

eHealth intervention for Problematic Internet Use (PIU)

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ABSTRACT

Excessive use of the Internet is considered a problematic behaviour by clinicians and researchers. Cognitive Behaviour Therapy (CBT) has been advocated for a long time as a treatment approach and has been extended to include family therapy in recent years. As eHealth has become an important component in the treatment of many mental health problems, it is prudent to explore the current status of the eHealth approach as an intervention option for this problem. This systematic review aims to examine the current development of online intervention programs for this particular condition. The PRISMA guidelines for systematic reviews and meta-analysis were employed to conduct the search for literature following a systematic and structured approach. Of the 182 articles screened, three satisfied the selection criteria. Information was extracted and analysed systematically for each study and tabulated. All these studies were pilot studies with small sample sizes. Two of these articles aimed to explore the therapeutic efficacy of newly developed online intervention programs for internet addiction (IA) and online gaming addiction. The third article described the design and development of an App for smartphone addiction. The results obtained from this review have provided insight into the on-going development of eHealth interventions as well as the Health Informatics approaches in offering a possible and practical solution to tackle this growing problem.

Keywords: Internet Addiction; Problematic Internet Use; eHealth, Intervention; Systematic Review

INTRODUCTION

Problematic Internet Use (PIU) and Internet Addiction (IA), among other terms, are used to describe the excessive use of information and communication technologies which has been recognised as a problematic behaviour for nearly two decades.[1-5] In her earlier work, Young developed a diagnostic criteria based on the Diagnostic and Statistical Manual of Mental Disorder 4 (**DSM-4**) criteria for pathological gambling.[5] In Young's model for the diagnosis of IA three main features were included: preoccupation, loss of control, and harmful effect.[5] The number of Internet users have grown rapidly in recent years. In particular online gaming among young people has increased, drawing significant attention to the phenomenon of IA.[6] This resulted in the recognition of Internet Gaming Addiction (IGA) as a potentially emerging disorder requiring further investigation, and its inclusion into Section III of the latest version of the Diagnostic and Statistical Manual of Mental Disorder (**DSM-5**).[7]

While the definition of PIU or IA is still a matter of contention with on-going debates, various schools of thought have developed to understand this newly emerged phenomenon of human behaviour. This results in different definitions and thus various approaches or models of assessment.[8-9] These models include the aforementioned Young's diagnostic framework, the Shapira et al definition of uncontrollable, markedly distressing, and damaging consequence, and some other similar concepts.[8-11] In this study, we adopt a more liberal view on the definition of PIU or IA that accommodates various thoughts. For Internet use, a range of Internet-based activities such as using the Internet for entertainment, social networking, gaming, gambling, online pornography viewing, online shopping etc. via multiple mobile devices are included.

In terms of the relationship between PIU and health, particularly the mental health of young people, the detrimental effect of PIU has long been documented.[12] Many studies have reported associations between PIU, psychiatric symptoms, and depression among adolescents.[12-16] For example, Ko et al. conducted a systematic review of the literature on the association between PIU and psychiatric disorders.[17] A number of disorders were identified as comorbidities of PIU including: substance use, attention-deficit hyperactivity disorder, depression, and social anxiety disorder.[17] In addition to the mental health effect, PIU has also been related to physical ill-health. According to a case-series report on patients who were addicted to the Internet, particularly to the Massive Multiplayer Online Role-playing Games (MMORPGs), it has been demonstrated that these games induced seizures in ten patients.[18]

As an emerging behavioural problem, the therapeutic community has responded swiftly in terms of offering possible treatment options. In an early meta-analytical study of various treatments for IA it was found that both psychological and pharmacological treatments were effective.[19●] The effect size of these treatment options were as high as 1.61 for IA. [19] In the area of psychotherapy, the Cognitive Behaviour Therapy (CBT) approach has long been advocated.[20-23] Studies have demonstrated that, in general, CBT is an effective treatment option for PIU with a significant reduction in the addictive behaviour in children, adolescents and adults.[21-22] In order to refine the therapeutic approach, an IA specific CBT module (CBT-IA) has also been developed by Young to target the main elements characterising her diagnostic framework.[23] This approach has been adopted and extended to include family therapy in recent years.[24]

eHealth, as defined by the World Health Organisation (WHO), is the use of information and communication technologies for health purposes. With advancements in digital and mobile technologies, eHealth and mobile health (mHealth) has become another rapidly growing option for the promotion of mental health and well-being as well as providing an additional treatment module for mental health problems. A number of recent review studies have also demonstrated the effectiveness of an eHealth or mHealth approach in terms of a positive clinical outcome of mental health.[25,26,27] Given the growing importance of eHealth as a component in the treatment of many mental health problems, it is prudent to explore the current status of the eHealth approach as an intervention option for PIU or IA.

The aim of this study is to examine the current development of online programs as an intervention for PIU or IA through a systematic review.

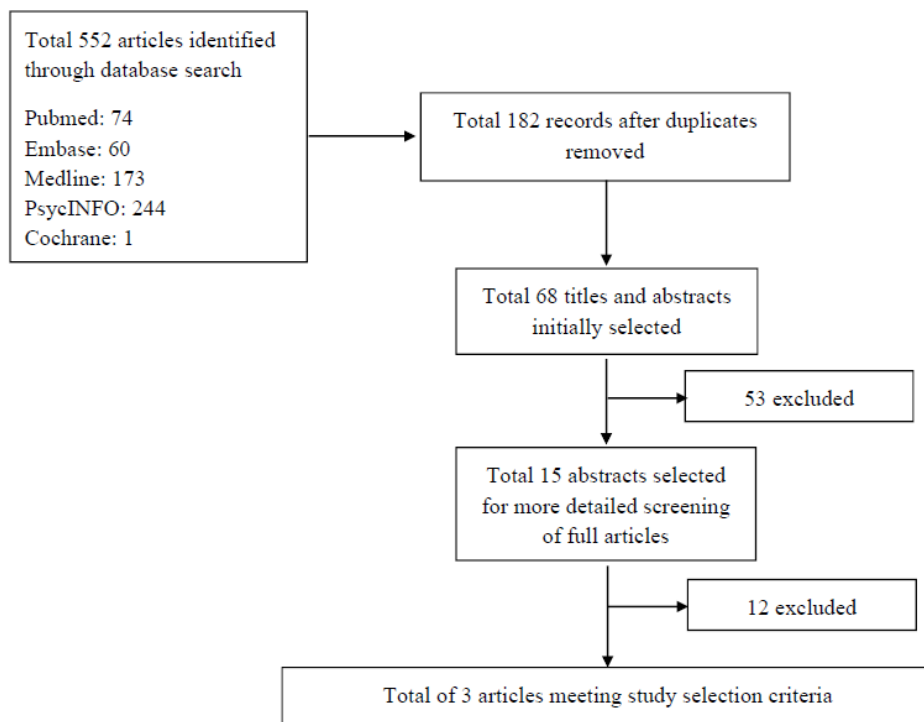
METHODS

Search strategies

The PRISMA guidelines for systematic reviews and meta-analysis were employed to conduct search for literature following a systematic and structured approach.[28] Major medical, health, and psychological literature databases including PubMed, Embase, Medline, PsycINFO and Cochrane database of systematic reviews, were used and the search included all publication years (till July 2016). The keywords used for the systematic search were: (“excessive Internet use” or “problematic Internet use” or “pathological Internet use” or “Internet addiction” or “excessive computer use” or “Internet gaming” or “computer gaming” or “Internet gaming addiction” or “Internet gaming disorder” or “online pornography” or “sexting” or “online shopping”) AND (“online intervention” or “eIntervention” or “eTherapy” or “eHealth”). The entry style of keywords was modified as required for each database. Included in the search were articles published as reviews for the purpose of identifying relevant studies. However, these review articles were not included in this systematic review. Restriction was imposed on the search for publications in the English language only. Upon completion of the search, titles and abstracts of the identified articles were assessed for their suitability to be included in the review. After assessing the titles and abstracts, full text of the articles that were deemed suitable were retrieved for further examination of the contents. The reference lists of the selected articles were also examined for additional suitable publications that might have been overlooked in the search. Figure 1 presents the flow diagram of the selection process.

Selection Criteria

The following selection criteria were applied to identify suitable articles: 1) studies with appropriate study design that included an online intervention for PIU or IA; 2) studies with clear descriptions of the intervention program and details that could allow replication; and 3) studies with a clear description on the effect of the intervention on PIU or IA. Conference proceedings, abstracts, and non-peer-reviewed journal articles were excluded from this review.



Information extraction and analysis

Information was extracted from the selected articles and tabulated for further analysis. Of interest was information on the details of the intervention program, and the relationship between the intervention and PIU or IA. Information extracted from the selected studies included the location of the study, study design, study sample, description of the intervention, assessment of PIU or IA, analytical approach, estimated effects, and other information or remarks relevant to the study. This information was then summarised and analysed descriptively.

RESULTS

An extensive search was conducted following the aforementioned procedures resulting in 182 unique articles. An examination of the titles and abstracts of the captured articles revealed that majority of these articles were not related to the current topic resulting in only 68 studies selected as possible candidates for inclusion in the review. Both authors selected these articles independently. A total of 15 articles were selected after close examination of the abstracts.[29-34,35,36-43] Inspection of the full text of these articles found that only three satisfied the selection criteria and contained sufficient information. All three were recent studies conducted in the East Asia Region where Internet Addiction was prevalent. Two of these were conducted in South Korea, and one in China. All were pilot studies with small sample sizes with two aiming to explore the therapeutic efficacy of a newly developed online intervention program for IA and online gaming addiction.[41-42] The study by Lee et al aimed to describe the design and development of an App for monitoring pathological smartphone use and provide usage analytics.[43] The main reason for the exclusion of other articles was that they did not satisfy the selection criteria of reporting an online or etherapy for IA or PIU. Detailed information was extracted from the selected articles and summarised in Table 1.

In the study by Su et al, the intervention was an online program developed based on the motivational interview procedure.[41] This procedure provided an interactive step-by-step

guide for users to explore their current situation and provided motivation for change. The aim of the procedure was to assist users to explore their existing situation, and to motivate him/herself to change by setting achievable goals. This intervention approach has been used in many areas including drug and substances abuse, physical activities, and obesity. This pilot study on the efficacy of the program used three different experimental conditions, including intervention in a laboratory environment, in a natural environment, a non-interactive program, with a control condition. Results from this pilot study suggested that significant differences across all four groups were found on the outcome measure of IA using Young's Diagnosis Questionnaire (YDQ) at follow-up ($\chi^2=14.11$, $p<0.01$). However, no differences were found among the three intervention groups. Results suggested a possible effect of the intervention on the reduction of IA.

The Park et al study was a pilot study that aimed to investigate the effect of Virtual Reality Therapy (VRT) on online gaming disorders in comparison to the conventional CBT.[42] In addition to using Young's Internet Addiction Scale (YIAS) as the outcome measure, the authors were interested in demonstrating the utilities of neuroimaging, particularly functional Magnetic Resonance Imaging (fMRI) for assessing functional connectivity in various regions of the brain. While the results did not show any difference in terms of the YIAS score between VRT and CBT after intervention, there were significant reductions in scores in both after the intervention when compared to the baseline measure. Results did not favour VRT against CBT, however, both could be effective in reducing IA.

The study by Lee et al aimed to describe the design and development of the Smartphone Addiction Management System (SAMS).[43] This App was designed to monitor smartphone usage and provided usage analytics with the additional aim of providing information on prevention and treatment suggestions to clinicians. While some basic information about the correlation of the frequency and time spent, and smartphone addiction was presented, the main focus of this small-scale verification study was to describe the design and development of the system.

DISCUSSION and CONCLUSIONS

The study followed the structured PRISMA guidelines for systematic review that ensured proper and methodical procedures. Three studies that fulfilled the selection criteria and contained potentially useful information on eHealth or eTherapy program were identified. The results of the review further confirm that the eHealth or eTherapy approach of intervention in the area of PIU or IA is lacking. The small number of studies found (most conducted recently), reflects the relative youth of PIU or IA as an area of study that has only recently drawn attention. As aforementioned, debates about the proper diagnosis in this area still on-going. Clinicians and researchers in the field are still examining appropriate psychotherapeutic approaches based on the conventional treatment model of psychopathology. Some positive results have been reported, particularly in the use of CBT as a treatment option of PIU, that may contribute some evidence to the argument for the establishment of IA as a proper diagnosis within the DSM diagnostic framework. As a recent phenomenon of human behaviour, research in the area has been growing rapidly in recent years. The interventions described in the three studies are considered ground breaking in the area for their novel ideas.

The results obtained from this review have provided insight into the on-going development of eHealth interventions as well as Health Informatics approaches that offer possible and practical solution to tackle this growing problem, particularly among young people. These studies have demonstrated the potential of cyber technology use in conjunction with conventional therapy

approaches, to provide broader treatment and management regimes for this newly emerging behavioural problem. As shown, there is a variety of different eTherapy programs aiming to tackle the issue of PIU. These include motivational interviews, virtual reality simulation, and the use of information feedback as a means for inducing self-regulation and as a treatment aid. However, further in depth analysis of these different eHealth approaches reveals that all but one of these approaches rely heavily upon technology as a driving force or motivation of the design. They are not based on any in depth conceptual understandings or a possible theory that may underpin the aetiology of the problematic behaviour. In other words, these eTherapy programs are mainly technologically driven, not based on or derived from a sound conceptualisation of the aetiology, trajectory or progressive development, and clinical manifestation, of the problem. Due to such short-comings in the design and development process, there is a lack of a clear intervention targets such as the psychological or the emotional state of the problematic Internet users and other environmental factors that are conducive to the problematic use. This may, in turn, impact on the efficacy and effectiveness of these online eTherapy programs in addressing the issue of PIU or IA. It is to be acknowledged however that all three studies did not aim to be proper trails of the newly developed programs, and were pilot studies.

The results obtained from this review have provided some insight into the on-going development of an eTherapy or eHealth approaches for the intervention of the PIU or IA. First, to ensure the basic construct validity of the intervention program, it is prudent to base the development of technology and/or therapies on a well-researched theoretical therapeutic framework that provide a strong reason for the therapeutic structure. Without the support of a clear theoretical therapeutic framework, it is difficult to pinpoint which interventional elements are effective should there be any positive outcomes generated from the program. Second, different approaches and platforms could be employed to tackle a similar behaviour or to achieve a specific behavioural outcome. This multi-platform approach has already been applied in other mental health problems, such as eating disorders.[44]

In conclusion, the eTherapy or eHealth approach, in conjunction with conventional treatment, could potentially provide an effective intervention for PIU. However, the design of the outline intervention program should be based on a well-researched therapeutic framework.

Compliance with Ethics Guidelines

Conflict of Interest: Both authors, Lawrence T Lam and Mary K Lam, declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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Table 1. Information extracted from individual studies on eHealth intervention for PIU.

Author, year, place	Study design, methods & participants	Intervention & outcome	Method of analysis & variable adjusted	Results	Comments
Su et al. (2011) ¹² , Beijing, China	<p>Design: Randomised experimental design with four parallel arms with baseline and 1 month post-intervention assessments.</p> <p>Participants: Sixty five university students satisfying the selection criteria of scoring 3 or higher on the YDQ and online more than 14 hours/week. (N=65).</p>	<p>Intervention: Online intervention using the motivational Interviewing procedures with 4 modules. Participants were randomised into one of the 4 experimental groups: online intervention in a laboratory environment; online intervention in a natural environment; non-interactive program; and control</p> <p>Outcome variable: Online hours /week, online satisfaction, and Internet Addiction assessed by YDQ.</p>	<p>Method of analysis: Data were analysed using non-parametric test with effect size (Cohen's d) calculated.</p> <p>Variables adjusted: Nil</p>	Significant differences across all four groups at follow-up ($\chi^2=14.11$, $p<0.01$). However, no differences among the three intervention groups.	This is a pilot study with small sample size for each group. No clear information on the randomisation, thus not sure whether it was properly conducted.
Lee et al. (2014) ¹³ , Korea	<p>Design: A single group study for the verification of the Smartphone Addiction Management System (SAMS).</p> <p>Participants: Fourteen smartphone users aged between 19 and 50 years with equal number of males and females (N=14).</p>	<p>Intervention: The SAMS with monitoring, data archiving, analysis, and intervention and treatment functions.</p> <p>Outcome variable: K-SAS score.</p> <p>Study variable: Daily use counts and times</p>	<p>Method of analysis: Correlations between daily use counts and time with K-SAS.</p> <p>Variables adjusted: Nil</p>	Moderate correlation between daily use counts with K-SAS, but no correlation between daily use time and K-SAS.	This is a pilot study with small sample size. The main focus was on the introduction of the SAMS and design details. Insufficient information on the efficacy of the intervention program
Park et al. (2016) ¹⁴ , Korea	<p>Design: Randomised experimental design with OGA patients randomly assigned to either the CBT or VRT groups. Casual gamers were recruited and underwent</p>	<p>Intervention: CBT and VRT with three steps 1) relaxation; 2) simulation of a high-risk situation; 3) sound-assisted cognitive reconstruction.</p> <p>Outcome variable: YIAS score and the FC score of cortico-striatal-limbic</p>	<p>Method of analysis: Nonparametric tests for comparing patients characteristics; Analysis of Covariance (ANCOVA) with repeated measures and paired t-tests were</p>	No significant difference between CBT and VRT in the severity of OGA (F=0.43, $p=0.52$). However, significant reductions in YIAS score before-and-after	This is a pilot study with small sample size. No information on the duration from intervention to post-intervention assessment, thus not clear it was only an immediate or a longer term effect. As there was no obvious difference between the CBT and VRT, so what

	<p>only baseline assessment and served as control.</p> <p>Participants: Twenty four patients with OGA and 12 causal game users with a mean age ranging between 23.3 to 24.2 years (N=36).</p>	<p>circuit assessed by neuroimaging (fMRI).</p>	<p>used for between and within group comparisons.</p> <p>Variables adjusted: Not mentioned, presumably demographics were included in the ANCOVA.</p>	<p>treatment in both groups were found. After treatment, the VRT group showed increased FC in targeted regions, and CBT showed increased FC in some other regions.</p>	<p>were the advantages of the VRT over and above the conventional CBT?</p>
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