Overview

The Association between Internet Addiction and Depression

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Internet addiction is a newly emerged disorder having great globalized psychosocial impact. Depressive disorder is one of the most reported comorbidities. To understand the comorbidity of Internet addiction and depressive disorder can shed light on the mechanism of Internet addiction. In this overview, we review the association between Internet addiction and depression. The cross-section study has shown a solid association between Internet addiction and depression. The prospective study has also demonstrated both temporal directions of a causal relationship between the two disorders. Covariance analysis has demonstrated a complex interaction between the two disorders. Here, we propose four candidate models – the escape, the negative consequences, the bi-direction, and the shared mechanisms model – as working candidate models in our temporary attempt to explain the association between those two disorders. While awaiting the validation for those models, we also suggest future directions for studies, and for treating subjects with Internet addiction.

Key words: Internet addiction, depression, comorbidity, prospective study


Introduction

In the last two decades, excessive Internet use has been noted by many researchers and defined as Internet addiction and problematic Internet use [1]. In the draft of the Fifth Edition of the Diagnostic Manual of Mental Disorders, Internet use disorder was already defined. In the published version of the DSM-5, Internet gaming disorder, one subtype of Internet addiction, has been listed in DSM-5’s section III, “Conditions for Further Study,” with research diagnostic criteria [2]. To stimulate further research to support Internet gaming disorder as a unique mental disorder is needed to include it in subsequent revisions of the DSM-5 [3]. Comorbidity with the depressive disorder is an important clinical and research issue of addictive disorder [4]. Depressive disorder can be the marker or risk factor of addictive disorder, one subtype of Internet addiction, has been listed in DSM-5’s section III, “Conditions for Further Study,” with research diagnostic criteria [2]. 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disorder and possibly be the result of some other addictive disorders [4]. Interventions for comorbidities such as depression, are essential to treat the addictive disorders. Thus, to understand comorbidity of Internet addiction can contribute to insight about the mechanism of Internet addiction, and guide for effective intervention.

Depressive disorder is one of the most mentioned comorbid disorders of Internet addiction [5]. But the possible mechanism showing integration of the association between depression and Internet addiction has not been addressed. The aim of the review is to evaluate previous reported studies for the association between Internet addiction and depression. Based on the knowledge in the literature, we attempt to propose a candidate model at the end of this overview, to explain the association, and suggest directions for future studies.

**The Cross-section Association between Internet Addiction and Depressive Disorder**

The cross-section association between Internet addiction and depression has been well-studied. Most of the studies show that the score of self-reported questionnaire of Internet addiction is positively associated with that of depression [6-8]. The association between Internet addiction and depression has been found in adolescents [6-8], youths [9, 10], and adults [11]. Furthermore, the same results have been demonstrated in people in Eastern [12], Western, and Middle Eastern [13, 14] countries. These global results show that those with higher severity of Internet addiction have higher depressive symptoms. In some studies, depression is the most associated factor of Internet addiction after controlling other factors [7]. Another study has also illustrated that depression is the discriminative factor for Internet addiction among adolescents [15]. Further meta-analysis study showed that depressive subjects have significantly higher risk to have Internet addiction (odds ratio = 2.77, 95% confidence interval = 2.04 - 3.75, z = 6.55, p < 0.001) [16]. Based on the studies, we suggest that depressive symptoms are highly closed associated with Internet addiction. Since all above studies are evaluated Internet addiction using self-reported questionnaire, whether the severity of Internet addiction has fulfilled the pathological level or otherwise, cannot be proven in those studies.

Several investigators have recruited subjects with Internet addiction using psychiatric interviews, and they have shown an association of depression in subjects fulfilling the pathological level of Internet addiction. One study demonstrated that 30 male patients consulted for Internet addiction, show higher depression scores [17]. Another study evaluated 31 clinical Internet addiction patients has also demonstrated their higher depression rate [18]. But higher depressive score has not indicated a fulfilled criteria of depressive disorder. Ha et al. first found that 3 adolescents are diagnosed to have major depressive disorder among 12 adolescents with Internet addiction [19]. Ko et al. have interviewed college students to show an association between Internet addiction and depressive disorder [20]. A previous interviewing study has demonstrated that Internet addiction is associated with depression among adolescents [21]. Another study for subjects with addiction disorder in rehabilitation centers has been found that the subjects comorbid with Internet addiction tend to have depressive disorder [22]. Those results support that subjects with Internet addiction are more likely to be comorbid with depressive disorder than those healthy subjects.
In those studies, the causal relationship between Internet addiction and depressive disorder has been discussed, but its relationship cannot be validated. Besides, the percentage of comorbid diagnosed depressive patients is low, indicating that depression is an important but not a major factor contributing to Internet addiction. Other factors such as family function [23] possibly confounding the association between depression and Internet addiction, are not controlled in those studies. We suggest that further studies with detailed designs are needed to clarify such an association between depression and Internet addiction.

The Causal Relationship between Internet Addiction and Depressive Disorder

One of the most used ways to support the causal relationship is to give a temporal relationship in the prospective study. But difficulties exist in recruiting subjects. Considering the economic cost, few studies can illuminate the causal relationship between Internet addiction and depression. The first prospective study assessed Internet addiction and depression with a self-reported questionnaire survey in a two-year follow-up study in young adolescents. The result showed that higher depression score in the first year of investigation predicts higher rate of Internet addiction in the two-year follow-up [24]. Another study in Korea demonstrated that depression in childhood predicts Internet addiction in male adolescents [25]. In another follow-up study on high school students, the investigators found that depression in the first year predicts the initiation and persistence of Internet addiction [26]. Another study in China showed that depression at the college entrance predicts the risk of Internet addiction three years later [27]. Those studies demonstrated that depression score predicts the incidence of Internet addiction. Whether depression is a predisposing factor for Internet addiction cannot be confirmed because depressive symptoms have fluctuated courses during follow-up.

One prospective study showed that an incidence group exhibits increased depression and hostility more than a non-addiction group, that the effect on depression is stronger in adolescent girls, and that the remission group decreases depression, hostility, and social anxiety more than the persistent addiction group [28]. Another two-year longitudinal study for children showed that depression, anxiety, social phobias, and lower school performance are possibly the consequence of Internet gaming disorder [29].

Based on those results, we suggest that depression and hostility are worse in the addiction process for the Internet addiction among adolescents. Consequently, Internet addiction can possibly affect the depressed mood, and furthermore, inspite that the score of depression and Internet addiction fluctuate during the course of the investigation. The data showed that depression and Internet addiction are increased or decreased together. But to understand which one occurs first is difficult. Until now, all longitudinal studies evaluating Internet addiction and depression have been based on answering copies of questionnaire. Thus, a study is needed to follow up the subjects with a diagnosis of Internet addiction to illustrate effect of Internet addiction on depression.

The Confounding Effect of Depression in Internet Addiction

Aside from causal relationships, many studies have shown specific confounding or interacting effect of depression on Internet addiction. For
example, one study exhibited that depression mediates the association between actual and virtual social support and Internet addiction [30]. This finding suggests that the social support or stress event affect the risk of Internet addiction through their effect on depression. In other words, if depression are treated and improved, the risk of Internet addiction should be lessened. Another study has demonstrated that parental problem drinking increases the risk of Internet addiction in depressed subjects [31]. Furthermore, depression has been found to mediate the association between Internet addiction and bulimia [32]. Those results all support the need to treat depression to lessen the risk of Internet addiction caused by other factors. A massive data showed that Internet addiction is negatively correlated with social support, but positively associated with depression, mediating the association between social support and Internet addiction [33]. Based on those study results, we support the above mentioned claims. But in all those studies, the investigators evaluated their hypothesis only based on cross-sectional data. Although the massive data have provided adequate covariance to analyze the mediating effect, it cannot provide temporal information to indicate causal relationship. In other words, those positive mediating results have at least demonstrated a strong association between Internet addiction and depression in cross-sectional data.

In a study proposing a self-medication model of Internet addiction, the investigators enrolled adolescent subjects in six countries and found that depression is associated with poorer psychosocial well-being directly and indirectly through Internet addiction, and that Internet addiction also mediates the association between social anxiety and poor psychosocial well-being among subjects in China, Hong Kong, and Malaysia [34]. Another study showed that positive association between Internet addiction and depression is partially mediated by psychosocial protective factors (mainly self-esteem) across gender, and that Internet addiction weakens the protective effects of self-efficacy and family support against depression [35]. Those study results suggest that Internet addiction contributes to the vulnerability of depression among adolescents when they face difficulty. Although those results have been supported using covariance analysis in cross-sectional data, the possible interaction or mechanism still cannot be validated without temporal evidence. Nevertheless, we suggest that those results indicate a complex interaction among stress, depression, and Internet addiction.

Factors Contributing to the Association between Internet Addiction and Depressive Disorder

Besides a causal relationship model, both Internet addiction and depression can possibly be associated with some disorder or situation. The previous study has also shown that like substance use disorder, Internet addiction is associated with depression [12]. This study result suggests that the Internet can be included in the organization of problem behavior theory [36], and that depression is a risk factor shared by problem behaviors in adolescents. Thus, treating depression improves both Internet addiction and other behavior problems.

Another study in clinical subjects of Internet addiction and pathological gambling showed that both have higher depressive scores [18]. Another study demonstrated that both Internet addiction and insomnia are associated with depression [37]. Further, depression has also been reported as being associated with both Internet addiction and
borderline personality disorder [38]. Those results also showed that depression are comorbid with various psychiatric disorders. Thus, we suggest that the comorbidity of Internet addiction may contribute partly to their depressive scores.

Environment modalities can be other factors contributing to the association between Internet addiction and depression. For example, migrant children and left-behind children with Internet addiction have been found to have higher depression rate in a study in China [39]. Similarly, family function is involved in mood disorder and Internet addiction in adolescents [23]. Impairments of family functioning such as behavior control, affective responsiveness, and problem-solving subscales, have been found among 30 clinical male subjects with Internet addiction [17]. Epidemiological data have demonstrated that adolescents who have perceived lower levels of parental attachment are more likely to experience both Internet addiction and depression [40]. One massive epidemiological study evaluated depression, life events, and Internet addiction using a survey of self-reported questionnaire. The result demonstrated that life events fully mediates the relationship between Internet addiction and adolescent depression [41]. Taken together, we suggest that negative environmental factors, inadequate family functioning, and life events can be factors confounding the association between Internet addiction and depression, and that those shared environmental factors should be evaluated for subjects with both Internet addiction and depression.

The Proposed Models of Internet Addiction and Depressive Disorder

Based on the findings of above published papers in the literature, we are proposing four candidate models to explain the association between Internet addiction and depression (Table 1).

The escape model

Criteria item 8 of Internet gaming disorder in DSM-5 (page 795) states that the use of Internet games is “to escape from or to relieve a negative mood (e.g. feelings of helplessness, guilt, and anxiety)” [2]. For adolescents under difficulties, such as family conflict [23], unfair environment, academic stress, or social interaction stress, they tend to experience negative mood. Without adequate coping strategy, resilience, or support resources, the negative mood can persist and needs to be relieved. As online gaming is popular, it can be served as an available way to relieve negative emotion. For example, a previous study showed that depressed youths have decreased their hostility after getting online [42]. The subjects who have used to play online games, are conditioned to get pleasure from repeatedly winning in the online games. To engage in online gaming can relieve the negative mood. Without an alternative way to relieve this negative mood, the relieved experience in gaming will drive negative reinforcement repeatedly. Then subjects can become habituated to the gaming behavior, and to risking addiction in online gaming. Based on this model, the percentage of Internet addiction among depressive patients gives important information not provided in previous studies.

Under this proposed model, depression contributes to the risk of Internet gaming disorder through escapism. In this model, we suggest that depression should be well-treated in subjects with Internet gaming disorder, and that to develop a coping strategy for stress is also essential to prevent depression. Furthermore, providing healthy alternative activities can develop more positive coping with stress. Finally, for chronic subjects,
Internet addiction can possibly persist even that depression is blocked or improved. Therefore, depression should be further treated independently.

**The negative consequence model**

Heavy Internet gaming can cause negative consequences, such as academic failure, loss of opportunity of a career, and impaired social functioning. With repeated unsuccessful attempts to control online gaming, subjects can experience depressed mood under long-term negative consequences. They can escape through relieving the depressed mood in a short time, but without an effective treatment for depression, the depressed mood can cause a vicious cycle. In the model, the persisting Internet addiction can result in developing depression.

Persisting Internet addiction should be treated to prevent negative consequences. But if the depression is severe with suicidal risk, the depression should be treated before intervention to restrict heavy Internet use. Further intervention to help subjects cope with negative consequences is also essential to give holistic intervention for Internet addiction.

**The bi-direction model**

Depression contributes to the risk of Internet addiction without treating depression. Persisting Internet addiction can cause negative consequences. Depressed mood can impair the coping with stress, and may make subjects escape the negative experience through entering into online gaming. This process can cause further negative consequences. Thus, depression and Internet addiction can worsen reciprocally. This model can explain why the severity of Internet addiction and depression fluctuate together in a longitudinal study [28]. The recent report also supported the model demonstrating that young adults remitted from Internet gaming disorder have lower depression than those with Internet gaming disorder [43].
In this theory, we suggest that treating either depression and Internet addiction can benefit the other. Because depressive disorders have clear treatment guidelines, we suggest that we treat depression first, then Internet addiction later.

**Shared mechanism model**

Some mechanisms exist and shared by the two disorders. Thus, this mechanism could contribute to their comorbidity. For example, both Internet addiction and depressive disorder have impaired cognitive control [44, 45]. Thus, the impaired cognitive control could contribute to the association between Internet addiction and depressive disorder. But there are many possible not well-evaluated shared mechanisms such as emotion regulation, emotion liability, or resilience. If the shared mechanisms contribute to both disorders and their association, treatment needs to be given for those two disorders at the same time.

This model can possibly explain why effective medications for treating depression with bupropion and escitalopram have been reported to be effective in treating Internet gaming disorder [46]. To have a preventive intervention for every disorder is impractical, we suggest that evaluating the shared mechanisms can give a treatment target on this shared-mechanism disorder.

**Conclusion**

Previous studies have confirmed the association between Internet addiction and depression. The prospective studies are attempted to demonstrate both directions of a temporal association between depression and Internet addiction. As shown in Table 1, we propose four models of association – the escape, the negative consequences, the bi-direction, and the shared mechanisms models – as working candidate models in our temporary attempt to explain the association between those two disorders.

Further prospective studies with subjects being interviewed, are necessary to confirm the diagnosis and to delineate the causal relationship between the two disorders. Depressive disorder should be evaluated and effectively treated in subjects with Internet addiction. While awaiting the validation for those models, we also suggest future directions for studies, and for treating subjects with Internet addiction. What’s more, the shared mechanisms contributing to both Internet addiction and depression should be evaluated in the future. Future study results have the potential to advance effective preventative programs for both Internet addiction and depression.

**Acknowledgement**

The authors of this overview declare no potential conflicts of interest in writing this report.

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