt, anxiety and emotional lability⁶⁵. Gambling and/or PG among adolescents has also been shown to be associated with lower conformity and self-discipline scores³⁰ and increased frequency of attention deficit hyperactivity disorder (ADHD), conduct-related problems⁴⁸, antisocial behaviors, and alcohol and substance abuse^{48, 66, 67}. Youth with PG also have maladaptive coping skills¹ that may be an important mediating factor as adolescents use gambling to help dissociate and escape from stressful events using money simply as a means to the end goal of continued playing^{30, 58}. Although less research has been performed into physiological and personality factors associated with adolescent PIU, the disorder has also been conceptualized within a stress-coping framework^{4, 68}.

Age of Onset and Course of Disorder

The average time of first gambling experience has been reported as twelve years of age, an age considerably younger the first use of alcohol, tobacco or other drugs²⁴. Adolescents with PG usually initiate in gambling behaviors even earlier, at approximately 10 years of age, compared to peers without problematic behaviors⁶⁹. Initiation of gambling in youth has been associated with an increased likelihood of a substance use problem to begin during young adulthood⁶⁶. Age of onset has been suggested to predict more severe problems later in life⁷⁰.

Compared to adults, adolescents may progress more rapidly from social forms of gambling to PG, chase losses more consistently, and have erroneous perceptions when gambling^{53,71}. Data indicate that early signs of impulsive behavior and ADHD are associated with excessive gambling involvement in adolescence and early adulthood^{72,73}. These early signs of impulsive behavior and ADHD may also be associated with addictive behavioral syndromes like PG and PIU in adolescence and resultant adult behavior.

PIU has been reported in children as young as six years of age⁴. It has been suggested that children and adolescents may be at increased risk for developing PIU, and anecdotal evidence suggests that the time of onset of PIU from first internet use is often within the first six months, giving rise to the term, “the newbie syndrome”⁵. After an individual develops PIU, behaviors may lead to decreased offline social activities and increased depression and loneliness over the course of several years⁷⁴. PIU may represent a chronic disorder with remissions and recurrences⁷⁵, although systematic longitudinal studies to support this notion are lacking.

Neurobiology

Adolescence and Impulsivity

Impulsivity is a construct with relevance to PG and multiple other psychiatric conditions^{2,76}. Impulsivity may be conceptualized as a disturbance in reward motivation⁷⁷ and identified through risk-taking⁷⁶. Gambling involves ritualized risk-taking and, therefore, impulsive individuals may be predisposed to gambling². Impulsive individuals may fail to change risk-taking behaviors in the setting of past losses or assess risks appropriately, and thus individuals may demonstrate a lack of inhibition and a greater propensity to discount delayed rewards at an excessive rate^{2,78}.

Adolescence, as a developmental stage, has often been associated with increased impulsivity². One hypothesis regarding increased impulsivity during adolescence implicates the immaturity of the frontal cortical and subcortical monoamine systems during this developmental period^{2,65,79,80}. Such immaturity may influence decision-making to allow for optimal learning drive during this developmental period, with dopamine and serotonin representing two contributing neurotransmitters. Dopamine discharge in the striatum may act to facilitate the action of a motivated drive in association with a reward benefit: (1) in the short term as a “go signal” for a motivated drive to result in behavior; and, (2) in the long term to create neuroplastic changes underlying motivational memory and repertoire. Dopamine function within the nucleus accumbens may promote a range of motivated behaviors^{81,82,83}, with the short-term reward mechanism functioning such that events that are novel, salient, rewarding or unpredictable are identified and given behavioral responses⁸³⁻⁸⁵. Neurodevelopmental changes within cortico-striatal functioning thus may contribute to impulsivity and PG during adolescence^{2,83,85}.

Prefrontal cortical networks have been proposed to limit control motivational drives. Serotonin systems, comprised of serotonin tracts emanating from the raphe nuclei and synapsing into the prefrontal cortex, have been proposed to contribute importantly to this process^{2,80}. Central markers for serotonin are decreased in individuals with impulse control disorders including PG⁸⁶, and prefrontal cortex compromise is associated with disadvantageous decision-making and engagement in seemingly impulsive behaviors^{87,88}. In normal development, substantial changes occur in the prefrontal cortex during adolescence and this may reflect a relatively diminished ability to exhibit self-control. The combination of changes within dopamine and serotonin systems and cortico-striatal circuitry during adolescence may reflect a greater susceptibility to engagement in impulse control

disorders like PG and PIU², although longitudinal biological investigations to directly investigate this hypothesis are warranted.

Unlike PG, there are limited biological data on PIU. The neurobiology may share similarities with those for substance abuse and impulse control disorders like PG, although currently there lacks direct evidence. Some research has suggested that adolescents with PIU have higher impulsivity than controls⁸⁹, but other studies have shown mixed results. It has been proposed that internet use is a goal-directed behavior controlled by the ventral tegmental area projections to the nucleus accumbens that may become aberrantly active leading to PIU^{4, 90, 91}. One study using naltrexone, an opioid receptor antagonist, successfully treated internet enabled sexual behavior⁹². This finding seems to suggest that medication may indirectly target dopamine function in the mesolimbic dopamine, thus being helpful for a broad range of impulse control disorders including PG and PIU^{93, 94}. Individuals with PIU who demonstrate excessive online gaming show increased emotional arousal and stronger cortical reactivity in response to computer game visual cues with increased urges to play, suggesting that gaming urges/cravings may share similar biological features with substance abuse craving⁹⁵. Empirical investigations comparing these conditions are warranted to examine this hypothesis.

Comorbidities

Both PG and PIU are associated with multiple psychiatric conditions. There is a strong association of substance abuse and dependence and PG. The increased occurrence of alcohol and tobacco use in teens with PG suggests the two disorders may share a similar etiology^{96, 97}. Shared neural features have been found in association with cocaine cravings and gambling urges⁸⁶, and a twin study with alcohol and PG suggest a common genetic vulnerability⁹⁸. In addition to substance abuse, PG has also been found to be associated with psychotic disorders, internalizing disorders (forms of depression and anxiety), and personality disorders^{2, 35, 99-101}. PG has been associated with suicidal ideation and attempts¹ and behavioral problems including increased delinquent and criminal behavior, poor school performance, and disrupted family and peer relationships⁴⁸.

Although less is currently known about the pathology of PIU, it is associated with co-occurring disorders, particularly depression⁴. A quarter of adolescents with PIU experience major depression¹⁰², and up to 70% of individuals with PIU have been diagnosed with bipolar I or II at some point in their lives¹⁰³. PIU may lead to isolation and depression, and the severity of depression may be correlated with the degree of internet use. It is also hypothesized that the excessive depression may lead to PIU when internet use is used as a coping strategy⁷⁴. PIU has also been associated with ADHD. One study found that of 500 Korean students, 22.5% with PIU had ADHD, and it has been suggested that adult ADHD may be the best predictor of PIU among college students^{104, 105}. Obsessive-compulsive disorder (OCD) and other impulse control disorders have also been associated with PIU in small samples¹⁰³. PIU has also associated with heavy alcohol use in college students¹⁰⁶. PIU may occur with social phobia and is believed to contribute to heavier internet use but may not explain the compulsive pattern of use seen in PIU¹⁰³. Unlike PG, psychotic disorders appear less common in PIU.

Prevention

Many prevention strategies for PG are based on approaches used in alcohol and substance abuse prevention and utilize the concept of risk and protective factors and their resultant interaction. Risk factors for future gambling problems may include impulsivity, early age of initiation (before 12 years old), being male, prior substance misuse, low scores on measures of resiliency and poor family and school connectedness^{30, 58, 70, 107}. These factors are

associated with adolescent risk behavior in general and have been applied to PG. At this point, there is insufficient information to develop a full list of protective factors for PG, but family cohesion has been reported to be a protective factor^{54, 108}. A goal of prevention strategies involves limiting the effects of putative risk factors while enhancing resiliency through enhancing protective factors. In doing so, PG is approached through a harm-reduction and minimization strategy—typically not involving abstinence but rather promoting responsible gambling. Abstinence models prohibit youth from legally accessing regulated gambling activities, and while stricter enforcements and adherence may be required, it has already been found that many youth still access and participate in gambling with prohibitive policies in place. For this reason, it seems reasonable to target informed use and utilize Beck's approach of "just say know" (1998) rather than a "just say no" approach. Canada's prevention efforts focused at the McGill University Centre for Youth Problem Gambling and High Risk Behaviors has adopted and paved the way for a risk-protective factor model by including efforts to bring multi-media prevention programs to elementary students since reports of gambling begin early, often in children aged 9 and 10 years old^{30, 31}. It is important to consider appropriate regulation and enforcement approaches to the prevention of youth gambling by advocating informed use¹⁰⁹. For example, current adolescent opinion reflects that participating in the lottery is not gambling¹⁸ so one approach would focus on disseminating and communicating information and strategies that create more realistic understandings of and attitudes towards gambling^{110, 111}. Direct examination of the effectiveness of prevention strategies for adolescent gambling and PG is needed as substance abuse prevention programs with seemingly logical tenets have not been found to be uniformly successful¹¹².

Currently, there is a little known about the risk and protective factors in PIU making the development of an effective prevention strategy difficult. A recent study found that depression and low-family monitoring were discriminating factors for PIU in adolescents regardless of age or gender, with low connectedness to school, high family conflict, peers with habitual alcohol use, and rural living environments also associated with PIU¹¹³. These data suggest that parents might increase home monitoring of internet use and aid youth in seeking treatment for depression to help prevent PIU.

Treatment

Evidenced-based treatments for PG have been reported, with advances over the past decade seen for both pharmacological and behavioral therapies for PG^{94, 114}. However, these approaches have largely been tested in adults with PG, and relatively few studies have systematically examined their efficacies and tolerabilities in youths¹¹⁵. Challenges related to lack of perceived gambling problems amongst youth identified via screening instruments as having them in conjunction with infrequent treatment seeking further complicate the treatment of adolescent PG^{116, 117}.

Data suggest that different types of adolescent gambling might require consideration in treatment development^{1, 73, 118}. The pathways approach that defines behaviorally conditioned, emotionally vulnerable, and antisocial impulsive gamblers may have important implications for both the diagnosis and treatment of PG and suggests that a dynamic and interactive strategy that takes into account the multi-factorial nature of the disorder may be most therapeutic^{1, 65}. Direct examination of this hypothesis in both adolescent and adult samples is warranted.

Both behavioral and pharmacological treatments for adult PG have shown initial positive results in controlled trials. Behavioral approaches including cognitive behavioral therapy, motivational interviewing, brief counseling, and imaginal desensitization have all shown

initial positive results, as have attendance in self-help programs (specifically Gamblers Anonymous)^{94, 119}. However, these approaches have largely not been systematically tested in youth populations. The transtheoretical model of intentional behavioral change has also been suggested to serve as a framework for treatment paradigm of adolescent PG^{27, 120-122}. Psychopharmacological approaches using serotonin reuptake inhibitors, mood stabilizers, opioid antagonists and glutamatergic agents have shown efficacy and tolerability in controlled trials in adults with PG, albeit not uniformly with all classes⁹⁴. Precise pharmacological recommendations for adolescents must wait until controlled treatment studies are performed^{115, 123-125}. As adolescents may not actively seek treatment, outreach programs (including telephone counseling and home-based treatment manuals) have been suggested^{121, 122}. Treatment approaches should consider addressing other co-occurring or underlying psychological problems that exist in addition to PG¹²⁶, particularly as PG and other impulse control disorders may go unidentified in youth with psychiatric concerns. Although adolescence typically involves a relatively narrow range of ages (12-17 years), there is great variability in maturity and different treatments should consider their appropriateness within a developmental framework⁶⁵.

The lack of uniformly agreed upon, formalized diagnostic criteria and valid and reliable assessment instruments for PIU make designing and measuring treatment paradigms and their efficacies and tolerabilities difficult. Nonetheless, there exist a growing number of outpatient treatment services including those at the Computer Addiction Study Center at Mclean Hospital of Harvard Medical School, the Illinois institute for Addiction Recovery at Proctor Hospital, and a halfway house for adolescents with PIU in China. The goal in treatment for PIU in these programs is typically controlled use, not abstinence. Treatment for adolescents might include family based interventions, skills for parents to improve communication, and increased monitoring of internet use¹²⁷. A study of cognitive behavioral therapy utilizing a daily log in conjunction with software to restrict access showed improvement in symptoms but appeared poorly generalized⁸. Motivational interviewing utilizing the transtheoretical model of behavioral change¹²⁸ and studies using both cognitive behavioral therapy and motivational interviewing showed improvements in quality of life and depression but no significant changes in computer use behaviors⁹². Insight orient psychotherapy has also been suggested as a model for treatment. Internet support groups may also serve a role in the treatment of PIU. On-line support groups provide wide accessibility and incorporate a medium that is familiar to these individuals. The extent to which these approaches might be helpful for youth with PIU warrants direct examination in controlled trials.

Psychopharmacology has been examined in some individuals with PIU. An open label study in 19 patients given a serotonin reuptake inhibitor showed decreased time spent online, decreased impulsivity and compulsivity, and increased overall global function⁹⁰. Additionally, a case report demonstrated improvement in an online gambler with depression treated with a serotonin reuptake inhibitor¹²⁹ and atypical antipsychotics, such as quetiapine, may offer augmentation strategies⁹. Naltrexone has also been successfully used to treat three of four men with PIU. Controlled trials are indicated to determine the extent to which these medications might be helpful, and direct examination with specific age groups is indicated to examine their efficacies and tolerabilities in a developmentally informed fashion.

PG and PIU share common negative consequences including disrupted interpersonal relationships, increased delinquent and criminal behavior, poor work and school performance, and greater social isolation^{30, 130}. Future directions in treatment-focused studies should further identify specific factors that motivate individuals with PG and PIU to engage excessively in gambling and internet use, respectively. If these factors can be more

precisely defined, clinical interventions may be designed to build resiliency such that individuals susceptible to PG and PIU may be better able to cope with adversity.

Conclusions

PG and subsyndromal gambling have been shown to be associated with adverse measures of functioning in youth and older individuals. Although PIU may share similarities with PG with respect to developmental impacts, few studies, particularly longitudinal ones, have been conducted to test this hypothesis. PG and PIU represent important and potentially growing public health issues that may go unrecognized by clinicians who focus on more “visible” behaviors such as drug and alcohol abuse. Parents, educators, clinicians and public health officials should address PG and PIU in youth before they escalate. As various treatments for PG and PIU may not translate across developmental groups, direct examination of their efficacies and tolerabilities are warranted in youths. Similarly, although prevention strategies from other fields (e.g., prevention of youth risk behaviors, including substance use and abuse) may be adopted and modified for PG and PIU, direct examination of their effectiveness is needed.

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Synopsis

Adolescence is characterized by participation in multiple novel and potentially risky behaviors. Amongst these behaviors are gambling and use of the internet, and excessive engagement in these activities (as seen in pathological gambling and problematic internet use) may be accompanied by serious impairments in school, mental health and social functioning. Here we review the potential impact of pathological gambling and problematic internet use in youth, the relevance of subsyndromal levels of participation, and how prevention and treatment strategies may be considered and tested within a developmental framework.