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Technology-Based Intervention for Depression in Adolescence: A Literature Review

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Abstract — Depressive disorder is a disorder that frequently occurs in adolescents. Although some interventions are already known, many adolescents have difficulty accessing care when needed and adhere to therapy. This study aimed to introduce the use of technology-based interventions for depression in adolescents. We searched PubMed, Springer, Sage, and Science Direct for articles in English using the search terms "adolescent depression" and "depression", combined with additional search terms, "technology-based '"online' "computer-based '"computerized' "prevention '"treatment' "CBT '"videoconference". We focused on papers from the past five years but also included papers published in the past 10 years (if sparse). We found that 25 articles were suitable for this topic. This review revealed that some novel development interventions, such as self-monitoring and mood assessment, computerized cognitive behavior therapy, and videoconference therapy, which could increase patient coverage and increase adherence to therapy, were more convenient to access from wherever patients lived and cost less for patients than conventional therapy, which showed the same effectiveness. Technological development in medical care, specifically in mental health, is a possible solution to increasing the coverage of interventions for depression in adolescence. Further research is needed to determine the effectiveness of this technology-based intervention in a larger population.

Keywords — cCBT; Videoconferencing; Depression; Adolescence

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INTRODUCTION

Adolescence is a critical period for individuals to develop certain skills and enter the workforce. One-quarter of the world's population (1.8 billion) are teenagers and young adults (aged 10-24 years), with 90% living in countries with low or middle economies [1]. The ability to develop a prosperous life requires good-quality mental health as its main asset and resource. At present, it is estimated that 10%-20% of adolescents around the world experience mental disorders, with nearly 50% appearing before the age of 18 years [1,2].

Depression is a dominant mental disorder in adolescents. The incidence of depression among adolescents is approximately 6%. The prevalence of depression in adolescents increases sharply after puberty [3]. Depressive disorders put teenagers and young adults at risk of committing suicide, which is the third leading cause of death in adolescents [2,4].
Depression in adolescents is difficult to recognize because adolescents tend to show masked depressive reactions [5]. However, there are several typical symptoms of depression in adolescents, including persistent mood changes [5], problems at school [6], [5], family and social conflict [5,6], drug abuse [5,7,8], and somatic symptoms [5].

The criteria for diagnosing depression in adolescents are permissible by assuming that depression experienced by adolescents is an early onset of depression in adulthood due to a strong relationship with recurrence in the future. The symptoms and patterns shown were similar to those observed in adults. Two present classification systems, specifically the International Classification of Diseases-10 (ICD-10) and the American Diagnostic and Statistical Manual of Mental Disorders (DSM-V),

define depression in a nearly identical manner, with the DSM-IV presenting a notable exception for children and adolescents, wherein irritability is a primary diagnostic criterion instead of a depressed mood [9].

Technology and the internet are the main forces driving innovation in the fields of e-health and mobile health, especially for teenagers. Electronic-based interventions have the potential to increase the coverage of adolescent psychological interventions in large numbers. These interventions are considered to require a small number of health care providers, are shorter, are more private, are easier to reach, and are less expensive [3,10,11]. This study is expected to contribute to the development of effective technology-based interventions for depression in adolescents. The implications of this review can assist mental health practitioners in selecting and implementing interventions that meet the needs of adolescents in the digital era. Additionally, the results of this review can serve as a foundation for the development of mental health policies that leverage technology to enhance access and quality of services for adolescents experiencing depression.

METHOD

The scientific writing methodology encompassed a literature review. We conducted a search on PubMed, Springer, Sage, and Science Direct for English-language articles utilizing the search terms “adolescent depression” and “depression,” in conjunction with the additional terms “technology-based,” “online,” “computer-based,” “computerized,” “prevention,” “treatment,” “CBT,” and “videoconference.” We concentrated on publications within the last 5 years, while also incorporating articles published during the previous 10 years, where limited. We identified 5 article reviews, 7 systematic reviews, 11 randomized controlled trials, and 1 qualitative study.

Various types of technology-based interventions for depressed adolescents

Compared with those in children and adults, mental health interventions in adolescents are more challenging because of the rapid development of physical, intellectual, and emotional problems. The characteristics of interventions for adolescents include being divided, lack of coordination, and lack of equal service quality [4].

As adolescents experience depression, their need for mental health services increases. This increasing need has led some researchers to develop technology-based mental health services [3]. This technological development involves prevention and therapeutic interventions. The British Association for Psychopharmacology includes technology-based interventions as part of its guidelines [12]. According to the guidelines, the use of technology-based interventions is part of psychological and behavioral interventions. According to the recommendations made, technology-based interventions can be used but cannot be routinely used for primary management. Its use is also limited in patients with mild to moderate depression or as an additional therapy in the use of antidepressants [3,10,12-15].

Technology-based interventions and mood assessment and monitoring tools

Electronic mood assessments and electronic-based monitoring tools are hypothesized to make patients feel efficient and responsible for their treatment, reduce the burden on healthcare providers, and create efficient and systematic treatment methods [3].

Mobiletype

Mobiltype are well-studied health-monitoring applications. A series of studies involving application creators have been conducted over several years. This application was designed to record and analyze adolescent mental health using mobile phones. This application can recognize mood, stress, coping mechanisms, exercise, diet, alcohol, and drug use in accordance with the

current conditions and then distribute a simple report to the teenager's health care provider. Users and health care providers can see changes in health conditions (including mood) at any time through a supportive site. Adolescents who report that they are more sensitive to emotional changes related to reducing depressive symptoms. For general practitioners, this application helps them understand mental health conditions and determine the decision when the general practitioner must give medication, make referrals, and determine the diagnosis [3].

Mind Your Mood

Mind your mood through a smartphone-based application recently developed by a Canadian University. This application can be used to search for user moods. Users can choose from approximately seven face images and 28 words to describe their current mood. This application also provides flexibility for users to determine the intensity of their positive and negative moods, create graphics and interactive reports, and send them via electronic mail to healthcare providers. To date, no research has been published on this application [3].

Computerized Cognitive Behavior Therapy (C-CBT)

Cognitive behavior therapy (CBT) is effective in the management of several mental disorders, one of which is depression. However, the number of children and adolescents who receive CBT is still limited for two reasons. The first is the limited number of psychiatrists who are experts in CBT, especially pediatric or adolescent patients. This indicates the need to increase the capacity of those who are experts. There is evidence that bedside-trained psychiatrists can effectively provide CBT to children and adolescents. Therefore, providing CBT through computers by health workers other than psychiatrists is a matter that needs to be developed to meet these needs. Second, there are still very few children and adolescents who experience emotional problems and who receive help from psychiatrists. To improve access to psychiatric interventions, such as CBT, methods that can be applied and applied in various conditions and media are needed. The independent use of self-help technology, school-based prevention programs, and computer-based interventions aims to increase the availability of CBT [16].

SPARX

One promising program for promoting well-being and preventing low mood, stress, and anger in youth is the SPARX-R C-CBT gaming program. The program focuses on managing strong emotions and teaching positive coping mechanisms such as problem solving and help seeking. SPARX-R is rich in multimedia, and most text-based content is accompanied by audio, which is important considering the common literacy difficulties among these students [17,18].

SPARX (smart, positive, active, realistic, X-factor thinking) is a complimentary online program designed to assist young individuals experiencing mild to moderate depression, as well as emotions of despair, stress, or worry. This program instructs participants in self-resolution of their concerns using cognitive behavioral therapy. The game, set in a 3D fantasy universe, guides players through seven regions, each lasting 30 to 40 minutes. The player personalizes an avatar and embarks on a journey around the seven provinces to fulfill various quests. Gamers confront GNATS (GNATS). These GNATS advance towards the avatar and utter disparaging remarks, such as, "you are a loser." Upon completion of a mission, the Guide elucidates the application of new talents to enhance well-being, address challenges, and appreciate reality. Players accomplish one or two levels in the game weekly [19,20].

A qualitative study indicated that SPARX was beneficial as it effectively imparted relaxation and cognitive restructuring skills. It enhanced participants' mood and elevated their levels of hope, and in certain circumstances, it was utilized by members to achieve a positive outcome [21].

MoodGYM

MoodGYM is a complimentary online program established by the Centre for Mental Health Research at the Australian National University. MoodGYM is a complimentary and straightforward C-CBT program. The MoodGYM consists of merely five sessions that can be finished within a few weeks. The MoodGYM includes a concise introductory session followed by five sequential sessions, each lasting 20 to 40 minutes, conducted through a personalized online workbook. Every session in MoodGYM concentrates on a specific facet of cognitive-behavioral therapy (CBT) and includes written content, interactive activities, animations, and assessments [22].

The MoodGYM was effective for depression postintervention, but only a medium effect on anxiety syndrome demonstrated its utility in people with depression and a medium impact on anxiety. MoodGYM was significantly more effective than the control at reducing stress symptoms but was not significantly associated with a reduction in symptoms of depression, anxiety, or impaired daily functioning [23].

Stressbuster

The Stressbusters program is a C-CBT initiative tailored for teenagers experiencing mild to moderate depression. The program was founded on a proficient face-to-face cognitive-behavioral therapy regimen for adolescents experiencing depression. Therapeutic elements encompass psychoeducation regarding depression and its treatment, behavioral activation, recognition and modification of negative automatic thoughts, enhancement of problem-solving abilities, improvement of social skills, and relapse prevention. Therapeutic elements are provided individually through a computer in a manner that is suitable and engaging for the age group, utilizing secure, interactive multimedia such as animations and videos. During each session, the user securely logs in, reports on their homework and current emotional state, is introduced to the session topic, selects a video featuring a young actor portraying a depressed teenager utilizing the treatment technique, applies the technique interactively, creates personalized homework based on that technique, and subsequently logs out. Stressbuster sessions were conducted separately using a laptop and headphones in a designated room at school, accommodating a maximum of five pupils per session. No restrictions were imposed on pursuing supplementary non-study therapies while participating in the Stressbusters program [24].

The Journey

The Journey is embedded in a fantasy game-like environment. The user should select and name an avatar and follow the narrative of a quest through magical lands where the content is linked to a theme (e.g., cognitive restructuring techniques are progressively covered in Sky and Star Cities, respectively). Users earn points for completing the modules and are rewarded with a simple mini-game at the end of each module. The Journey contain seven modules, each with a different topic. Each module takes approximately 25–30 min to complete and begins with a mood monitor, followed by a quiz to recap the messages of the previous module, agenda setting, and a number of interactive exercises, animations, and illustrative video clips. Modules end with a summary of content and challenge (homework) setting [25].

ProjectTECH

ProjectTECH is an online preventive intervention utilizing cognitive-behavioral therapy strategies for teenagers with melancholy and substance abuse issues. The projectTECH program was developed using the ThinkFeelDo intervention framework, which is a responsive web application accessible via mobile devices and laptops. The curriculum comprised instructional lessons and resources grounded in cognitive-behavioral therapy principles. The lessons were disseminated five

times weekly, each lasting 5 minutes for reading. Every class ended with a directive to apply skills through site tools or engage with the peer group [26].

The primary CBT instruments employed were THINK, FEEL, and DO. Think offered cognitive restructuring approaches, including the challenge of negative beliefs; FEEL motivated users to monitor their mood; and DO served as a behavioral activation method, involving the planning of activities and reflection on users' sense of achievement. The player utilized a goal-setting instrument (ACHIEVE) and a collection of relaxation audio recordings (RELAX). All activities displayed on the homepage feed shared with the peer group resembled those available on Facebook [26].

REThink

The REThink game was developed to address these concerns, aiming to provide a theory-driven preventative intervention that enhances psychological resilience in children and adolescents throughout the general community. The REThink game aims to assist youngsters in acquiring effective skills for managing maladaptive negative emotions, including anxiety, rage, and depression. REThink is founded on affirmative preventive initiatives rooted in Rational Emotive Behavioral Therapy (REBT) and Rational Emotive Behavior Education (REBE). REBT and REBE emphasize the process of transformation by fostering rational beliefs to supplant particular irrational beliefs, including demandingness, catastrophizing, frustration intolerance, and self-other/life denigration, with alternative rational beliefs such as preferences, negative evaluations, frustration tolerance, and unconditional acceptance of self, others, and life. This is accomplished via learning modules that employ experiential and educational techniques designed to instruct children in recognizing their thought processes and modifying their maladaptive emotional responses by reformulating their irrational beliefs, implementing effective problem-solving and decision-making strategies, and fostering positive emotions and social behaviors [27].

Other technology-based interventions for depression in adolescents

SMS-based interventions

A potential strategy for constructing a technology-based intervention is the implementation of supportive messages or reminders transmitted via SMS. SMS-based interventions provide enhanced flexibility in interactions between physicians and patients. Besides in-person consultations, the mobile and asynchronous characteristics of SMS provide an excellent opportunity to overcome conventional barriers to care, represent a practical and widely recognized intervention format, and may function as a straightforward, cost-effective supplemental therapy. This digital intervention can address patients' daily tasks in a more contextually relevant manner according to their mood. The utilization of text messaging applications can yield preventative advantages, enhance patient engagement, and facilitate behavioral modification [28,29].

Effectiveness of technology-based interventions in handling depression

One study showed that independent internet-based interventions were effective in the treatment of depression. A meta-analysis comparing internet-based interventions with control interventions, such as cognitive behavior therapy (CBT) and interpersonal psychotherapy (IPT), revealed a significant effect in accordance with the effects of face-to-face psychotherapy on depression. A study that analyzed 25 randomized controlled trials (RCTs) with 5,509 patients reported that there were differences in results between the provision of internet-based therapy and conventional face-to-face therapy. However, other studies in 9 RCTs showed smaller differences [30,31].

One of the best outcomes of electronic-based mental health interventions is psychotherapy for depression. However, research on adolescents is still lacking compared with that on adults. Some of the results of other studies on the provision of

technology-based interventions in depressed adolescents showed an insignificant effect on the improvement of depressive symptoms [3].

Advantages of technology-based interventions

Technology-based interventions offer several advantages. Some advantages are related to the need for a smaller amount of human resources and less expensive funding than standard therapies [3,10,30]. However, one important advantage of technology-based interventions is real-time assessments. This real-time assessment makes it possible to measure and predict a patient's mental condition in daily life. Handheld telephones also provide several sensors, such as an accelerometer, which is useful for measuring location changes, and GPS sensors to determine locations. Smartphones now also have several functions, such as calling, messaging, the internet, and social media. This function can be used to develop personal models to determine mood changes associated with depression [10].

Data protection, privacy and security in technology-based interventions

Managing public trust when managing and sharing personal health data is the main issue, and the community needs to be involved in such discussions, especially regarding issues of privacy and data security. Here, an ethical issue is needed in technology-based mental health services because of the sensitivity of personal-related data [30].

Future challenges using technology-based interventions

There are no definite limits when clinicians can apply technology-based interventions to patients. Little research has been conducted on the conditions under which certain criteria deserve to be met for this kind of intervention. There are still many questions related to whether this intervention can be a single therapy, primary therapy, an adjunct therapy, or other treatments, such as questions about what can be combined with the intervention model [31]. The broad application of technology-based interventions still requires further research, as do several rules and codes of ethics. These rules and codes of ethics are needed to protect patients and therapists from carrying out their work so that both therapists and clients feel safe and comfortable in carrying out their therapy. [32].

CONCLUSION

Depression is a disorder that often appears in adolescence; although some interventions are known, adolescents still have difficulty accessing it when they need it and are obedient to therapy. Technological developments in the field of health, especially mental health, have become a solution for improving interventions for adolescents who suffer from depression. At present, some interventions, such as mood monitoring and assessment, computerized cognitive behavioral therapy, and other technology-based therapies, have begun to be developed for adolescents who suffer from depression. These interventions have been shown to provide therapeutic effectiveness in several RCTs in the form of reduced depressive symptoms, similar to conventional therapy. These therapies have the advantage of being more accessible from wherever adolescents live and less expensive, thereby increasing adherence to therapy. The lack of such intervention requires ethics and legal applications in the field. However, these deficiencies do not hinder their application. Technology-based interventions can begin to be implemented while they need periodic monitoring. The application of such interventions is expected to expand the reach of mental health service providers to provide therapy to adolescents with depression.

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