REVIEW

Web-Based Interventions for Youth Internalizing Problems: A Systematic Review

Jazmin A. Reyes-Portillo, PhD, Laura Mufson, PhD, Laurence L. Greenhill, MD, Madelyn S. Gould, PhD, Prudence W. Fisher, PhD, Naomi Tarlow, BA, Moira A. Rynn, MD

Objective: To review published reports on Web-based treatment and prevention programs for depression, anxiety, and suicide prevention in children, adolescents, and emerging adults. **Method:** A systematic search of the PsycINFO, PubMed, Medline, and Web of Science databases was conducted in December 2013. Programs were classified according to evidence-base level (Well-Established, Probably Efficacious, Possibly Efficacious, Experimental, and Of Questionable Efficacy). **Results:** Of the 14,001 citations initially identified, 25 articles met inclusion criteria for Web-based interventions. These described 9 programs, of which 8 were Internet based and 1 was a mobile application. No Web-based interventions for suicide prevention were identified. Of the randomized controlled trials (n = 14) and open trials (n = 3) identified, 10 reported significant postintervention reductions in symptoms of depression and/or anxiety or improvements in diagnostic ratings, with small to large effect sizes. Many of these studies also reported significant improvements at follow-up. The methodological quality of the studies varied. Many programs were limited by their small sample sizes and use of waitlist or no-treatment control groups. **Conclusion:** There is limited evidence for the effectiveness of Web-based interventions for youth depression and anxiety. Additional research and program development are needed to fill the current gaps in the literature. J. Am. Acad. Child Adolesc. Psychiatry, 2014;53(12):1254–1270. **Key Words:** Web-based intervention, emerging adult, depression, anxiety

The use of the Internet and mobile phone applications (apps) for the prevention and treatment of mental health disorders is a burgeoning area of research. This is a promising development because Web-based interventions may increase opportunities for engaging children and adolescents (youth) in need of psychotherapy.[1] It is estimated that only 39.4%, 17.8%, and 30% to 45% of youth with depression, anxiety, or suicidality, respectively, enter face-to-face treatment.[2-4] This gap may be partly due to the limited availability of mental health services, as well as youths' reluctance to seek professional help.[5,6] These barriers are of particular import for youth with internalizing problems, such as depression, anxiety, or suicidality, who are less apt to come to the attention of adults than youth with externalizing problems.[7] The Internet and Web-based technology may be an attractive means of engagement for enrolling these youth in treatment. Possible advantages of Web-based interventions include their ability to reach a larger and more diverse audience across a wider geographic area, 24-hour access, little or no cost, user autonomy and anonymity, and minimal waiting lists.[8] A recent report from the Pew Foundation indicates that 95% of adolescents in the United States are online, and 78% of adolescents have a mobile phone, with 47% owning smartphones.[9] Adolescents are also the most frequent users of Internet-based mental health sites.[10] Media use is also pervasive among children, with 22% of 5- to 8-year-olds using a computer at least daily and 52% having access to a smartphone, iPod, or iPad in 2011.[11] Psychological interventions that use the Internet or mobile apps may be


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especially attractive to youth in need of mental health services.

There is a growing number of Web-based interventions based on face-to-face cognitive-behavioral therapy (CBT) for depression, anxiety, and suicide prevention.[1,12] Randomized controlled trials (RCTs) have provided support for the effectiveness of Web-based interventions in reducing symptoms of depression and anxiety in adults.[13] Few such programs have been developed for youth, but the field is growing.[1] Three systematic reviews to date have examined Web-based interventions for youth depression and anxiety, which cover studies up to December 2009.[1,14,15] Given the rapid growth and evolution of Internet-based technology and its uses, reviews of this topic must be conducted regularly to keep pace with the rapidly changing landscape.[16] This article focuses on Web-based interventions or self-guided treatments delivered via Web sites that are designed to educate and/or cause therapeutic change.[17] These include mobile app–based interventions downloaded and operated off the Internet for smartphones, tablets, computers, and other portable devices, which comprise a subset of Web-based interventions.[18]

Given the similarity in psychotherapeutic interventions for these conditions, this study presents the results of a systematic review of Web-based interventions for the treatment and prevention of depression and anxiety, as well as suicide prevention in youth. Although this review includes research described previously, it extends findings from earlier reviews by including studies published after December 2009, and studies focusing on late adolescents or emerging adults (aged 18–25 years), an at-risk population often neglected in previous reviews of the Web-based literature on youth internalizing disorders.[19]

METHOD

Relevant articles were identified through a computer search of articles in the PsycInfo, PubMed, Medline, and Web of Science databases published between January 2000 and December 2013. The following key search terms were used: "Internet OR Internet-based OR Web-based OR online therapy OR online treat* OR online intervention OR cellular phone OR mobile phone OR smartphone application* OR smartphone app* OR mobile app* OR social media OR m-health OR e-health OR telemedicine OR telepsychiatry OR computer assisted" and "anxiety," "depression," or "suicide." An asterisk added to each term captures all derivatives of a term (e.g., "treat*" captures treatment and treatments). For a sample search strategy see Supplement 1, available online.

The title, abstract, and/or full paper were assessed to determine which studies met the following inclusion criteria: sample comprised children (aged 5–12 years), adolescents (aged 13–17 years), and/or emerging adults (aged 18–25 years); sample age did not exceed 25 years; the focus was a Web-based intervention designed to treat or prevent symptoms of depression, anxiety, and/or suicide; paper published in an English-language peer-reviewed journal; mental health outcomes reported using specific measures; and intervention delivered via the Internet or a mobile app. Case series, editorials, reviews, abstracts, and protocol papers were excluded. Studies describing a virtual reality exposure treatment, interactive voice response technology intervention, Web-camera (cam) intervention, or a text messaging–only intervention without a mobile app component were also excluded. All potential studies were independently assessed by 2 coauthors (J.A.R.P and N.T.) and required unanimous agreement for an article to be included. An advisory committee (L.M, L.G., P.W.F, M.S.G., and M.A.R.) then reviewed the final set of articles to ensure that all met the inclusion criteria. The reference sections of earlier reviews and the included papers were also hand searched to identify other relevant studies. In addition, the authors of the included articles were contacted and asked whether their research groups had published any additional articles.

Two coauthors (J.A.R.P and N.T.) then extracted and summarized information from the remaining articles, focusing on details such as the intervention used, sample characteristics, methodological design, adherence, participant satisfaction, and clinical outcomes. Data abstraction followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (for PRISMA Systematic Review Checklist, see Table S1, available online).[20] Between-group effect sizes were estimated using Cohen's *d* (standardized mean difference)[21] for the primary outcomes of each study with the exception of studies describing secondary data analyses. For cases in which the primary outcomes were not specified or multiple measures of the same construct were examined, only the first outcome described in the Methods section of the paper was reported. Positive effect sizes indicated a positive intervention effect, with 0.20, 0.50, and 0.80 representing a small, medium, and large effect size, respectively.[21] Given the heterogeneous quality of studies and the difficulty in extracting effect sizes from some of the data descriptions, a meta-analysis was not conducted.

Finally, the research evidence for each program was evaluated using the evidence-base level criteria proposed by Southam-Gerow and Prinstein,[22] which classifies treatments as Well-Established, Probably Efficacious, Possibly Efficacious, Experimental, and Of Questionable Efficacy. These criteria are an updated version of the criteria developed by the American