Understanding internet addiction: a comprehensive review

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Abstract
Purpose – The purpose of this paper is to delineate the overall theoretical framework on the topic of internet addiction through the comprehensive narrative review to make readers aware of the conceptual growth and development in the respective field. The paper evolves theoretically from the historical foundation, phenomenology, clinical feature, etiological model to the treatment outcome of internet addiction. Multiple studies have been done in the field of mental health but dearth of work given head to toe theoretical overview for understanding of this trendsetter research area in mental health.
Design/methodology/approach – Extensive review of literature has been carried out to make a systematic layout for conceptual paper.
Findings – The internet has been a source of gratification for several behavioral addictions as well as psychiatric disorders. Mainly because of the lack of established diagnostic criteria and a dearth of large sample surveys, the prevalence of problematic internet use (PIU) in general population has not been established. Still, from all the consolidated data, PIU seems to have a male preponderance and manifests itself in late adulthood. Symptoms of PIU can easily be masked with signs of dependence, tolerance and withdrawal which is quite similar to the phenomenology of substance addiction. Psychiatric co-morbidities are more of a norm than the exception in case of PIU. Even though the clinical status of PIU is doubtful, still there is a significant demand for its treatment all over the world. Overall, the excessive use of internet has been strongly debated in literature from PIU to a positive addiction. Only time will tell how it affects our civilization as a phenomenon of evolutionary significance.
Originality/value – The paper is providing a general conceptual framework for internet addiction/PIU to enable readers to know about the topic in depth from the evolution of the concept to the recent developments in the area.
Keywords Substance use disorder, Internet addiction, Behavioural addiction, Problematic internet use (PIU), Psychiatric co-morbidity
Paper type General review

Background

When J.C.R. Licklider wrote his first memoir on the “Galactic Network” in Man-Computer Symbiosis (Licklider, 1963), he would have hardly thought of it evolving into a phenomenon of immense evolutionary significance. From the successful demonstration of the Advanced Research Projects Administration (ARPANET) in 1972 to the World Wide Web, the internet has come a long way. The word internet starts from the word “Web Connection Network” (Greenfield, 1999) which connects computers around the globe with a standard convention. World Wide Web made an extraordinary and user-friendly prop to the personal, professional and social existence of world populace. Its utilization ranges from exceptionally essential web crawlers, socializing, shopping to the complex research helps, managing an account and business. At the same time, it has also come with its share of misuses like accessing inappropriate sites, hacking, stalking, spamming, phishing, etc. In the era of digital technology, the internet has its very significant role in sprouting vulnerability toward a different form of addiction whether it is chemical or behavioral addiction, at the same time providing a platform to manage it well. Bisen and Deshpande (2017) introduced internet as a global phenomenon and explored positive and negative consequences of problematic internet use (PIU).
The purpose of the present paper is to delineate the overall theoretical framework on the topic of internet addiction through the comprehensive narrative review to make readers aware of the conceptual growth and development in the respective field. The paper evolves theoretically from the historical foundation, phenomenology, clinical feature and etiological model to the treatment outcome of internet addiction. Multiple studies have been done in the field of mental health but dearth of work given head to toe theoretical overview for understanding of this trendsetter research area in mental health.

Positive impact of the internet

The internet has various social, psychological and educational advantages. Users can “meet” new, similar people and to promote productive impressions. The internet enables users to pass on data rapidly, maintain associations, play games, boost emotional support and find out about a different culture (McNamee, 1996; Parks and Floyd, 1996; Scherer, 1997). Financial advantages can be harvested from this medium (Morahan-Martin, 1998); individuals have begun online businesses and have picked up access to market customers that were previously inaccessible to them. The internet has enhanced job prospects for some people by giving them simple access to a wide releasing of employment postings (Shotton, 1991). While excessive use of the internet can become associated with the various psychiatric disorder, on the other side internet is also being developed as an effective tool to treat such mental health issues. Web-based interventions on the positive side provide a cost-effective and readily accessible user-friendly platform to reach out to a vast majority of patients and help them in seeking treatment and getting into structured programs at the same time. (Carlbring and Andersson, 2006) Web-based cognitive behavioral therapy has increasingly become a popular empirical evidence-based therapy for various anxiety spectrum disorders. Evidence suggests that internet-delivered CBT works for panic disorder (Carlbring et al., 2001) Social anxiety disorder (Andersson et al., 2006), generalized anxiety disorder (Titov et al., 2009), post-traumatic stress disorder (Lange et al., 2003) and specific phobia (Andersson, 2009).

Negative impact of the internet

Despite its positive side, the internet has been connected to the variety of problems. Shotton (1989) and Young (1996) studied that internet addicts spend less time with individuals in their lives, resulting in restlessness, contentions and a strained relationship. Numerous individuals in the workplaces are getting dependent on the internet. Suler (1996) detailed that many directors believe that employees are utilizing internet mostly for non-business purpose that undermines employees’ activity viability and efficiency; hence some organization authorities introduced jammer to track and eliminate internet utilization. Such findings lead employers to doubt their workers and become suspicious of their utilization of the internet (Young, 1996, 1998a). Internet overuse can lead to a lot of psychological disorders. It has been postulated that there is a positive association between PIU and substance use disorders with the severity of PIU adversely affecting the substance use disorder. Young (1999) studied that alcohol consumption behavior in students was extensively studied and results showed that students with PIU consumed more alcohol (32.1 percent) compared to the non-PIU group (20.4 percent). There is ample proof that PIU is a predictor of future risk of cigarette smoking and alcohol intake (Chiao et al., 2014). People who sit online and in front of their internets for longer periods have shown a definite pattern of addictive behavior like cigarette smoking.

Internet addition vs internet engagement

This section is discussing the distinction between (pathological) internet addiction and (non-pathological) internet engagement. The internet can be engaging because it provides users with an intrinsically pleasant experience, enabling them to relax and get away from the daily life hassles. The term of internet engagement initially emerges in the factor analytical study of the internet apathy and anxiety scale (Charlton and Birkett, 1995), with engagement considered contrast to the apathy. The vital difference between the addiction and engagement
is that addict may think to be dependent since they experience negative results yet the other
may be simply do not experience (Charlton and Danforth, 2007). In their study, it is found that
genagement loaded highly upon the tolerance, euphoria and cognitive salience whereas
addiction loaded highly upon withdrawal, relapse and reinstatement, conflict and behavioral
salience. This suggests before reaching addiction, one progress through a stage of high
engagement at which there are no major negative consequences of excessive internet use.
Another study by him found a discrepancy between engagement and addiction differentially
related to personality factors (extraversion, emotional stability, agreeableness, negative
valence and attractiveness). Findings validate that internet addiction scores are related to
negative personality traits to an extent to which scores on internet engagement
(non-pathological) are not.

Internet engagement arises as a new pedagogy to incline students to use internet-based
e-learning to enhance online engagement to promote affective learning. A study done by Gupta
and Pandey (2018) on online engagement has affirmed the utility of online resources on
enhancing academic engagement and in turn affective learning.

Historical perspective

Although the term internet addiction was given by Goldberg (1996), the Psychologist Young
(1998b) is credited with the first published case report on PIU. Her patient was a 43-year-old
homemaker who had no psychiatric disorder or addictions, was spending up to 60 h
a week online after being introduced to the internet. Young modified the diagnostic criteria for
pathological gambling to develop a questionnaire, as pathological gambling was considered
contiguous to PIU and was applied to heavy internet users. Later on Shapira et al. (2003)
proposed a more detailed scheme in the line of impulse control disorder, as they considered the
definition based on substance dependence or pathological gambling too narrow.
They favored the use of term PIU over internet addiction for lack of scientific proof for the
latter. In a much bigger study, the Virtual Addiction Survey, an online survey on 17,251
respondents conducted by Greenfield (1999), approximately 6 percent met the criteria of
addictive internet usage patterns. However, other researchers have questioned the existence
of PIU and IAD itself. Musetti et al. (2016) revised literature and found that the internet
addiction disorder was not univocally defined and that the construct was somehow too broad
and generic to be explicative for a diagnosis. Mitchell (2000) expressed his doubts whether PIU
was due to some underlying psychiatric co-morbidity and was justifiable as an entity.
At present, the status of PIU/IAD is still ambiguous with DSM-5 referring to it as "other
excessive behavioral pattern" and not including it in addictive disorders due to insufficient
peer-reviewed evidence. DSM-5 has also included internet gaming disorder in the section
"Conditions for further study." ICD 10 does not have any mention of PIU/IAD as the terms came
after its publication.

Epidemiology

Mainly because of the lack of established diagnostic criteria and a dearth of large studies, the
prevalence of PIU in general population has not been established. The surveys conducted are
broadly divided into online and offline surveys, with higher rates in the former due to inherent
selection bias. The studies tend to attribute PIU as a “Disorder of Young” mostly because they
focused on young people rather than the wider adult population. The prevalence rates in these
studies range from 0.9 to 38 percent mostly because of the different diagnostic criteria and
varying sample sizes. Still, from all the consolidated data, PIU seems to have a male
preponderance and manifests itself in the late 20s. Heritability estimate was same for girls and
boys; 48 percent for individual difference in compulsive internet use was influenced by genetic
factors and 52 percent remaining variance by the environmental influence that was not shared
among family members. Gender was not found to be a significant predictor of PIU. Most of
studies did not find any gender prevalence; at the same time, some of the research support the
fact that males are more prone to PIU (Durkee et al., 2012). Bisen and Deshpande (2016)
found that male students are more prone to smartphone addiction than female students.
Some studies focused on gender difference on the basis of indulgence in different online
activities by male and females. For example, women and older addicts prefer chat forums while men and younger addicts prefer online games and pornography (Mitchell, 2000).

Multiple studies have been conducted to know prevalence rate and gender difference which are depicted in Table I.

Classification and phenomenology

PIU has been variously described in the literature as “internet addiction” and “pathological internet use” in which an individual’s inability to control his or her internet use causes marked distress and/ or functional impairment. First of all, from the point of view of an addictive disorder, it has features of withdrawal (anger, tension, etc., when not available), preoccupation (neglect of other activities), tolerance (need for better software, spending more hours) and uses despite negative consequences. But these features as mentioned before have been heavily debated in the literature. Nevertheless, till date, there are no established diagnostic criteria for PIU. The various names like “compulsive internet use,” “pathological internet use,” “PIU,” “internet dependency,” “internet addiction” and “internetomania” are proof of the fact that the condition has been perceived in various ways. Hence, we would be discussing the major studies which have proposed some form or other to diagnose the condition.

Young (1996) modified the pathological gambling criteria from DSM-IV and made an eight-item questionnaire for PIU, which she defined as five or more symptoms present in the preceding six months.

The Young’s (1996) diagnostic questionnaire:

1. Do you feel preoccupied with the internet (think about a previous online activity or anticipate next online session)?
2. Do you feel the need to use the internet with increasing amounts of time in order to achieve satisfaction?
3. Have you repeatedly made unsuccessful efforts to control, cut back or stop internet use?
4. Do you feel restless, moody, depressed or irritable when attempting to cut down or stop internet use?
5. Do you stay online longer than originally intended?

Table I  Prevalence surveys on internet addiction

<table>
<thead>
<tr>
<th>Study</th>
<th>Location</th>
<th>Sample</th>
<th>Age (years)</th>
<th>Assessment tool</th>
<th>Prevalence (%)</th>
<th>Gender ratio (F:M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim et al. (2006)</td>
<td>South Korea</td>
<td>1,573 students</td>
<td>15–16</td>
<td>YDQ</td>
<td>1.6</td>
<td>1:1</td>
</tr>
<tr>
<td>Aboujaoude et al. (2006)</td>
<td>USA</td>
<td>2,513 adults</td>
<td>&gt;18</td>
<td>DSM-IV-TR criteria</td>
<td>0.7</td>
<td>NR</td>
</tr>
<tr>
<td>Cao and Su (2007)</td>
<td>China</td>
<td>2,620 students</td>
<td>12–18</td>
<td>YDQ</td>
<td>2.4</td>
<td>5:1</td>
</tr>
<tr>
<td>Siomos et al. (2008)</td>
<td>Greece</td>
<td>2,200 students</td>
<td>12–18</td>
<td>YDQ</td>
<td>8.2</td>
<td>3:1</td>
</tr>
<tr>
<td>Bekken et al. (2009)</td>
<td>Norway</td>
<td>3,399 adults</td>
<td>16–74</td>
<td>YDQ</td>
<td>1.0</td>
<td>2:1</td>
</tr>
<tr>
<td>Thomas and Martin (2010)</td>
<td>Norway</td>
<td>1,326 students</td>
<td>15–54</td>
<td>DSM-IV-TR criteria</td>
<td>4.6</td>
<td>3:1:1</td>
</tr>
<tr>
<td>Video games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grusser et al. (2006)</td>
<td>Germany</td>
<td>7,069 adults</td>
<td>&gt;15</td>
<td>ICD 10 criteria</td>
<td>11.9</td>
<td>NR</td>
</tr>
<tr>
<td>Gentile (2009)</td>
<td>USA</td>
<td>1,178 students</td>
<td>8–18</td>
<td>DSM-IV-TR criteria</td>
<td>8.5</td>
<td>4:1</td>
</tr>
<tr>
<td>Rehbein et al. (2010)</td>
<td>Germany</td>
<td>15,168 students</td>
<td>14–16</td>
<td>KFN-CSAS-II</td>
<td>1.7</td>
<td>10:1</td>
</tr>
<tr>
<td>Thomas and Martin (2010)</td>
<td>Australia</td>
<td>1,326 students</td>
<td>15–54</td>
<td>DSM-IV-TR criteria</td>
<td>5</td>
<td>3:1</td>
</tr>
<tr>
<td>Porter et al. (2010)</td>
<td>Australia</td>
<td>1,945 adults</td>
<td>14–40</td>
<td>DSM-IV-TR criteria</td>
<td>8</td>
<td>NR</td>
</tr>
<tr>
<td>Gentile et al. (2011)</td>
<td>Singapore</td>
<td>3,034 students</td>
<td>12–18</td>
<td>DSM-IV-TR criteria</td>
<td>9</td>
<td>3:1</td>
</tr>
</tbody>
</table>

Notes: YDQ, young diagnostic questionnaire; DSM-IV-TR, criteria varied across studies; KFN-CSAS-II, video game dependency scale. Aboujaoude assorted criteria for impulse control disorder, obsessive-compulsive disorder and substance abuse were modified, used and adopted DSM-IV criteria for pathological gambling were used in several studies.
6. Have you jeopardized or risked the loss of significant relationship, job, educational or career opportunity because of the internet?

7. Have you lied to family members, therapists or others to conceal the extent of involvement with the internet?

8. Do you use the internet as a way of escaping from problems or of relieving a dysphoric mood (e.g. feelings of helplessness, guilt, anxiety, and depression)?

Beard and Wolf (2001) modified Young’s criteria on the grounds that it was more consistent with an impulse control disorder and proposed that all 1-5 criteria from YDQ must be present and at least one of the criteria 6–8 from YDQ should be present to diagnose internet addiction.

Shapira et al. (2003) proposed the criteria based on impulse control disorder found in DSM-IV-TR. They preferred the term PIU over internet addiction. They defined PIU as uncontrollable, markedly distressing, time-consuming or resulting in social, occupational or financial difficulties and not solely present as a manifestation of hypomania and manic symptoms. They proposed the following broad diagnostic criteria for PIU:

1. Maladaptive preoccupation with internet use, as indicated by at least one of the following:
   - preoccupations with use of the internet that are experienced as irresistible; and
   - excessive use of the internet for periods of time longer than planned.

2. The use of the internet or the preoccupation with its use causes clinically significant distress or impairment in social, occupational or other important areas of functioning.

3. The excessive internet use does not occur exclusively during periods of hypomania or mania and is not better accounted for by other Axis I disorders.

Tao et al. (2010) came up with a detailed criterion for internet addiction disorder.

**Symptom criteria**

All of the following must be present:

- preoccupation with the internet (thinks about a previous online activity or anticipates next online session); and
- withdrawal, as maintained by a dysphoric mood, anxiety, irritability and boredom after several days without internet activity.

At least one (or more) of the following must be present:

- tolerance marked an increase in internet use required to achieve satisfaction;
- persistent desire and/or unsuccessful attempts to control, cut back or discontinue internet use;
- continued excessive use of the internet despite knowledge, and persistent or recurrent physical or psychological problems are likely to have been caused or exacerbated by internet use;
- loss of interests, previous hobbies and entertainment as a direct result of and with the exception of internet use; and
- uses the internet to escape or relieve a dysphoric mood (such as a feeling of helplessness, guilt and anxiety).

**Exclusion criterion.** Excessive internet use is not better accounted for by psychotic disorders or bipolar I disorder.

**Clinically significant impairment criterion.** Functional impairment (reduced social, academic and working ability), including loss of a significant relationship, job, educational or career opportunities.

**Course criterion.** Duration of internet addiction must have lasted for an excess of three months, with at least six hours of internet usage (non-business/non-academic) per day.

**Proposed criteria.** Persistent and recurrent use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress as indicated by five (or more) of the following in a 12-month period:

1. Preoccupation with internet games. (The individual thinks about previous gaming activity or anticipates playing the next game; internet gaming becomes the dominant activity in daily life).
   
   Note: this disorder is distinct from internet gambling, which is included under gambling disorder.

2. Withdrawal symptoms when internet gaming is taken away. (These symptoms are typically described as irritability, anxiety or sadness, but there are no physical signs of pharmacological withdrawal).

3. Tolerance—the need to spend increasing amounts of time engaged in internet games.

4. Unsuccessful attempts to control the participation in internet games.

5. Loss of interest in previous hobbies and entertainment as a result of, and with the exception of, internet games.


7. Has deceived family members, therapists or others regarding the amount of internet gaming.

8. Use of internet games to escape or relieve a negative mood (e.g. feelings of helplessness, guilt and anxiety).

9. Has jeopardizing or lost a significant relationship, job or educational or career opportunity because of participation in internet games.

Note: only non-gambling internet games are included in this disorder, use of internet for business or profession, recreational or social internet use is excluded similarly sexual internet sites are excluded:

Internet Gaming Disorder (IGD) can be mild, moderate or severe depending on the basis of the degree of disruption of normal activities. There are no well-researched subtypes. IGD has a similar feature like substance addiction including tolerance, withdrawal, repeated unsuccessful attempt to cut back or quit and impairment in normal functioning. Clinical features include persistent and recurrent participation in computer gaming. Resistance toward school work or interpersonal activities. Prevalence of IGD is unclear but seems to be the highest prevalence in Asian countries and to a lesser extent, in the west. Computer availability, gender, age, environment and heritability are a risk and prognostic factors. IGD may lead to school failure, job loss or marriage failure (DSM-5, American Psychiatric Association, 2013).

Other relevant diagnostic criteria were by Ko, Yen, Chen, Chen and Yen (2005) based exclusively on a study conducted on Taiwanese students and Aboujaoude et al. (2006) who developed four sets of diagnostic criteria based on obsessive-compulsive disorder and substance use. Liu and Potenza (2007) also suggested giving the DSM-IV diagnosis of impulse control disorder not otherwise specified to people with IA.

Phenomenologically many researchers have tried to identify subtypes of PIU/IAD. Needless to say, those researchers are yet to arrive at a consensus on this issue.

Young (1999) based on a survey of therapists suggested that five specific subtypes of internet addiction could be categorized:

1. cybersexual addiction—compulsive use of adult websites for cybersex and pornography;

2. cyber-relationship addiction—over-involvement in online relationships;

3. net compulsions—obsessive online gambling, shopping or online auction or trading;

4. information overload—compulsive web surfing or database searches; and

5. computer addiction—obsessive computer game playing (e.g. Doom, Myst or Solitaire).

Their study also indicated that the leading factor for PIU was the anonymity of the media which specifically encouraged deviant and deceptive acts, allowed a safe social platform for shy and
introvert people, promoted cyber affairs, ability to develop an alternative online personality and a platform to live one’s fantasies.

Block (2007) proposed PIU as a compulsive-impulsive spectrum disorder and categorized it into three types—excessive gaming, sexual preoccupations and e-mail/text messaging.

Hinic (2011) modified the types proposed by Young (1999) to give the following subtypes:

- generalized disorder;
- disorder of online social interaction;
- online gaming;
- compulsive online shopping; and
- consumption of pornographic content.

Clinical features

With so many practical uses of internet, signs and symptoms of addiction can easily be masked or justified. Often the client does not present the complaints of internet addiction. People may initially present with signs of clinical depression, bipolar disorder, anxiety or obsessive-compulsive tendencies, only for the treating professional to later discover signs of internet abuse upon further examination (Shapira et al., 2000). Addicted users generally use internet up to 40–80 h per week (Young, 1999). Sleep patterns are disturbed in accommodating such excessive use due to late night logins. Patient sleeps very late and in extreme cases uses stimulants to facilitate longer sessions. The patient is often preoccupied with thoughts of the internet when offline and often has inexplicable sadness or frustration when not able to use the internet. The patient creates virtual relationships and often values them more than his/her real-world relationships leading to adversely affected personal and social life. Suler (2004) coined the term “online disinhibition effect” to describe the phenomenon of disinhibition which leads to online excessive spending, confiding, crimes, etc.

Etiology

Addictions are habitual compulsion to engage in certain activities or utilize a substance, notwithstanding the devastating consequences on the individual’s physical, mental, social, spiritual and financial well-being. Addiction typically has both psychological and physical dependence. Physical dependence occurs when an individual’s body becomes dependent on a certain substance and develops withdrawal symptoms upon discontinuing the substance. Psychological dependence is when the individual experiences symptoms such as depression, craving, insomnia, irritability, etc., on discontinuation of the substance or the behavior. Both substance and behavioral addiction give rise to psychological dependence. PIU individuals have high impulsivity as measured by both behavioral and self-reported impulsivity scale in positive correlation with severity (Cao et al., 2007). Dong et al. (2012) in a functional MRI study concluded that impaired inhibitory control was seen in young men with internet addiction. These and several other studies undoubtedly attributed impulsivity as a central feature of PIU and so close to pathological gambling. Hence, the DSM-5 describes internet gaming disorder as the most likely candidate to join pathological gambling in the category of behavioral addiction (Robbins and Clark, 2015). The following outlines various models proposed to explain PIU as a behavioral addiction.

Cognitive behavioral model. Davis (2001) conceptualized PIU as a distinct pattern of internet-related cognitions and behaviors that result in negative life outcome. He proposed two forms—specific and generalized. Specific PIU involves overuse of specific contents on the internet. Generalized PIU is multidimensional overuse of net and the individual is drawn to the experience of being online. Young (1998b) suggested that people with catastrophic thinking tend to use internet compulsively as a psychological escape mechanism to avoid problems. Subsequent studies hypothesized that other maladaptive cognitions such as overgeneralization or catastrophizing and negative core belief also
contribute to the compulsive use of the internet (Caplan, 2002). Individuals with perceived inadequacies about self-tend to use the internet as a media to overcome these complexes. The cognitive model helps to explain why internet users develop a habit or compulsive use and how negative self-thoughts maintain patterns of compulsive behavior.

**Neuropsychological model.** Human instinct of pursuing pleasure and avoiding pain is attributed as representative of various motives to use the internet. The feeling of euphoria on using the net drives the individual to use the internet excessively to extend the euphoria. Once addiction is established the euphoria is replaced by a habit and state of numbness. Repeated use increases the threshold of satisfaction which leads to the development of tolerance in form of increased usage or need for better applications. The individual on stopping or decreasing the usage develops abstinence reaction characterized by dysphoria, emotional instability, insomnia, etc. The individual develops passive coping mechanisms to the environment when he/she is confronted through disturbance or receives outside harmful effects, which includes passive behaviors such as adverse event imputation, cognition distortion and the formed repression, escape and aggression. Finally, the "avalanche effect" which includes passive experience consisting of tolerance and abstinence reaction, and combined drive consisting of individual’s passive coping styles on the basis of the individual’s primitive drives (Huang et al., 2007) (Figure 1).

**Neurobiological model.** The proposed model of brain reward circuitry in addiction involves the expansion of dopamine when certain areas of the brain are invigorated. The researcher has since quite a while ago connected addiction with changes in neurotransmitters in the brain, and a few scholars have contended that all addictions autonomous of the sort (sex, food, alcohol and internet) can be activated by similar changes in the cerebrum. As of late, genetic polymorphisms of the serotonin transporter gene (SSSHTTLPR) have been found in excessive internet user. Notwithstanding, in perspective of the relationship of this polymorphism with various other mental conditions (e.g. mood disorders, anxiety disorders, alcoholism and nicotine reliance), this discovery needs replication in a well-controlled populace. A voxel-based morphometry contemplated by Zhou et al. (2011) found that adolescent internet addicts had lower gray matter density in the left anterior cingulate cortex, left posterior cingulate cortex, left insula and left lingual gyrus, compared with healthy controls. They proposed that this may give another understanding of the pathogenesis of internet compulsion, particularly in light of deficits in decision-making function and lagging in learning strategy.

![Figure 1 The vicious cycle of habit to addiction formation](image-url)
Compensation theory. Tao and Hong (2000) argued that the “unified evaluation system” for academic achievement has led many young people to seek spiritual rewards from online activities. Young people also seek compensation for identity, self-esteem and social networks. Morahan-Martin and Schumacher (2003) found higher levels of loneliness among pupils with PIU. Through the exchange of online messages, users offset what they may lack in real life (Caplan and High, 2011). Researchers have found that most internet users are poor, more likely they used the internet to escape (Young and Rogers, 1998). Therefore, it is important for doctors to understand how consumers can compensate for what is missing in their lives by using them on the internet.

Situational factors. Individuals who experience life-changing events or personal problems tend to absorb themselves in a virtual world full of fantasies (Young, 2007). Drug addicts especially ones with multiple addictions are at great risk to suffer from PIU. They believe PIU as a “positive addiction” (the term given by Glasser, 1976). A person is vulnerable to addiction when he/she is not satisfied with life or does not have strong bonds or a loss of hope (Peele, 1985). These individuals have an increased likelihood of developing PIU as they do not know other ways of coping (Young, 1998b).

Complications and co-morbidities

Physical health problems
PIU individuals have a tendency to skipping a meal and snacking (Kim and Chun, 2005). Savige et al. (2007) also reported similar behavior in individuals with PIU. This could affect their health adversely and the growth and development of adolescents. High-risk internet users reported more irregular sleep patterns and more episodes of sleep disturbance than no risk internet users (Choi et al., 2009). The sedentary act of prolonged computer use resulting in a lack of proper exercise also leads to an increase in several lifestyle-related disorders such as obesity, eyesight weakness and back strain (Young, 1999).

Familial problems
Young (1996) reported serious relationship problems in 53 percent individuals with PIU. Marriages are the most affected of all relationships and giving rise to the feeling of “Cyberwidow” in the spouse. Individuals form online relationships at the cost of real ones and there has been an increase in divorce cases due to “Cyber affairs” (Quittner, 1997). Internet use then interferes with real-life interpersonal relationships as those who live with or who are close to the internet addict respond in confusion, frustration and jealousy around the computer. Similar to alcoholics who will try to hide their addiction, internet addicts engage in the same lies about how long their internet sessions really last or they hide bills and fees for internet service. These same characteristics create distrust and over time will hurt the quality of once stable relationships (Young, 1999).

Academic problems
Originally claimed as an educational tool, in a survey 86 percent educators believed that internet use by children does not improve their performance as the information on the net was too disorganized and mostly unrelated to the curriculum (Barber, 1997). Young (1996) found that 58 percent of students reported a decline in study habits, a significant drop in grades, missed classes or being placed on probation due to excessive internet use. Even though it is an ideal research tool, students use the internet mostly for chatting, surfing irrelevantly, playing games, etc., at the cost of the productive activity.

Occupational problems
There is a definite concern among executives that internet also distracts their employees. In a survey, 55 percent executives believed that non-business surfing was undermining the effectiveness of their employees. Employers not knowing about the problem tend to warn, suspend or terminate an employee with PIU, instead of referring them to the company’s employee assistance program (Young, 1996).
Psychiatric co-morbidities

Several cross-sectional studies have shown that co-morbidities are more of a norm than the exception in case of PIU (Liu and Potenza, 2007) (Table II).

Assessment tools

Several scales have been developed and the definition of PIU varies across instruments. The most frequently cited ones are as follows.

Internet addiction test (Young, 1998b)

It is the oldest and the most widely used. It consists of a 20-item questionnaire rated on a five-point Likert scale. It was devised in the framework of Young’s diagnostic questionnaire. Young suggested that a score of 20–39 points is an average online user who has complete control over

| Table II Comprehensive outline of various studies done on psychiatric co-morbidity and PIU |
|---------------------------------|----------------------------------|
| **Psychiatric co-morbidity**    | **Contributors**                 |
| Substance use disorder         | Black et al. (1999), Shapira et al. (2000), Shaw and Black (2008), Ko et al. (2008), Fisoun et al. (2012), Bozkurt et al. (2013), Kuss et al. (2013) |
| Alcohol consumption            | Young (1999), Califano (2008), Chi Chiao et al. (2014) |
| Cigarette smoking              | Chi Chiao et al. (2014) |
| Marijuana                       | Primack et al. (2009), Califano (2008) |
| Other drug dependence          | Gong et al. (2009) |
| Dysthymia                      | Bernardi and Pallanti (2009) |
| Suicidal risk                   | Fu et al. (2010), Lee et al. (2014) |
| Insomnia                       | Cheung and Wong (2011) |
| Loneliness and social isolation | Young and Rogers (1998), Whang et al. (2003), Chou et al. (2005), Wartberg et al. (2011), Casale and Fioravanti (2011) |
| Anxiety disorder               | Shaw and Black (2008), Ko et al. (2009), Musarrat Azher et al. (2014), Yen et al. (2008) |
| Social phobia                  | Shapira et al. (2000), Campbell et al. (2006), Bernardi and Pallanti (2009), Casale and Fioravanti (2011), Lee and Stapinski (2012), Bozkurt et al. (2013) |
| Generalized anxiety disorder   | Bernardi and Pallanti (2009) |
| Obsessive compulsive disorder  | Yang et al. (2005), Ha et al. (2006), Bernardi and Pallanti (2009), Cooper (2013), Mueller et al. (2011) |
| Bipolar disorder               | Shapira et al. (2000), Bozkurt et al. (2013) |
| Hypomania                      | Bernardi and Pallanti (2009) |
| Mania                          | Rosen et al. (2013) |
| Schizophrenia                  | Ha et al. (2006) |
| Impulse control disorder       | Shapira et al. (2000), Shaw and Black (2008) |
| Attention deficit hyperactivity disorder | Shaw and Black (2008), Bernardi and Pallanti (2009), Ko et al. (2009), Bozkurt et al. (2013), Yen et al. (2008) |
| Borderline personality disorder | Black et al. (1999), Bernardi and Pallanti (2009), Floros et al. (2014) |
| Schizotypal personality disorder | Mittal et al. (2007) |
| Narcissistic personality disorder | Black et al. (1999), Kim et al. (2008), Rosen et al. (2013) |
| Avoidant personality disorder  | Bernardi and Pallanti (2009) |
| Histrionic personality disorder | Black et al. (1999), Rosen et al. (2013) |
| Personality traits             | Teague et al. (2014), Tsai et al. (2009), Yan et al. (2014), Floros et al. (2014) |
| Neuroticism                     | Yan et al. (2014), Floros et al. (2014) |
| Psychoticism                    | Park and Lee (2012), Floros et al. (2014) |
| Sensation and novelty seeking   | Yen et al. (2008) |
| Harm avoidance                  | Casale and Fioravanti (2011) |
| Shyness                         | Wartberg et al. (2011), Yen et al. (2014) |
| Low self-esteem                 | Kim et al. (2008) |
| Poor self-control               | Cao et al. (2007), De Berardis et al. (2009), Lee et al. (2006) |
| Impulsivity                     | Kim et al. (2008), Ko et al. (2009) |
| Hostility and aggression        | Bozkurt et al. (2013) |
| Elimination disorder            | Bozkurt et al. (2013) |
his/her usage. A score of 40–69 signifies frequent problems due to internet usage, and a score of 70–100 means that the internet is causing significant problems. In a meta-analysis, Frangos and Sotropoulos (2012) concluded that it is more reliable in college students and probably in Asia. The internal reliability calculated from the same study was from 0.88 to 0.89.

Chen internet addiction scale (Chen et al., 2003)

It was originally developed by Taiwanese researchers based on diagnostic criteria of impulse control disorder, substance use disorder in the DSM-IV, together with the clinical experiences from interviewing problematic internet users. It consists of 26 items on a four-point scale ranging from 1 (does not match my experience at all) to 4 (definitely match my experience). It consists of five subscales: compulsive use (Sym-C), withdrawal (Sym-W), tolerance (Sym-T) symptoms of internet addiction, interpersonal and health-related problems (RP-IH) and time management problems (RP-TM). These clusters of constructs rest on the axis of core symptoms and the related problems of internet addiction. The internal reliability of the scale in the original study ranged from 0.79 to 0.93.

Diagnostic interview of internet addiction for adolescents (Ko, Yen, Yen, Chen and Chen, 2005)

It was developed as a structured diagnostic interview. Diagnostic criteria derived from impulse control disorder and substance use disorder in DSM-IV-TR and diagnostic criteria for internet addiction in previous studies and clinical experiences were selected on the basis of diagnostic accuracy. It provided a good diagnostic accuracy (95.4 percent), with high specificity (97.1 percent) and accepted sensitivity (87.5 percent) for adolescent internet addiction.

Compulsive internet use scale (Meerkerk et al., 2009)

It is a 14-item scale, covering five typical symptoms of compulsive internet use: loss of control, preoccupation, withdrawal symptoms, coping or mood modification and conflict. Each item can be answered on five-point Likert scale, ranging from “never” to “very often.” This scale does not include an item on tolerance.

Other important scales

Pathological internet use scale (Morahan-Martin and Schumacher, 2000) developed with a key focus on psychological and behavioral problems, and daily life routine disruption associated with internet use.

Generalized PIU scale (Caplan, 2002) was developed from Davis’ (2001) cognitive behavioral model of pathological internet use.

Treatment

Even though the clinical status of PIU is doubtful, still there is a significant demand for its treatment all over the world. Widyanto and Griffiths (2006) reported that most treatments utilized cognitive behavior therapy but they did not comment on their efficacy. Peukert et al. (2010) indicated cognitive behavioral and pharmacological approaches as potentially effective treatments in their review. They further suggested that interventions with family members or other relatives could be useful. Siomos et al. (2010) in their study concluded on the effectiveness of a combination of CBT and pharmacotherapy in adolescents with PIU. Winkler et al. (2013) in the most recent review of studies concluded that psychological and pharmacological interventions were highly effective for improving PIU, depression and anxiety.

Cognitive behavior therapy

Young (2007) positively verified the effectiveness of CBT in PIU. According to it the patients to learn how to control their thoughts and feelings that can be detrimental to their functioning and
may trigger the impulse to escape into the virtual world. This therapy is administered in two stages. Stage I focuses on behavioral modification and setting of realistic goal that helps to avoid relapse. Patients have to keep a record of daily internet login (day, duration, event, online activity and outcome). This stage aims at decreasing number of hours spent, structuralized online activity, eliminate temptation and control one’s usage. Stage II focuses on a cognitive aspect such as cognitive restructuring. This stage aims at reducing thought that triggers excessive online activity and reducing maladaptive cognition. Another effective treatment is harm reduction therapy (Table III).

**Family therapy**

Recent studies have emphasized the importance of family therapy in internet addicts, especially adolescents. Researchers suggest that good relationship and communication with parents are protective factors for adolescents from internet addiction (Kim et al., 2008). Involvement of family members in treatment facilitates the process of recovery and helps the addict maintain a lasting effect of intervention after sessions (Zhong et al., 2011). The authors also found family-based intervention superior to group therapy that involved only the adolescents in reducing symptoms of PIU. In a very recent study, Liu et al. (2015) found the six-session multi-family group therapy effective in reducing internet addiction behaviors among adolescents and recommended for it to be included in preventive programs for PIU in future.

**Pharmacotherapy**

Very little has been studied on pharmacological interventions in PIU and the few recommendations are based on extrapolation from other forms of addiction. Based on a very small sample, Goldsmith and Shapira (2006) reported symptomatic improvement in PIU after drug therapy. Camardese et al. (2012) concluded on valproate as the best among antiepileptic as a potential agent for the treatment of IA. They also recommended opioid antagonists as a possible best choice for its anti-craving properties and SSRI (Bupropion) in co-morbidity with depression and anxiety in the same study. Based on evidence, group II metabotropic receptor agonists are potential agents reducing the rewarding potential of any substances. Moussawi and Kalivas (2010) recommended its possible benefits in improving impulsive behavior.

**Treatment centers.** Realizing the potential magnitude of the problem, many countries across the world have established treatment centers for internet addiction with in-patient treatment facility. Numerous “boot camp” programs for internet-addicted adolescents have emerged in both China and Korea (Koo et al., 2011). Several clinics on the same line have emerged in the western countries, including: the Center for Online and Internet Addiction located in Bradford, Pennsylvania, USA; The Computer Addiction Study Center at McLean Hospital, Belmont, Massachusetts, USA; The Broadway Lodge residential rehabilitation unit located in Somerset, England; and The Smith & Jones 12-step (Minnesota Model).

<table>
<thead>
<tr>
<th>CBT variants in the treatment of PIU</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Time management skills (Du et al., 2010)</td>
<td>Improved time management skills</td>
</tr>
<tr>
<td>Solution-focused brief therapy with family therapy (Fang-ru and Wei, 2005)</td>
<td>Internet addiction disorder and online time decreased; improved psychological function</td>
</tr>
<tr>
<td>The group with individual therapy; diaries, social skill training, and exposition training (Jager et al., 2012)</td>
<td>Reduced and controlled internet and computer use</td>
</tr>
<tr>
<td>CBT in combination with bupropion (Kim et al., 2012)</td>
<td>Reduced online gameplay and anxiety, improved life satisfaction</td>
</tr>
<tr>
<td>Behavior modification (Rong et al., 2005)</td>
<td>Reduced internet addiction symptoms</td>
</tr>
<tr>
<td>Cognitive restructuring (Young, 2011)</td>
<td>Sustained motivation to attend the therapy, improved online time management, reduced social isolation and sexual dysfunction, increased abstinence from problematic applications</td>
</tr>
<tr>
<td>Harm reduction therapy (Young, 2007)</td>
<td></td>
</tr>
</tbody>
</table>
A clinic located in Amsterdam, Holland. There are also several online facilities (e.g. www.netaddiction.com; www.netaddictionrecovery.com; www.onlineaddiction.com.au), many of which are modeled on 12-step self-help treatment philosophies including specific types of groups such as Online Gamers Anonymous.

Theoretical framework. A theoretical model of internet addiction is proposed in the form of mind-map (see Figure 2). The model expresses that the apparent alluring highlights of the internet direct the connection between historical development in classification, phenomenology, etiology, diagnostic criteria, assessment measures and treatment variants of internet addiction.

Conclusion
The unfortunate thing about this world is that good habits are so much easier to give up than bad ones and the problem complicates further when it becomes difficult to decide whether the habit is good or bad. Excessive use of internet has been strongly debated upon from PIU to a positive addiction in the line of meditation and exercise. Much research has been conducted and as further studies accumulate the balance seems to be tipping in favor of PIU. The DSM-5 has already considered it as an “excessive behavior pattern” and not included it in behavior addiction due to lack of sufficient evidence. But as on date while we are going through this writing, studies are coming up with more evidence in support of PIU. Nevertheless, we should keep our fingers crossed for the future of PIU as a disorder. But there is clear evidence supporting the fact that internet itself has contributed both in a positive and negative way to the established psychiatric disorders, especially addictions. On the one hand, it has helped interventions to reach a wider and more remote population. While on the other hand, it has also increased the accessibility and availability of all kinds of resources. Only time will tell that which end of this double-edged sword sharpens up more and how it affects our civilization as a phenomenon of evolutionary significance. The next step for future research would be to explore the meta-synthesis and analysis of latest update on the field to make readers aware of the challenges faced by this questionable disorder. This would be useful for initiating discussion on preventive measures to tackle the future genesis.

Figure 2 Theoretical framework for internet addiction disorder
References


Further reading


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