

DIGITAL SCREENING AND EDUCATIONAL INTERVENTIONS TO REDUCE DEPRESSIVE SYMPTOMS IN ADOLESCENTS: A SCOPING REVIEW

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Abstract

Introduction: Depression is a mental health disorder commonly found across all age groups, including adolescents. Adolescent depression imposes burdens on individuals, families, and caregivers and may lead to social, educational, occupational, and physical health problems. This study aimed to identify digital educational interventions to reduce depressive symptoms in adolescents. **Methods:** This study conducted a scoping review, analyzing articles from four academic databases: Scopus, Web of Science, PubMed, and Science Direct. Study selection was guided by the PCC (Population, Concept, Context) framework and followed the PRISMA-ScR reporting standards. **Results:** A total of 1,787 articles were identified, with 12 studies meeting the inclusion criteria. The review indicated that digital educational interventions can be categorized into three main approaches: (1) CBT-based interventions, (2) psychoeducation and self-management programs, and (3) chatbot- or social media-based interventions. All twelve studies (100%) reported reductions in depression scores, along with improvements in anxiety and resilience among adolescents. Most interventions demonstrated significant reductions in depressive symptoms, anxiety, and improved resilience among adolescents. Several applications also integrated digital screening tools such as PHQ-8 and PHQ-9. **Conclusion:** Digital nursing interventions delivered through mobile health applications are effective in reducing depressive symptoms among adolescents. These interventions are innovative, scalable, and complement traditional mental health services by providing accessible, interactive, and youth-oriented approaches that address both psychological and physical needs.

Keywords: adolescent depression, digital intervention, digital nursing, education, screening

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INTRODUCTION

Adolescence is a critical transitional phase from childhood to adulthood, characterized by significant biological, cognitive, psychosocial, and emotional changes. During this period, adolescents often experience stagnation in identity exploration, problem-solving, and commitment, making them vulnerable to mood disorders and depression (Bogaerts *et al.*, 2021). Depression is characterized by disturbances in mood and diminished interest in nearly all activities (American Psychiatric Association, 2013) and frequently emerges as a common mental disorder among adolescents aged 15–21 years (Bauer *et al.*, 2019). Prolonged depression can interfere with daily activities, work, and school, with suicide being its most severe consequence (WHO, 2023). If not managed properly, the resulting burden affects not only individuals but also the nation as a whole (Idris and Tuzzahra, 2023).

World Health Organization (WHO) estimates that 3.8% of the global population experiences depression, including 5% of adults and 5.7% of older adults above 60 years. More than 700,000 people die from suicide annually, making it the fourth leading cause of death among those aged 15–29 years (WHO, 2023). According to the 2023 Indonesian Health Survey, the national prevalence of depression was 1.4%, with the highest rates found in the 15–24 age group (2%). The prevalence was higher among female adolescents (2.8%), those with middle-level education (2.2%), and those who were unemployed, working in labor-based occupations, drivers, domestic helpers, or still in school (>2%) (Survey Kesehatan Indonesia, 2023).

Adolescent depression is closely associated with stress, anxiety, sleep disturbances, school dropout, smoking, drug and substance abuse, and obesity (Putri *et al.*, 2022). Depression in adolescence can place a significant burden on individuals, families, and caregivers, leading to social, educational, occupational, and physical health problems (Manfro *et al.*, 2023). Adolescents face many emotional changes that require adaptation and coping skills. Failure to adapt may lead to feelings of worthlessness, hopelessness, helplessness, and persistent negative thoughts that increase the risk of depression (Mandasari and Tobing, 2020).

Currently, most adolescents with depressive symptoms do not seek professional help or receive appropriate support (Bauer, 2019). Barriers to help-seeking include poor mental health literacy, stigma, feelings of shame, and depressive symptoms

themselves, such as worthlessness or guilt (Gulliver, 2010). Mental health literacy can help individuals detect mental disorders, promote help-seeking behaviors, and reduce stigma (Clarke, Kuosmanen and Barry, 2015). Promotive efforts in mental health can be manifested through education campaigns, school-based mental health programs, and youth health posts. Health education may be delivered directly to communities or via social media, websites, and digital applications targeting adolescents, with the aim of improving mental health literacy (Singh, Kumar and Gupta, 2022). Meanwhile, preventive measures include early screening of mental health issues in order to identify symptoms at an early stage and ensure timely interventions (Colizzi, Lasalvia and Ruggeri, 2020).

Internet-based interventions have emerged as an innovative and effective strategy to overcome these barriers, as research indicates that adolescents frequently use the internet to search for health-related information and support (Park and Kwon, 2018). Adolescents tend to feel more comfortable using digital media that is private and flexible, making this approach suitable for addressing barriers such as social stigma, limited access to professional services, and low mental health literacy (Luxton *et al.*, 2011; Fleming *et al.*, 2018). Although internet-based interventions have been recognized as effective in addressing depression among adolescents, existing studies in Indonesia remain limited and descriptive. The recent national review mapped various digital mental health technologies but did not specifically examine interventions targeting adolescent depression (Ihsanuddin and Kurniawan, 2025). Therefore, this study aims to identify evidence on digital screening and educational interventions to reduce depressive symptoms among adolescents, addressing both global best practices and existing research gaps.

METHOD

This study design was a scoping review that aimed to identify digital screening and educational interventions to reduce depressive symptoms among adolescents. The scoping review identifies literature obtained from various sources or databases using different research methods through several stages: (1) identifying the research question, (2) identifying relevant studies, (3) selecting studies, (4) mapping the data and (5) compiling, summarizing, and reporting the results (Arksey and O'Malley, 2005). Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) were used as guidelines to identify the articles.

Search Strategy

We used four academic databases in this study (Scopus, Web of Science, Pubmed, and Science Direct) using the following keywords: “health education OR health promotion OR health literacy” AND “application OR apps OR mobile application OR smartphone” AND “depression OR depressive symptoms OR psychological distress” AND “adolescents OR teen”. The keywords were developed from the research questions.

Inclusion and Exclusion Criteria

The PCC framework (Population, Concept and Context) were used to determine the eligibility criteria. The inclusion criteria were a) studies focusing in depression among adolescents b) studies focusing on application-based digital educational interventions c) studies in English language. Inclusion criteria in this study included qualitative and quantitative research designs published in English between 2019 - 2025. Studies were excluded if were not full-text papers, duplicates, literature reviews, or articles withdrawn due to publication ethics.

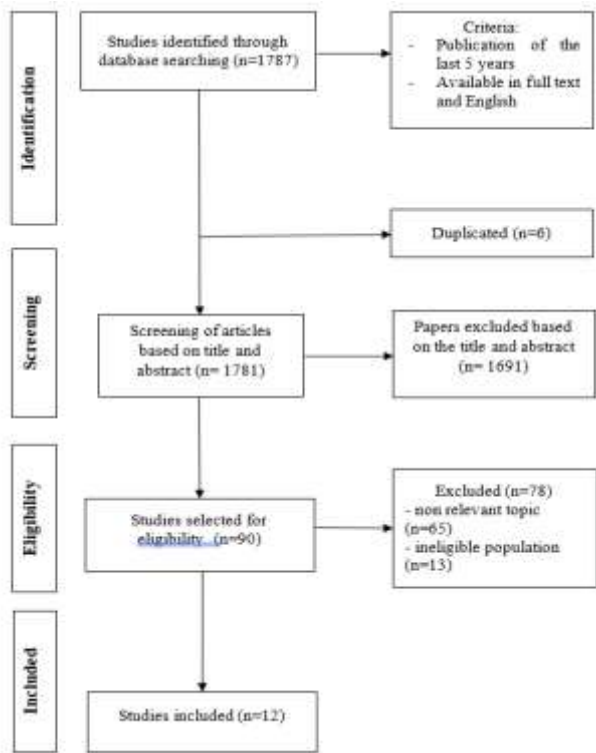


Figure 1. Prisma Flow Diagram

Data Extraction

The extracted data were presented in a table containing columns for the study title and author(s), country, outcome(s), sample size, study design, type

of intervention, and key findings. Additional information, such as the year of publication and study population characteristics, was also recorded where available to provide a more comprehensive overview of each included study.

Data Analysis

Data analysis was performed independently by at least two reviewers to minimize potential bias. A descriptive qualitative approach was employed to identify and summarize the key themes emerging from the study findings. The primary goal of the analysis was to categorize and describe digital screening and educational intervention to reduce depression among adolescent.

RESULT AND DISCUSSION

A total of 1,787 articles were identified four databases, comprising 412 from Scopus, 421 from Web of Science, 371 from PubMed, and 583 from ScienceDirect. Six duplicate articles were removed, and 1,691 articles were excluded during title and abstract screening for not meeting the eligibility criteria. Among these, ninety articles underwent full-text review resulting in 12 studies being included in the final scoping review (Figure 1). The characteristics of the included studies are presented in Table 1, with the majority published between 2020 and 2024 and conducted in various countries, including Japan, the Netherlands, Belgium, the United States, Australia, Mexico, the United Kingdom, and China. Most studies employed a randomized controlled trial (RCT) design (67%) to evaluate the effectiveness of the interventions.

A total of 12 articles that met the inclusion criteria were analyzed. Digital educational interventions to reduce depressive symptoms in adolescents can be grouped into three main methods: (1) CBT-based digital interventions, (2) psychoeducation and self-management programs and (3) chatbot or social media-based interventions

CBT-Based Digital Interventions

CBT-based digital educational interventions were applied in several studies (Nagamitsu et al., 2022; Willems et al., 2024; Peake et al., 2024; Newbold et al., 2020). These interventions primarily focused on enhancing adolescents’ understanding of the interrelationship between thoughts, emotions, and behaviors, while also developing skills to identify and address cognitive distortions.

Table 1. Data Extraction

No	Author	Outcome	Country	Sample	Study Design	Intervention	Result
1	(Nagamitsu <i>et al.</i> , 2022)	Reduce depression scores	Jepang	17 participants	RCT	CBT app	Both intervention groups (WCV and WCV + CBT app) showed a significant reduction in depressive symptoms. Digital screening also used in application using PHQ-9.
2	(Willems <i>et al.</i> , 2024)	Reduce depression score, anxiety and stress	Belanda	50 adolescents	Studi protokol	Boost My Mood (BMM) app	Significantly reduced symptoms of depression, anxiety, worry, and stress
3	(Graham <i>et al.</i> , 2020)	Reduce depression symptoms and anxiety	Amerika	16 participants	RCT	IntelliCare App	The use of the application was effective in reducing depression and anxiety.
4	(Renfrew <i>et al.</i> , 2020)	Reduce depression score, anxiety and stress	Australia	458 participants	RCT	Web dan mobile application	Significant improvements were observed in the intervention group, particularly in reducing depressive symptoms.
5	(Moritz <i>et al.</i> , 2024)	Reduce depression symptoms and anxiety	UK	13 participants	RCT	COGITO app	Significantly reducing depression scores and improving self esteem
6	(Litvin <i>et al.</i> , 2023)	Reduce depression score	UK	165 students	RCT	eQuoo app	Significantly reducing anxiety and depression scores. Digital screening also used in application using PHQ-8
7	(Guo <i>et al.</i> , 2020)	Reduce depression score	China	10 participants	RCT	WeChat Based Intervention	A significant reduction in CES-D (depressive symptom) scores was observed in the intervention group at the third month.
8	(Liu <i>et al.</i> , 2022)	Reduce depression score and anxiety	China	83 students	RCT	AI chatbots XiaoNan	The chatbot effective in reducing depression and anxiety. Digital screening also used in application using PHQ-9.
9	(Peake <i>et al.</i> , 2024)	Reduce depression score	Jepang	10 participants	RCT	PARX (game berbasis CBT)	SPARX significantly reduced depression. Digital screening also used in application using PHQ-8.
10	(Baldofski <i>et al.</i> , 2019)	Reduce depression score	Jerman	13 adolescents	Studi protokol	E.motion	Both online interventions were effective in reducing depressive symptoms compared to the control.
11	(Watkins <i>et al.</i> , 2024)	Reduce depression score and anxiety	UK	648 students	Studi protokol	CT self-guided mobile program	Significantly reduced depression and anxiety
12	(Newbold <i>et al.</i> , 2020)	Reduce stress, depression and anxiety	Jerman	150 students	Studi protokol	StudiCare based CBT	Significantly reduced stress and depression.

Psychoeducation and Self-Management Programs

Six studies were classified under psychoeducation and self-management interventions (Baldofski et al., 2019; Renfrew et al., 2020; Watkins et al., 2024; Graham et al., 2020; Moritz et al., 2024; Litvin et al., 2023). The educational content provided in this group included information on depression, risk factors, early warning signs, and preventive strategies.

Chatbot and Social Media-Based Interventions

Meanwhile, two studies utilized chatbot- and social media-based interventions, namely *WeChat Run4Love* (Guo et al., 2020) and the AI Chatbot *XiaoNan* (Liu et al., 2022). Education was delivered through interactive conversations, short messages, and videos containing materials on depression, healthy lifestyle practices, and simple coping strategies such as meditation, journaling, and breathing techniques. The chatbots also provided motivational support in a responsive and personalized manner.

Digital Screening

Four interventions: WCV, Spark DTx, eQuoo, and XiaoNan Chatbot were found to embed validated instruments such as the PHQ-8, PHQ-9, and GAD-7 directly into the application. The integration of in-app screening facilitated continuous assessment, enhanced user engagement, and supported real-time tracking of mental health outcomes, distinguishing these applications from others that only conducted screening during recruitment phases.

Discussion

This scoping review aimed to identify digital education-based interventions to reduce depression among adolescents. The findings of this review indicate that digital educational interventions designed to reduce depressive symptoms in adolescents can be broadly classified into three main categories: (1) CBT-based digital interventions, (2) psychoeducation and self-management programs, and (3) chatbot or social media-based interventions. All twelve studies included in this review (12/12; 100%) reported a reduction in depression scores following the use of digital applications, demonstrating consistent positive effects on adolescents' mental health across various intervention formats. Each category demonstrates unique strengths and limitations in addressing adolescent depression. Digital nursing interventions

delivered through mobile health (mHealth) applications can be implemented via one-way or two-way communication platforms. One-way applications typically provide psychoeducation through modules, articles, and videos, as well as depression screening. Two-way applications, such as chatbots on WeChat, enable interactive communication and user feedback.

The integration of digital screening tools within mental health applications represents a significant advancement in the early detection and monitoring of depressive symptoms. Four digital interventions embedded validated measures (PHQ-8, PHQ-9, GAD-7) directly into their platforms. Spark DTx provided weekly PHQ-8 monitoring, enabling real-time symptom tracking. eQuoo used PHQ-8 and GAD-7 during onboarding and follow-ups, embedding screening within gamified narratives to improve engagement and retention. XiaoNan Chatbot incorporated PHQ-9 at baseline and four-week intervals, combining assessment with conversational AI to strengthen therapeutic alliance. These findings align with broader evidence that digital mental health interventions incorporating self-assessment tools can effectively reduce depressive symptoms and improve adherence (Torous *et al.*, 2021). Furthermore, in-app screening enhances research validity, clinical utility, and user engagement, though challenges remain regarding data security, attrition, and user burden (Firth *et al.*, 2017).

CBT-based digital interventions has been widely studied as a first-line approach. Randomized controlled trials (RCTs) demonstrate that internet- and mobile-delivered CBT are effective in reducing depressive symptoms in adolescents (Nagamitsu, 2022). Most interventions lasted between 5–12 weeks, consistent with CBT protocols (berapa lama rata-rata dari studi CBT). Studies such as *Boost My Mood* and *Spark* allowed users to evaluate progress and tailor program components, increasing relevance and acceptability (Watkins et al., 2024; Ebert et al., 2020). Recent evidence demonstrates that CBT-based mobile applications designed for adolescents are both feasible and effective, offering accessible psychoeducation, coping strategies, and interactive tools that enhance engagement and adherence, thereby supporting sustained improvements in mental health (Ibrahim *et al.*, 2025). A recent systematic review indicate that internet-based CBT (iCBT) produces outcomes comparable to face-to-face CBT and significantly improves depressive symptoms across diverse populations, highlighting the robustness and adaptability of digital CBT approaches (Riadi *et al.*, 2022). Similarly, an app developed to support adolescents in practicing CBT skills for anxiety

demonstrated that CBT-based mobile interventions are easy to use, helpful for practicing skills outside therapy sessions, and well integrated into adolescents' daily routines, further emphasizing the importance of usability, personalization, and relevance in enhancing treatment outcomes (Newton *et al.*, 2020).

One-way digital interventions provide psychoeducation through modules, articles, storytelling, and videos, often supplemented with self-monitoring. The COGITO app found that a free self-help app improved self-esteem and depressive symptoms (Moritz, 2024). Similar findings show that a self-guided digital program incorporating CBT, mindfulness, and positive psychology significantly reduced perceived stress and rumination in adolescents (Boucher *et al.*, 2024). Other mobile-based studies further highlighted the benefits of guided or self-directed psychoeducation, including improved coping, emotional regulation, and reductions in depressive symptoms (Graham *et al.*, 2020). A recent systematic review confirmed that digital interventions enhance emotion regulation in adolescents, suggesting that self-management programs not only reduce depressive symptoms but also build coping skills for long-term resilience (Reynard *et al.*, 2022). Gamified digital interventions improved motivation, emotional competence, and resilience, demonstrating the value of engaging psychoeducational formats for sustaining mental well-being (Litvin, 2023). Wellbeing applications further incorporated educational components on mindfulness, self-reflection, and self-esteem enhancement, often employing gamification approaches to increase adolescent engagement. Furthermore, a recent feasibility study showed that self-guided digital interventions combining behavioral activation, self-monitoring, and positive activity engagement could effectively decrease depressive symptoms in adolescents and young adults (Miller *et al.*, 2023).

Two-way interventions such as chatbots delivered through WeChat or social media, provide feedback and personalized responses, enhancing engagement (Graham, 2020). *Run4Love* integrated cognitive behavioral stress management (CBSM) modules and physical activity promotion (Guo *et al.*, 2020). Similarly, the AI chatbot *XiaoNan* provided effective self-help for university students, leading to significant reductions in depression and anxiety compared to bibliotherapy while also fostering a stronger therapeutic alliance (Liu *et al.*, 2022). While *Run4Love* demonstrates the promise of structured, multimedia-based health promotion,

XiaoNan illustrates how conversational AI can extend scalable, self-directed psychological support to young adults. Recent systematic review and meta-analysis confirmed that chatbot-delivered interventions significantly reduced psychological distress among young people, highlighting their feasibility and acceptability (He *et al.*, 2022). Likewise, a randomized controlled trial of a mental health chatbot showed significant reductions in depressive and anxiety symptoms while demonstrating good user engagement and satisfaction, reinforcing the role of conversational AI in delivering accessible and scalable interventions (Li *et al.*, 2025). These findings collectively suggest that integrating evidence-based therapeutic principles into digital platforms can reduce depressive symptoms, enhance coping, and overcome barriers related to stigma and resource limitations.

In the current digital era, educational interventions delivered through internet-based platforms, particularly those incorporating cognitive behavioral therapy (CBT) principles, show strong potential to prevent and reduce depressive symptoms among adolescents. With the widespread use of smartphones, applications, and social media among young people, digital educational interventions represent an accessible and innovative strategy for promoting adolescent mental health. Nevertheless, challenges remain regarding user adherence, data privacy, and equitable access to technology and reliable internet. Evidence from umbrella reviews and meta-analyses suggests that effectiveness is enhanced when digital programs are embedded within stepped-care models that include referral pathways for high-risk adolescents. However, findings remain heterogeneous due to variations in program design, duration, and target populations. Many studies combine adolescents with young adults, employ short follow-up periods, and lack long-term evaluation. Future research should therefore prioritize large-scale randomized controlled trials (RCTs) focused specifically on adolescents, investigate mediators such as skill acquisition, and examine moderators including baseline severity and gender.

CONCLUSION

Digital nursing interventions delivered through mobile health applications ranging from CBT-based programs to psychoeducation and chatbot platforms have demonstrated effectiveness in reducing depressive symptoms among adolescents. Most studies report improvements in depression, anxiety, stress, and resilience, particularly when interactive or guided components are included. In the Indonesian context,

digital interventions should be integrated into existing community health structures, such as collaborative programs between schools and Puskesmas, to enhance accessibility and continuity of mental health care. Community nurses should receive structured training in digital literacy and mental health promotion to facilitate early detection, guidance, and follow-up for adolescents using these platforms. Moreover, the development of national policies and clinical guidelines that support evidence-based digital mental health interventions is essential to ensure quality, ethical standards, and data security. By combining therapeutic principles such as CBT with culturally adapted, accessible digital delivery, these interventions can complement conventional nursing practice and strengthen the role of primary care in preventing and managing adolescent depression in Indonesia.

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