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DIGITAL INTERVENTION FOR ADOLESCENTS WITH DEPRESSION: A SCOPING REVIEW

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ABSTRACT
A significant public health problem is depression in adolescents. Depression is a mental disorder characterized by negative emotions and feelings of worthlessness. With the advancement of technology, interventions for adolescents experiencing depression can be delivered digitally through websites, apps, and other online platforms. Objective to review digital interventions used to address depression in adolescentsT. his article uses five data bases, namely ProQuest, Scopus, Scient Direct, EBSCOhost and PubMed . Article search from 21,554 articles which were then extracted to get 8 articles, peer review, full text and the last 5 years (2020-2025). Of the eight interventions analyzed, five were digital CBT-based interventions, two were psychoeducation and social support-based interventions, and one was a remote support therapy-based intervention. Apps enable a more cost-effective, more accessible, and more flexible approach compared to conventional methods. Digital interventions based on CBT, psychoeducation, and distance psychotherapy are the main approaches in treating adolescent depression.

Keywords: adolescents; depression; digital; intervention

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INTRODUCTION

A significant public health problem is depression in adolescents. Depression is a mental disorder characterized by negative emotions and feelings of worthlessness (Natasubagyo & Kusrohmaniah, 2019). The prevalence of depression is increasing worldwide (Mkhize et al., 2024), (Petrova, 2022). The World Health Organization (WHO) shows that in 2023, the population experiencing depression is estimated to be 3.8% (World Health Organization (WHO), 2023). Depressive disorders have increased in Indonesia by around 6.2% of adolescents aged 15 to 24 years (Health Research and Development Agency (Badan Litbangkes), 2018) , (Putri et al., 2022).The factors causing depression in adolescents are multifactorial, including biological, genetic and psychosocial aspects. An imbalance of neurotransmitters such as serotonin and dopamine plays a role in mood regulation. Genetic factors also contribute, where a family history of depressive disorders increases a person's risk of experiencing a similar condition (Robby, 2013). Psychosocial factors include stress from life events, such as loss, or financial problems, as well as premorbid conditions, social and educational disorders, and poor physical health and problems at school are the main triggers for depression in adolescents (Wang et al., 2024) , (World Health Organization (WHO), 2023).

Direct implementation is essential to carry out. Digital technologies have been highlighted as particularly valuable given their potential to increase reach and facilitate access to psychotherapy, at relatively low cost. Digital technologies can vary in design, for example, website-based or delivered via an app (Abbasi et al., 2024). Some technologies are supported by healthcare providers or other professionals. There is

growing evidence to support the use of several technologies in preventing and treating adolescent anxiety and depression. Digital mental health technologies, namely resources and interventions to support and improve mental health, have the potential to expand reach and increase adolescents' access to therapy, at relatively low cost. Many young people have access to the internet and mobile technologies, including in low- and middle-income countries (Jones et al., 2023).One intervention that has proven effective in dealing with this problem is digital intervention. This intervention can be done actively (through counseling) or passively (through information media such as books, applications and videos) (Lumongga, 2016). With the development of technology, interventions for adolescents experiencing depression can be provided digitally through websites, applications and other online platforms (Desi et al., 2020).

Although digital interventions for adolescents with depression are growing. So far there has been no specific scoping review . In Indonesia, several scoping reviews have been conducted with a focus on adolescent mental health issues, such as digital interventions to prevent suicide, scoping reviews related to depression and anxiety. In general, digital interventions review the impact of depression during the COVID-19 pandemic. However, there has been no scoping review aimed at reviewing digital interventions for depression in adolescents that specifically map the types, characteristics, and outcomes of digital interventions specifically aimed at adolescents with depression, regardless of suicidality, other comorbidities, or the context of the pandemic. Therefore, a scoping review is needed to identify, synthesize, and comprehensively map digital interventions that have been used or developed for adolescents with depression. This study is expected to be the basis for the development of more appropriate interventions, as well as a reference in clinical practice and digital mental health service policies for adolescents in Indonesia and other regions with similar characteristics.

Previous research conducted by (Jones et al., 2023) has conducted a systematic review of 33 digital interventions aimed at preventing and treating depression and anxiety in adolescents. This study examined various psychological approaches used, such as cognitive behavioral therapy (CBT), positive psychology, and interpersonal therapy, as well as various forms of technology such as serious games, online modules, chatbots, and moderated social media platforms. These findings provide an important basis for further studies that examine in more depth the coping mechanisms facilitated through digital interventions in reducing depressive symptoms in adolescents.

METHOD

Research Design

This study uses a scoping review method that aims to map and provide an overview of digital interventions. Scoping review is a method that used to identify literature in depth and comprehensively from several sources related to the research topic. Research involves identifying relevant research questions using systematic literature based on formulated research questions, collecting research results, tabulating results, compiling, analyzing, explaining, and reporting results (Reangsing et al., 2024). At the stage of identifying research questions based on the research objectives, namely "What are the digital interventions that can be used for adolescents with depression?"

Data Collection

scoping review , the articles that will be included are studies that examine digital interventions aimed at adolescents with depression. The digital interventions referred to include various forms, such as mobile applications, web platforms, computer programs, digital games, or

online counseling services. Literature search using five databases are Pubmed, Scopus, Scient Direct, EBSCO, and ProQuest. The keywords used are "Intervention" AND "digital" AND " adolescent", "depression" AND "adolescent ". The similarities are “app intervention” OR “digital technology”. The search for academic articles was conducted directly, in English that has been peer reviewed and full text online in the years of publication 2020-2025. Accepted studies include quantitative, qualitative, and mixed methods research. Conversely, articles were excluded if they were not specific to adolescents, did not directly address digital interventions, were not available in full text, or were written in a language other than English. Data from the articles to be reviewed by looking at the authors, study design, objectives, and samples. In the search for articles identified as many as 21,554 articles which were then extracted to obtain 8 articles that could be used. The findings of this review describe digital interventions for depression in adolescents. The literature selection process was carried out by looking at relevant titles, while irrelevant ones were removed and eliminating duplicate articles using the reference manager, namely Mendeley. After that, article mapping was carried out based on characteristics. The full text of the research abstract was read to determine the research included in the review.

Data extraction and charting information

The guidelines used in article selection refer to PRISMA-Scr which can be seen in Figure 1. The article search process was developed with the help of librarians who helped search the database and complete the screening process. The authors also reviewed the search strategy and verified the eligibility of the articles included at each screening stage. After the final articles were identified, each article was summarized by mapping relevant information. The data collection that had met the criteria and stages was then arranged in Microsoft Word by creating a table containing several components including the author's name, article title, year of publication, explanation of the intervention, research design, research objectives, and a summary of the main findings.

RESULT

The reviewed article that digital interventions use many applications. Psychological interventions in the treatment of depression in adolescents have experienced rapid development, along with technological advances and a better understanding of mental health. These approaches are from several article reviews, especially in three main groups, namely digital interventions based on cognitive-behavioral therapy (CBT). A total of five interventions are included in the CBT category that utilizes digital technology (applications, computers, or the web). This approach is considered effective in increasing adolescent engagement. Interventions that fall into the CBT category are Spark, DTx, SparkX, Smartteen and Boost My Mood (BMM). Some programs combine CBT with advanced technology such as virtual reality and fantasy-based online games to deliver emotion regulation and problem-solving skills. Other interventions present CBT sessions in a computer-assisted format that address aspects such as behavioral activation, negative automatic thought recognition, and self-esteem enhancement.

Psychoeducational interventions based on social support consist of two interventions combined with increasing social support from the environment. The interventions are PSSB (Psychosocial Support-Based Psychoeducation) and Mood Hwb. PSSB consists of eight sessions designed to improve adolescents' understanding of psychosocial issues, emotional management skills, interpersonal relationships, and future parenting skills. Meanwhile, Mood Hwb contains educational programs that focus on basic understanding of mood and depression, as well as the importance of self-help, support from family and friends, and mood monitoring. Most of the apps are designed to be accessed without a therapist, that is,

directly. The next topic is distance psychotherapy intervention. There is one intervention that utilizes long-distance communication media, namely the telephone, as a means of delivering individual therapy. Tele-Support Psychotherapy is a telephone-based individual support psychotherapy service. Through eight structured sessions, clients are provided with an in-depth understanding of mental disorders, coping skills, empowerment, and independent living planning. This service also includes training and supervision of counselors to maintain the quality of interventions, as well as system integration with other digital health services such as laboratories and pharmacies.

The reviewed articles targeted adolescents (aged 12-21 years) with mild to severe depressive symptoms , subclinical symptoms, and involved school and college students. which is still categorized as adolescents. Most articles use effective digital interventions given for at least 4 weeks to 12 weeks. But there are 2 protocol articles so the intervention is a 6-12 month time range for data collection. Of the eight articles, none of the countries where digital intervention was carried out were Indonesia and were predominantly in the United States and India. Various studies use various instruments to measure the effectiveness of digital interventions for depression in adolescents, including the Adolescent Depression Knowledge Questionnaire (ADKQ), Depression Stigma Scale (DSS), General Help-Seeking Questionnaire (GHSQ), Self-Efficacy Questionnaire for Depression in Adolescents (SEQ-DA), Behavioral Activation for Depression Scale (BADS), Mood and Feelings Questionnaire (MFQ), Screen for Child Anxiety Related Emotional Disorders (SCARED), Strengths and Difficulties Questionnaire (SDQ), Hospital Anxiety and Depression Scale (HADS), Patient Health Questionnaire (PHQ-8/PHQ-A), Edinburgh Postnatal Depression Scale (EPDS), Children's Depression Inventory 2 (CDI-2), Beck Depression Inventory-II (BDI-II), Children's Depression Rating Scale-Revised (CDRS-R), Clinician's Global Impression-Severity (CGI-S), and Children's Global Assessment Scale (CGAS).All studies discuss effective digital interventions for the newly designed approaches. Treatment for most children is not easily accessible due to the high cost of mental health services. Health apps reduce waiting times for appointments and the need to see a doctor in person. Using health apps is even cheaper than other methods.

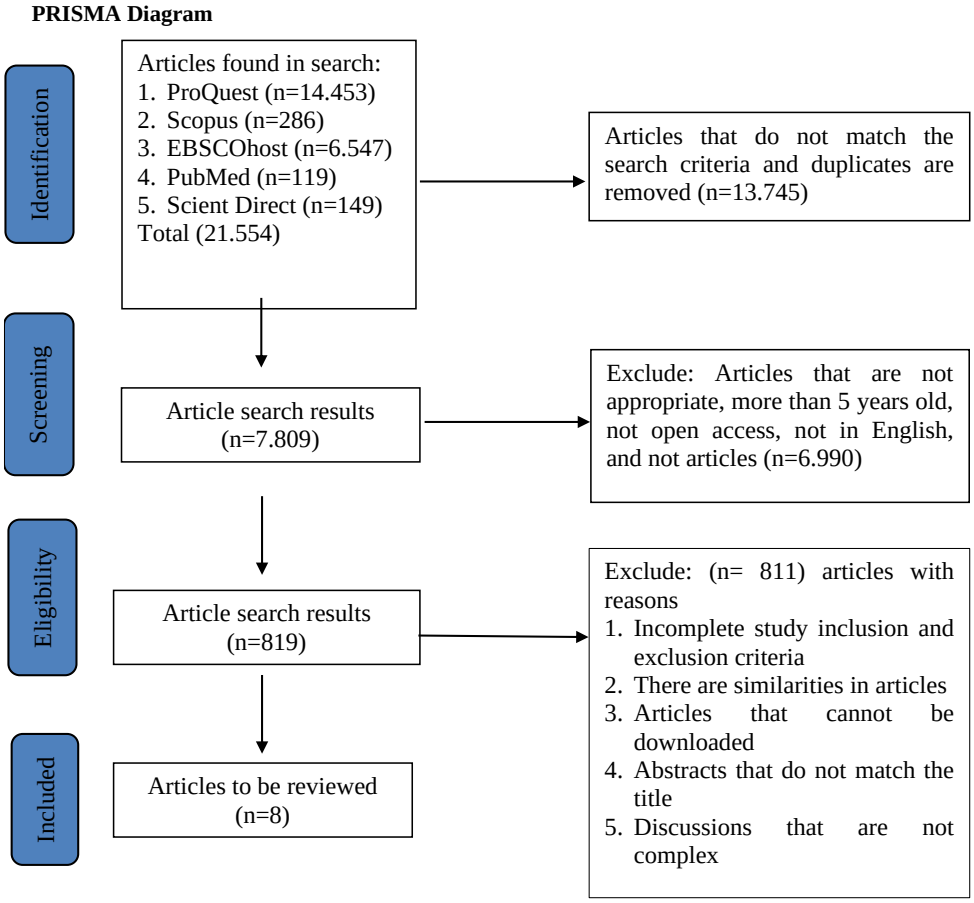

Figure 1. Flow diagram for database search

Table 1.
Article Review

No	Author, Year, Country	Design	Sample Inclusion Criteria	Depression used	Intervention Contents	Results
1.	(Jones et al., 2020), Welsh (UK)	Mix method (qualitative and quantitative), 59 young people but after evaluation there were 44 young people and 31 parents or caregivers, the minimum intervention duration was 2 months. Questionnaire: - Adolescent Depression Knowledge Questionnaire (ADKQ - Depression Stigma Scale (DSS)	- Young people aged at least 13 years - Choose one of 2 conditions, namely having a history of current or previous depression and being at high risk of experiencing depression. - Parents who have children who meet these criteria - Professionals who have mental health issues	Risk of depression	MoodHwb Intervention 1. Education: explaining the difference between mood and depression 2. Possible reasons: factors that influence someone to have a bad mood and depression, for example experiences and family history. 3. Self help (self help): can help themselves to manage bad moods and depression 4. Where to get	Participants found the intervention engaging, clear, easy to use and comprehensive, and stated that it could be integrated into existing services. Young people found the "Self-help" and "Mood monitoring" sections particularly helpful. The findings provide initial support for the theory of the intervention program, for example depression literacy improved following the intervention (mean difference in literacy scores: 1.7, 95% CI 0.8 to 2.6; p<0.001 for young people; 1.2, 95%

		- General Help-Seeking Questionnaire (GHSQ) - Self-Efficacy Questionnaire for Depression in Adolescents (SEQ-DA) - Behavioral Activation for Depression Scale (BADS) - Mood and Feelings Questionnaire (MFQ) - Screen for Child Anxiety Related Emotional Disorders (SCARED) - Strengths and Difficulties Questionnaire (SDQ) - Hospital Anxiety and Depression Scale (HADS)			help: family, friends, school, GP 5. Other health problems: difficulties that may be experienced include anxiety and physical illness. 6. Family, friends and professionals: information for families, carers and others who care about young people who may be experiencing low mood and depression. 7. Mood monitor and diary: monitor your mood every day 8. Likes: breathing exercises, singing, playing guitar, sports, reading books etc.	CI 0.4 to 2.2, p=0.006 for parents and caregivers).
2.	(Miller et al., 2023), United States	Consisting of 30 adolescents and young adults aged 12 to 21 years with self-reported moderate to severe depressive symptoms , intervention duration 5 weeks, questionnaire PHQ-8 (Patient Health Questionnaire)	- Age : 12–21 years - Access to mobile devices - Willing to provide consent (and permission from a guardian if <18 years)	Moderate to severe depression	Spark Intervention a. Module 1 : Introduction to the program, depression and behavioral activation. In-depth video on depression and behavioral activation (e.g., the relationship between thoughts, feelings and actions) b. Module 2: Mood tracking, identifying the relationship between mood and behavior, and growth mindset. In-depth educational video clips on the relationship between thoughts,	The Spark program was found to be a feasible and acceptable means of delivering a self-guided cognitive behavioral therapy (CBT)-focused intervention to adolescents and young adults with depressive symptoms. Preliminary data also suggest that the Spark program reduces depressive symptoms in adolescents and young adults.

					feelings, actions, and neural plasticity. c. Module 3: Introduction to mindfulness and activity scheduling. Mindful breathing exercises d. Module 4: Introduction to problem solving and continuous activity scheduling. Guided meditation on problem solving e. Module 5: Mindfulness, relapse prevention, and sustainable activity scheduling. Guided meditation on transformation and relapse prevention.	
3.	(Nakimuli-mpungu et al., 2025), Kampala (Uganda)	Type : Controlled trial followed by a randomized quantitative trial (pilot RCT). Mixed-methods : started with a qualitative study to adapt the intervention. Location : 3 districts in Kampala: Makerere University, Kamwokya, and Naguru Go-down (slum). Participants : 300 young men (15-30 years) with mild-moderate depression, intervention duration 6-12 months, Self-Reporting	- Age 15–30 years - Living in Kamwokya, Naguru, or Makerere (Kampala) area - Have a cell phone - Can speak English or Luganda - Providing written consent	Mild to moderate depression	Tele-Support Psychotherapy Intervention 1. Psychotherapy services via telephone call, Each participant receives therapy according to the Group Support Psychotherapy structure that has been modified for an individual format. 2. There are 8 sessions 3. Tele-Psychotherapy Platform (Call Center), an automatic recording system of who called and the counselor who served. Integrated with other digital health services (laboratory,	-

		Questionnaire (SRQ-20)			pharmacy, etc.). 4. Counselor training and supervision to be given intensive training before the service starts. There is quality monitoring through training logs, exit interviews.	
4.	(Peake et al., 2024), United States	Design : Randomized controlled trial (RCT), open-label, internet-based. Participants : 160 adolescents (aged 13–21 years), intervention duration 2 months, Patient Health Questionnaire (PHQ-8)	- Age 13–21 years - Residing in the United States during studies - Under the care of a mental health professional or primary physician in the US - Fluent in English - Have a smartphone and internet access - Willing to fill out electronic consent (e-consent) (also from guardian if <18 years) - Stable in treatment or therapy for at least the last 2 months	Mild to severe depression	DTx Intervention Version 2.1 1. Level 1 (Start Your Journey): Introduction to the program and learning about the BA model of depression 2. Level 2 (Making Choices): Tracking mood swings and activity ups and downs 3. Level 3 (Problem Solving): Learn about activity scheduling and complete 3 activations, 4. Level 4 (Stay Active): Complete 4 activations 5. Level 5 (End of Journey): Complete 5 activations Version 2.2 1. Level 1: BA Onboarding and Introduction (no difference) 2. Level 2: Mood tracking (no difference) 3. Level 3: Mindfulness and Activity Scheduling (addition of 2 psychoeducational tasks that teach and reinforce mindfulness skills)	There is preliminary evidence that a self-guided cognitive behavioral therapy-based DTx intervention can effectively treat mild to severe depressive symptoms in adolescents. DTx may improve access to mental health care for adolescents or serve as an important complement to treatment.

					4. Level 4: Problem Solving and Activity Scheduling (addition of 2 psychoeducational tasks that teach and reinforce problem solving skills) 5. Level 5: Relapse Prevention and Activity Scheduling (addition of 6 psychoeducational tasks that teach relapse prevention skills). Control application version The 5 levels of control applications include: Lesson 1: Understanding Behavior Lesson 2: Exploring the Brain Lesson 3: Mastering the Messenger Lesson 4: Riding the Wave Lesson 5: People and Personality.	
5.	(Cicek, 2023), Turkey	Type: Randomized Controlled Trial (RCT) with pre-test and post-test design, 4-week intervention duration, Edinburgh Postnatal Depression Scale (EPDS) questionnaire	- Adolescent girls aged 15–19 years - Third trimester of pregnancy (because of higher risk of anxiety and depression) - Able to read and write	Depression in pregnant teenagers	PSSB Intervention a. Session 1 To inform participants about the psychoeducational program and to get to know the participants. b. Session 2 To increase their level of knowledge about psychosocial issues and minimize psychosocial stress by providing them with information about methods to increase social support from	The results of this study showed a significant decrease in anxiety and depression levels and an increase in perceived social support levels in the experimental group compared to the control group after the PSSB psychoeducational intervention (P <0.05) .

		partners, family, and friends.	
		c. Session 3 Information is provided about emotions, thoughts and behaviors, as well as methods for recognizing and managing emotions, developing and maintaining positive relationships, making responsible decisions, and strengthening interpersonal relationships.	
		d. Session 4 To help participants use appropriate coping methods, as well as enable them to develop new coping methods.	
		e. Session 5 To introduce the concepts of stress, anxiety and depression to participants and teach them stress coping skills.	
		f. Session 6 To determine each participant's perception of parenting and ask them to share their concerns about future parenting skills.	
		g. Session 7 training is provided and the importance of social support and cooperation is	

					explained to partners, family and friends. h. Session 8 To evaluate the effectiveness of the program and to reinforce what has been learned.	
6.	(Werner-Seidler et al., 2025), Australia	Type : Cluster Randomized Controlled Trial (RCT). Participants : 6,388 students from 134 schools in Australia, intervention duration 6 weeks-12 months, PHQ-A (Patient Health Questionnaire-Adolescent version) questionnaire	- 8 students (ages 13–14 years) - Providing active informed consent from students and parents - Have a smartphone (iOS/Android) and a telephone number	Symptoms of depression	SPARX Intervention SPARX is a web-based cognitive-behavioral treatment for adolescent depression. Core skills covered include emotion identification, emotion regulation, behavioral activation, challenging unhelpful thoughts, and problem solving. SPARX is delivered through seven 20-minute modules in a game format where participants explore a fantasy world. Participants are encouraged to work through one to two modules per week without human guidance and have access to SPARX for 6 weeks on their smartphone.	Scaled delivery of a digital cognitive-behavioral program did not reduce depressive symptoms.
7.	(Willems et al., 2024), Netherlands	Participants 50 adolescents aged 16-21 years with (sub) clinical depressive symptoms . The study was conducted in five secondary schools in the Netherlands, intervention duration 3 months, questionnaires Children's Depression Inventory 2 (CDI-2)	- Teenagers aged 16–21 years - Experiencing subclinical or clinical depressive symptoms , based on a score ≥10 on the Children's Depression Inventory 2 (CDI-2) - Not currently undergoing treatment for a mental disorder - Not at high risk for suicide	Subclinical depression in adolescents	BMM Intervention The Boost My Mood (BMM) application is a preventive early intervention suitable for adolescents with (sub) clinical depressive symptoms . The application focuses on four main themes that correspond to the main symptoms of adolescents experiencing depression: 1. The need for a better mood 2. Less stress 3. Worry less 4. Sleep better	The study showed significant reductions in not only depressive symptoms, but also anxiety, worry, and stress while using the BMM app. Sleep problems did not decrease significantly over time while using the BMM app.

					Each theme contains the following three components: psychoeducation; stories and tips from other teens who have experienced depressive symptoms; and CBT-based tasks, such as journals or activity schedules.	
8.	(Srivastava et al., 2020), India	Type : Single-blind, Randomized Controlled Trial (RCT), intervention duration : 12 weeks - BDI-II (Beck Depression Inventory II) - CDRS-R (Children's Depression Rating Scale-Revised) - CGI-S (Clinician's Global Impression-Severity) - CGAS (Children's Global Assessment Scale)	- Age 13–19 years - ICD-10 Diagnosis - Average IQ , computer literate , and understand English - Undergoing stable treatment for at least 4 weeks	Mild to moderate unipolar depression (not bipolar or mixed disorder)	Smartteen Intervention 1. There are 12 sessions namely session 1 psychoeducation (introduction to CBT), sessions 2-5 mood tracker (behavioral activation), sessions 6-10 thought buster (Option 1- CBT skills to overcome Rumination Identify negative automatic thoughts Option 2-Skip 1, Introduce content designed to help identify maladaptive thoughts), session 11 problem attacker (problem solving skills training) and session 12 self-esteem (improving self-esteem and Relapse prevention) 2. Throughout 12 sessions and illustrate examples of thoughts, feelings, and behaviors they experienced in four different situations including, 1) breaking up with a romantic partner, 2) exam stress, 3) conflict	Smartten was shown to reduce the time spent by therapists delivering 12 sessions of CBT treatment for depression. The results suggest that smartteen could be subjected to more rigorous evaluation with a larger sample size and considered for wider application if proven effective.

		with parents, and 4) interpersonal problems with peers. 3. Treatment as Usual (TAU) was administered by the first author. The TAU group received pharmacotherapy and 12 weeks of active psychological therapy (including interventions such as psychoeducation, supportive interventions, stress management).	

DISCUSSION

Studies have shown that digital technology can also help with other mental health outcomes, including knowledge, stigma, and help-seeking behaviors. Given the rapid pace of digital technology and culture, there are a number of possible future developments in digital mental health practice and research. Technology is likely to become more complex, flexible, and more personalized, including the use of avatar-based virtual therapy. For example, a study is underway to examine whether virtual reality interventions provide a more engaging experience for users than comparable purely web-based interventions (Jones et al., 2023).Recent studies have shown that digital CBT is significantly effective in reducing depressive symptoms in adolescents, both in self-directed and guided forms. A meta-analysis by (Wu et al., 2023)confirmed that digital CBT can produce comparable reductions in depressive symptoms to face-to-face CBT, with higher effectiveness when it is actively used and personalized. In addition, the use of VR and educational games such as Spark and SPARX are considered to increase adolescent engagement. In line with findings from (Townsend et al., 2022)the gamification approach in digital CBT has been shown to increase motivation to learn emotional skills and strengthen self-regulation. CBT is a psychosocial intervention that focuses on the relationship between thoughts, feelings, and behaviors and teaches coping skills (Miller et al., 2023).

Interventions such as PSSB, Mood Hwb, and BMM emphasize psychoeducation as the core of prevention and strengthening psychological resilience. This approach includes providing information about depression, stress management, social relationships, and mood monitoring. Digital psychoeducation has advantages in terms of accessibility, affordability, and contextual adaptability. Studies have shown that digital psychoeducation is effective in reducing early symptoms of depression and increasing mental health literacy in adolescents when combined with interactivity and social support (Wickersham et al., 2022).Telephone intervention models, such as Tele-Support Psychotherapy, have shown to be particularly relevant in resource-limited contexts, particularly in rural settings or during emergencies such as pandemics. Studies have shown that tele-support therapy significantly helps reduce the severity of depressive symptoms and improves emotional well-being, with the caveat that counselor training and regular supervision are required (Reay et al., 2020). Among psychotherapy approaches, CBT is considered the current gold standard treatment for

depression in adolescents and has been found to be effective in reducing depressive symptoms and improving quality of life (Srivastava et al., 2020). The advantages of app-based psychological interventions include availability, accessibility, freedom of time and space, and flexibility in self-guidance (Willems et al., 2024).This scoping review shows that digital interventions based on CBT, psychoeducation and psychotherapy have great potential in treating depression in adolescents. Moving forward, the development of digital interventions needs to incorporate elements of interactivity, personalization, and social support that are adaptive to local contexts. Further research is also needed to evaluate the long-term effectiveness and acceptance of adolescents towards various forms of digital technology.

CONCLUSION

These interventions include a variety of methods, including counseling, cognitive-behavioral therapy, health education through modules, and technology-based programs such as online applications or web platforms. All of these methods have shown consistent results in increasing mental health literacy, decreasing depression rates, and improving emotional regulation and social relationship skills in adolescents. This application enables a more cost-effective, more accessible and more flexible approach compared to conventional methods. With the prevalence of depression continuing to increase, digital-based interventions are relevant and strategic interventions in supporting adolescent mental health. Digital interventions based on CBT, psychoeducation, and distance psychotherapy are the main approaches in treating adolescent depression. The effectiveness and feasibility of this intervention has been demonstrated in a variety of cultural and country contexts. Digital interventions carried out need to pay attention to the frequency, duration and techniques used.

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