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EDUCATION AND DEPRESSION SCREENING FOR ADOLESCENTS BASED ON SMARTPHONE APPLICATIONS: A SCOPING REVIEW

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ABSTRACT

Depression is the leading cause of disability among adolescents. Many adolescents experience long-term mental health issues because they do not know what to do, leading many to engage in negative behaviors such as substance abuse, violence, criminal activities, dropping out of school, and more. This is due to the lack of information they receive regarding mental health issues. Method: A scoping review was conducted by searching literature in PubMed, ProQuest, Scopus, and Science Direct. Included studies (2020–2025) explored education and depression screening for adolescents based on smartphone applications. Excluded were incomplete, duplicate, review, and retracted articles. Results: Of the 2,128 identified articles, seven studies met the criteria for further analysis. Findings indicate that education methods based on digital applications can be utilized as tools for early screening, monitoring, and real-time evaluation of depressive symptoms to support the mental well-being of adolescents. By integrating technology and evidence-based practices, these applications provide psychoeducational tools and self-monitoring mechanisms to help adolescents effectively manage their mental health. Conclusions: Education and smartphone-based depression screening can enhance sustainable support for adolescents. The importance of using smartphone applications in education and depression screening for adolescents indicates that technology-based applications can be effective tools for supporting the mental well-being of young people by providing easier access and reducing stigma associated with mental health services.

Keywords: education; screening; depression; smartphone applications

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INTRODUCTION

Adolescence is a transitional period between childhood and adulthood, marked by both physical and psychological changes towards maturity. The term adolescence encompasses a broader meaning that includes mental, emotional, social, and physical maturity. During this age, adolescents undergo many physical changes, including changes in body shape, voice, emotions, psychosocial changes, and intellectual changes. Because adolescents often experience emotional turmoil or unstable emotions, this can lead to various issues, including depression (Hutahaean & Silaban, 2020). Depression is a common and serious medical illness that negatively affects feelings, thinking patterns, and behavior. Depression causes feelings of sadness and/or a loss of interest in daily activities. It can interfere with sleep, appetite, concentration, and fatigue. Depression can affect a person's productivity and may be long-lasting or recurrent (Nemeroff et al., 2022). Depression is also referred to as an invisible disease. Unlike other illnesses such as the flu, the sufferer is typically aware that they have the flu, while individuals with depression often do not realize that there is a disorder affecting their mental health (Sulistyorini & Sabarisman, 2017). Research conducted by (Avenevoli et al., 2015) Found that the peak onset of depression occurs during adolescence. However, when individuals experience depression during their teenage years, it is predicted that they will encounter difficulties in their functioning later in life. A longitudinal study also found that individuals who experienced depression during their adolescence reported more difficulties in adulthood compared to those who did not experience depression in their teenage years

(Jonsson et al., 2011). Data from Riset Kesehatan Dasar (RISKESDAS, 2018) Showed that there are three mental health disorders: psychosis/schizophrenia, depression, and mental health issues specifically related to depression among young people in Indonesia. About 154million of them suffer from depression. One in seven adolescents aged 10-19 experiences psychological problems. Depression is the leading cause of disability among adolescents. Depression can lead to suicide, and suicide is the fourth leading cause of death among adolescents worldwide.

Depression is understood as a common mental disorder characterized by sadness, loss of interest or pleasure, feelings of guilt, low self-esteem or inferiority, sleep disturbances, decreased or increased appetite, fatigue, and difficulty concentrating (Huang et al., 2021). Many adolescents experience long-term mental health problems because they do not know what to do, leading many to resort to negative behaviors such as substance abuse, violence, criminal activities, dropping out of school, etc. This is due to the lack of information they receive regarding mental health issues. The implementation of a screening process is necessary to prevent depression from occurring in adolescents independently. The most noticeable method for this is the use of smartphones. (Kroning & Kroning, 2016). A smartphone is a phone that provides integrated services from communication, computing, and the mobile sector, including voice communication, messaging, personal information management applications, and wireless communication capabilities. Smartphones are the most frequently used devices for communication, and nearly 27% of smartphone usage by consumers is for online activities (Andermo et al., 2020). Education and screening for adolescents based on smartphone applications can be conducted through the development of applications designed to independently, quickly, and efficiently identify symptoms of depression. With the large number of smartphone users, the use of application-based early detection tools for depression in adolescents can reach a broader audience (Chamorro-Delmo et al., 2024). The implementation of smartphone application-based depression screening for adolescents is discussed in various journals, but some results are not stated more specifically. Due to this variation in results, the researcher attempts to review further the implementation of education and screening for adolescents based on smartphone applications. This Study conducted a scoping review approach that aimed to identifying the gaps in the implementation of education and depression screening for adolescents based on smartphone applications.

METHOD

Scoping review guidelines was undertaken to identifing literature through several stages including 1) identification of research question, 2) identification of relevant studies, 3) selection of studies, 4) charting the data, 5) collating, summarizing and reporting results (Arksey & O'Malley, 2005).

Search Strategy

Four academic databases were used in this study (Scopus, PubMed, Proquest, and Science Direct). Keywords were developed based on the research question (education screening OR screening method) AND (depression OR depressive symptom) AND (smartphone App OR mobile application OR mobile App OR portable software) AND (adolescents OR youth OR teen OR teenager).

Inclusion and Exclusion Criteria

Inclusion criteria in this study included qualitative and quantitative research designs published in English between 2020-2025. The searches was limited to topics exploring education focused screening of depression in adolescents based on smartphone application. Meanwhile, exclusion criteria include articles that are not full papers, duplicate articles, and articles that

were withdrawn due to publication ethics.

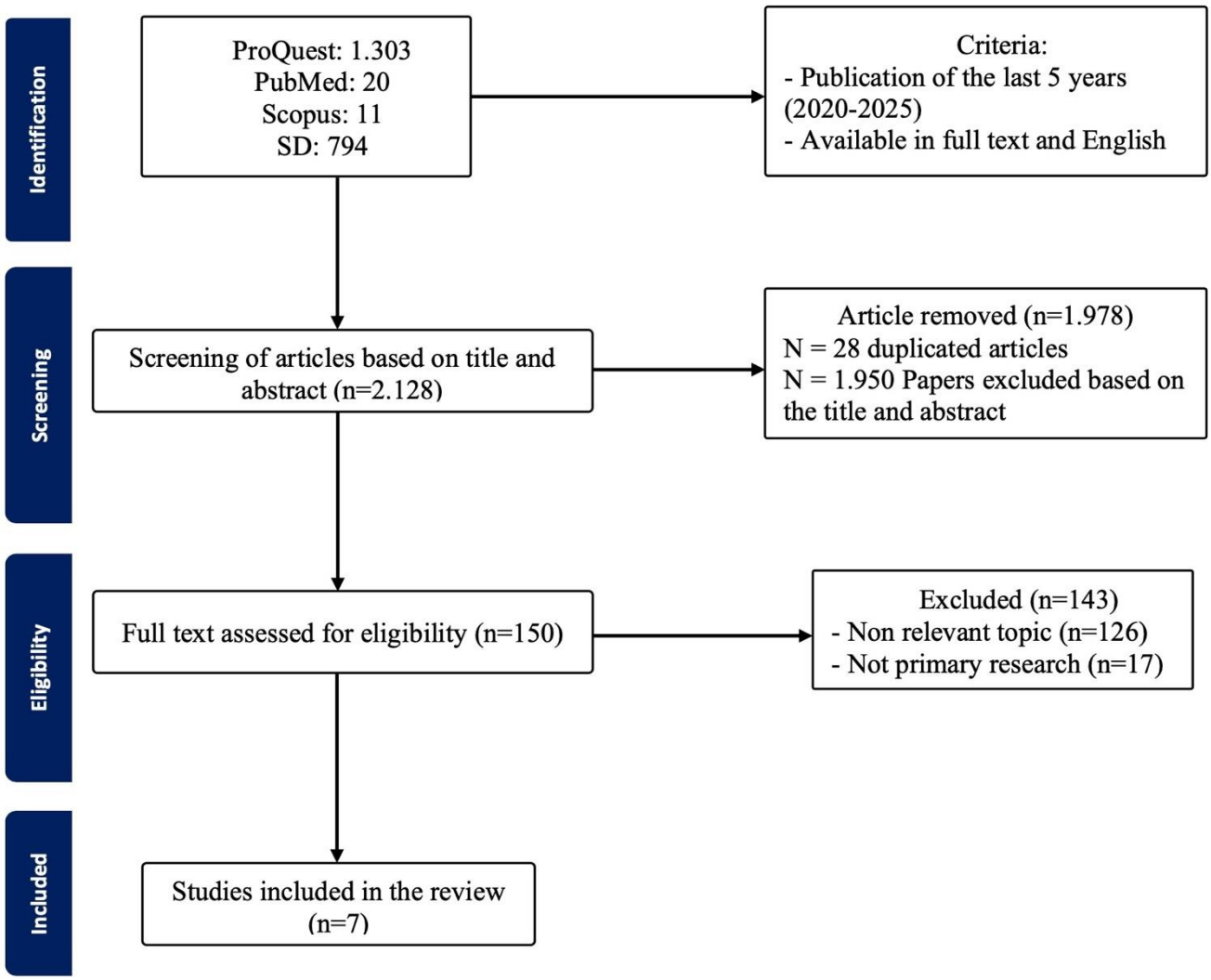

Figure 1. Preffered Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (PRISMA)

Data Extraction

Data extraction was conducted manually in a table that consists of the author's name, country, research objectives, sample, study design, type of education, screening used, and outcomes. The data extraction process was carried out by two individuals to enhance data accuracy and reduce bias.

Data Analysis

Data analysis was conducted by at least two individuals to reduce bias. The analysis included descriptive qualitative analysis by identifying and describing the main themes that emerged from the research findings. The data analysis aimed to identify the types of education used for depression screening in adolescents.

RESULT

A total of 2.128 articles were identified from four databases. The authors removed 28 duplicate articles based on the first selection and exclusion. Then, the authors evaluated the articles based on the title and abstract, there were 1.950 articles did not met the criteria. Next, 150 articles were identified and went through a full text review process based on inclusion and exclusion criteria. At the end of the process, 7 articles were involved in the scoping review (Figure 1). The characteristics of the study analysis results are shown in Table 1, and the themes identified are described in Table 2. The majority of study articles were published between 2020 and 2025 and were carried out in various countries such as Texas, Florida, Japan, California, and Australia. The majority of the articles were conducted using Longitudinal observational study and RCT to evaluate the effectiveness of the education used for depression screening in adolescents.

Education and Depression Screening For Adolescents

The results show several educational methods based on smartphone applications used for depression screening. Health education is an effective method to prevent depression by providing education to adolescents about early screening of depression symptoms as an initial effort to prevent actions that can cause mental disorders.

Table 1.
Article Analysis

Author	Country of Origin	Aim	Study desain	Sample	Result	Limitation
(Cao et al. 2020)	Texas	To investigate whether smartphone applications are useful in evaluating and monitoring depression symptoms in a clinical population of adolescents compared to clinical psychometric instruments.	Longitudinal observational study	13 adolescents and 12 parents	This study shows that the use of smartphone apps for evaluating and monitoring depression symptoms in adolescents is feasible, well-accepted, and effective. A combination of self-input, parental assessments, and passive sensor data yields accurate symptom predictions, with potential to reduce user burden in the future.	Small sample size, reliance on Android devices, short time frame, and recruitment from a single source (closed AIM program). Logistics reduced full family participation.
(Ng et al. 2024)	Florida	To investigate individual triggers of depression and validate smartphone-based mobile sensing data	Longitudinal observational study with multimethod and multimodal measurements	50 adolescents	This study identifies individual-specific drivers of depression in adolescents through the use of smartphone-based	Validation of mobile sensor data against participants with mild depression and low suicide risk may limit the

Author	Country of Origin	Aim	Study desain	Sample	Result	Limitation
		against existing ambulatory methods.			Ecological Momentary Assessment (EMA) and passive mobile sensing.	applicability of results for adolescents with severe depression; network ability to determine relationship direction is limited by 2-hour EMA sampling intervals.
(Nagamitsu et al. 2022)	Jepang	To test the efficacy of two adolescent health promotion interventions: Well Child Visits (WCV) with risk assessment interviewing and counseling, and self-monitoring with a cognitive behavioral therapy (CBT) app.	Randomized Controlled Trial	217 adolescents	The main finding of this trial is that WCV intervention, with or without the CBT app, effectively improves depression symptoms in adolescents with severe symptoms, particularly among those with scores above the DSRS-C cutoff. However, this effect does not persist after one month, and although CBT intervention did not show better outcomes, it succeeded in reducing suicidal ideation during the observation period.	Limitations include a short follow-up period (4 months) that may not be sufficient to observe long-term effects, low feasibility of CBT apps due to lack of self-monitoring from participants, potential volunteer bias due to participation from highly motivated individuals, and the need for additional CBT modules to enhance intervention effectiveness.
(Chiauzzi et al. 2023)	California	To conduct a randomized controlled trial evaluating the feasibility and acceptability of Woebot for Adolescents (W-GenZD) in outpatient	Randomized Controlled Trial	133 adolescents	W-GenZD may imply expanding options for adolescents seeking mental health treatment for depression and/or anxiety. Providing effective treatment options	The study excluded adolescents with acute symptoms such as active suicidal ideation or bipolar disorder, limiting the generalizability of findings for

Author	Country of Origin	Aim	Study desain	Sample	Result	Limitation
		mental health clinics for adolescents experiencing depression and/or anxiety.			leveraging technology for those with lower severity may help allocate limited resources for those with more severe mental health needs.	adolescents with more urgent care needs. Additionally, the use of group therapy as a treatment arm may limit sample representation as some adolescents may feel uncomfortable with the group format, and the brief intervention design may not fully reflect longer group CBT treatments.
(Giovanelli et al. 2023)	California	To develop and assess the feasibility and acceptability of Appa Health (Appa), an evidence-based mental health coaching program for adolescents experiencing symptoms of depression and anxiety	Pilot Study	14 adolescents	The main findings of this study indicate that Appa Health, a web-based coaching program over 12 weeks, was well accepted by adolescents, with 85% of participants recommending the program to friends. Participants actively engaged in video chat sessions and appreciated the short video content teaching CBT skills. The program also demonstrated early efficacy, with significant reductions in depressive and anxiety symptoms during the 12 weeks.	Limitations include selection bias due to low response rates from parents, which limited the sample of participating adolescents, as well as the small sample size which restricts exploration of program experiences and effectiveness. Additionally, the lack of post-end-point follow-up makes it difficult to assess the sustainability of improvements, and there were no objective metrics to measure participant engagement.

Author	Country of Origin	Aim	Study desain	Sample	Result	Limitation
(Li et al. 2022)	Australia	To evaluate the effectiveness of the ClearlyMe app in reducing depressive symptoms in adolescents.	Randomized Controlled Trial	489 adolescents	The MobiliseMe study shows that the ClearlyMe app, based on CBT, has the potential to reduce symptoms of depression, anxiety, and improve adolescent well-being, while offering accessible, cost-effective, and scalable care solutions.	Limitations include the lack of clinical interviews for formal diagnoses, reliance solely on psychometric measures, and being conducted in a controlled environment that may not reflect real-world use. Limited follow-up after 4 months did not allow for assessment of long-term effects, and early usage guidelines based on clinical predictions may not be optimal. Additionally, the cost-effectiveness of the ClearlyMe app has not yet been evaluated, necessitating further research to explore real-world usage, sustainability of effects, and cost efficiency.
(Prochaska et al. 2023)	California	Descriptive quantitative study with a brief longitudinal approach to describe the BeMe app-based platform to support the mental health and well-	Quantitative descriptive study	13,421 adolescents	The BeMe app successfully engaged over 13,000 adolescents in 8 weeks without incentives, indicating a high demand for digital mental health support. BeMe particularly	Limitations include incomplete data on key measures due to the self-directed nature of BeMe, and assessment completions being opportunistic as adolescents

Author	Country of Origin	Aim	Study desain	Sample	Result	Limitation
		being of adolescents, and to examine engagement, usability, and satisfaction with the app.			attracted younger adolescents, girls, and gender-neutral individuals, with an average engagement of 8 sessions in 30 days.	needed to proactively find mood and well-being assessments. Various information collected about participant characteristics were also limited to minimize burden during initial evaluations of app usage.

The table above shows that smartphone-based applications have significant potential in monitoring and intervening in depression symptoms among adolescents. Various studies demonstrate early effectiveness in identifying and managing depression symptoms, as well as positive user acceptance. However, there are many limitations regarding sample size, short follow-up periods, and a focus on adolescents with mild symptoms. Therefore, further research is needed to explore the long-term effectiveness of these applications, as well as to understand the best ways to integrate them into the broader adolescent mental health care system.

Table 2.
Themes Summary

Theme	Detailed Aspect	Refrences
Technology Based Development	Use of smartphone applications (SOLVD, EARS, Appa Health, ClearlyMe, BeMe) to monitor symptoms of depression and anxiety. Integration of features such as passive sensors (GPS data, steps, calls, screen time), self-surveys, and interactive components like Woebot or peer mentors. Adaptation to the latest operating systems (EARS) and cross-platform compatibility (iOS and Android).	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Ng et al., 2024) (Nagamitsu et al., 2022) (Chiauzzi et al., 2023) (Giovanelli et al., 2023) (Li et al., 2022) (Prochaska et al., 2023)
Effectiveness of Interventions	Reduction of depressive symptoms after using the application. More significant effectiveness in adolescents with more severe depressive symptoms. The combination of psychoeducational approaches, self-monitoring, and the use of sensor data shows satisfactory results.	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Nagamitsu et al., 2022) (Giovanelli et al., 2023) (Prochaska et al., 2023)
Intervention Research	CBT-based applications (ClearlyMe, Woebot, Appa Health) offer emotional regulation training, cognitive restructuring, and mindfulness. Interventions using storytelling, short educational videos, or gamification to enhance understanding and motivation for users.	(Nagamitsu et al., 2022) (Chiauzzi et al., 2023) (Prochaska et al., 2023) (Giovanelli et al., 2023) (Li et al., 2022)
Security and Privacy	Data protection with secure server storage, access codes, and strict privacy policies. Only primary researchers or licensed therapists can access the data.	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Ng et al., 2024) (Nagamitsu et al., 2022) (Chiauzzi et al., 2023)

Theme	Detailed Aspect	Refrences
		(Prochaska et al., 2023)
Involvement of Others	Involvement of parents to provide additional evaluation and support for adolescents. Trained peer mentors to support and provide accountability. Coaching features enable direct communication with trained coaches or licensed therapists	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Ng et al., 2024) (Chiauzzi et al., 2023)
Monitoring and Data Collection	Symptom monitoring is conducted through a combination of active data (EMA survey responses) and passive data (smartphone sensors). Actigraphy for physical activity and sleep patterns. Routine notifications (e.g., every 8 PM) to ensure user adherence.	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Ng et al., 2024) (Nagamitsu et al., 2022) (Chiauzzi et al., 2023)
Accessibility and Usability	Simple and resource-efficient (battery and internet data) application use. Easily accessible anytime without the need for face-to-face interaction. Suitable for adolescents with varying levels of motivation. Can be operated anywhere and anytime without requiring much time.	(Cao, Truong, Banu, Shah, & Sabharwal, 2020) (Giovanelli et al., 2023) (Prochaska et al., 2023)
Sustainability	Participation tends to stop after the child's condition improves. Strengthening adherence through gamification or incentives (e.g., graphs and trophies on EARS) is necessary.	(Nagamitsu et al., 2022) (Ng et al., 2024) (Cao, Truong, Banu, Shah, & Sabharwal, 2020)
Screening	Symptom screening using tools such as PHQ-A, PHQ-8, and GAD-7. Real-time monitoring for early detection of risk factors and depressive symptoms.	(Li et al., 2022) (Prochaska et al., 2023)

DISCUSSION

Technological Development

The development of technology-based solutions integrates technology with evidence-based practices to support adolescent mental well-being. The development of technology-based applications aims to leverage smartphone capabilities to provide real-time monitoring and evaluation of depression symptoms in adolescents, which has the potential to enhance understanding and management of mental health (Chiauzzi et al., 2023), (Prochaska et al., 2023). The applications are designed to offer psychoeducational tools and self-monitoring features to help adolescents manage their mental health effectively (Ng et al., 2024)The development of digital tools with direct human support is more suitable for adolescents, who often prefer interactive and supportive environments (Nagamitsu et al., 2022). The development aims to provide accessible and effective support for adolescents facing mental health challenges, ensuring compatibility with the latest operating systems (EARS) and cross-platform compatibility (iOS and Android). These applications also include background mobile recorders that capture various smartphone sensor data, integrating features such as passive sensors (GPS data, steps, calls, screen time), self-surveys, and interactive components like Woebot or peer mentors (Cao et al., 2020), (Li et al., 2022), (Giovanelli et al., 2023).

Effectiveness of Interventions

One of the discussions in the review is about the effectiveness of application interventions. The effectiveness of the SOLVD application correlates well with conventional psychometric

instruments. Furthermore, the study highlights the importance of parental input in tracking adolescent mental health, which can enhance the accuracy of predictions regarding depressive conditions. Overall, the interventions show promising results in utilizing smartphone technology to monitor mental health in adolescents (Cao et al., 2020)Health care visits, or well-care visits (WCV), combined with risk assessment interviews and counseling, as well as self-monitoring using cognitive-behavioral therapy (CBT) applications on smartphones, showed that both intervention groups experienced significant reductions in depressive symptoms in the first month of observation. Additionally, there was a significant decrease in suicidal ideation among participants in both intervention groups during the 4-month observation period. The CBT application specifically demonstrated effectiveness in helping participants develop self-monitoring skills and in reducing depression symptoms (Nagamitsu et al., 2022).

The effectiveness of the BeMe application interventions is designed to support adolescent mental health through a combination of digital content, interactive activities, live training, and access to clinical services. Satisfaction ratings are generally high, with a significant percentage of users finding the content helpful for coping and improving self-efficacy (Prochaska et al., 2023). The effectiveness of Appa Health interventions, which combine web-based guidance with cognitive-behavioral therapy (CBT) skills, was assessed through pilot studies involving adolescents experiencing symptoms of depression and anxiety. The results indicated that participants found the program beneficial, with 100% of youth reporting feeling better after the 12-week program. Qualitative feedback from participants also supports the positive impact of these interventions, highlighting the effectiveness of mentorship relationships and the application of CBT skills in their daily lives (Giovanelli et al., 2023).

Intervention Research

The Appa Health study combines mentorship through a web-based program and CBT video content, where adolescents are paired with mentors based on preferred characteristics such as gender, race, or ethnicity, and LGBTQ status. This program runs for 12 weeks, during which participants engage in video chats with their mentors. The content delivered through the application includes asynchronous digital tools teaching various CBT skills, such as cognitive distortions and active coping strategies, like progressive muscle relaxation (Giovanelli et al., 2023).The combination of mentorship strategies and cognitive-behavioral therapy can positively impact adolescent mental health, indicating the potential effectiveness of this intervention model (Giovanelli et al., 2023).The research on the ClearlyMe application uses cognitive-behavioral therapy (CBT). Participants use the ClearlyMe® application independently, engage with its content, and receive additional support from the research team, which may include guidance and encouragement during the intervention period. The effectiveness of this intervention will be assessed based on changes in depressive symptoms measured by the PHQ-A at various time points (Li et al., 2022).

The BeMe application research uses various interventions based on established therapeutic approaches to support adolescent mental health. The main interventions include Dialectical Behavior Therapy (DBT), which focuses on emotion regulation skills and distress tolerance, and is most frequently used by users, encompassing 25.5% of all viewed content. Cognitive Behavioral Therapy (CBT) includes problem-solving skills that are also significantly utilized, comprising another 25.5% of the viewed content. The intervention employs storytelling, short educational videos, or gamification to enhance understanding and motivation among users. Overall, this application provides a diverse range of therapeutic content to address various aspects of mental health and well-being among adolescents (Prochaska et al., 2023).

Security and Privacy

The Effortless Assessment of Risk States (EARS) mobile application used in this research employs stringent data security features, demonstrating that measures are taken to protect the data collected from participants, especially given the sensitive nature of information related to adolescent mental health (Ng et al., 2024). The functionality of the SOLVD application, developed with a focus on user privacy and security, uses one-way MD5 hashes to encrypt sensitive information, such as phone numbers and email addresses, ensuring that users' identities are never recorded either locally or remotely (Cao et al., 2020). The BeMe application is designed with a strong emphasis on security and privacy, particularly considering its adolescent user base. Collectively, these measures aim to protect the privacy and safety of adolescent users while providing them access to mental health resources (Prochaska et al., 2023). W-GenZD follows safety recommendations from the American Psychiatric Association and the American Medical Association, ensuring user privacy through clear privacy policies and terms of service (Chiauzzi et al., 2023). Overall, for data security protection, secure server storage, access codes, strict privacy policies, and only principal researchers or licensed therapists can access the data.

Involvement of Others

The involvement of others, particularly parents, plays a crucial role in monitoring and predicting depression symptoms in adolescents. The SOLVD-Teen application and the SOLVD-Parent application are designed to facilitate this involvement. Parents are included in the data collection process, enabling them to submit their own assessments and record background smartphone data. Peer mentors are trained to support and provide accountability toward feedback from adolescents and parents, thereby enhancing the accuracy of predictions regarding depressive symptoms (Cao et al., 2020).The involvement of others, particularly caregivers and family members, is an essential aspect of research to identify individual-specific triggers of depression in adolescents. The research protocol emphasizes the importance of obtaining parental or guardian consent for adolescent participation. The coaching features allow direct communication with trained coaches or licensed therapists (BeMe, Appa Health), ensuring that at least one parent or legal guardian is willing to engage in the research. This collaborative approach reflects the perspectives of adolescents and caregivers on adolescent mental health. This method aligns with real-world clinical practices that emphasize the importance of family involvement in mental health care. Caregivers are involved in discussions about safety planning, especially in cases of suicidal ideation (Ng et al., 2024, (Chiauzzi et al., 2023).

Monitoring and Data Collection

Participants will engage in ecological momentary assessment (EMA) via smartphones, requiring them to self-report on their depressive symptoms, processes, affect, and sleep through brief web-based or text surveys. This active input is complemented by passive data collection using mobile sensing technology, tracking various behaviors and physiological metrics such as mobility, physical activity, sleep patterns, and communication habits through the Effortless Assessment of Risk States (EARS) smartphone application. Additionally, participants will wear a wrist actigraph. This device uses accelerometers and other sensors to provide accurate estimates of sleep and activity levels, and its data will be validated against established methods such as polysomnography (Ng et al., 2024).In cognitive-behavioral therapy (CBT) model research, which includes tracking thoughts, feelings, bodily responses, and actions related to daily events, data will be collected at four time points: baseline, 1 month, 2 months, and 4 months, using various questionnaires to assess depression symptoms and other outcomes. All data will be securely stored on a main server, with access limited to principal researchers to ensure confidentiality (Nagamitsu et al., 2022), (Cao et al., 2020).

Participants receive email and SMS reminders for assessments and can earn rewards of up to $125 in the form of Amazon gift cards for completing all assessments. Data collected will include demographics, psychiatric history, eligibility, clinical outcomes, safety data, and engagement metrics (Chiauzzi et al., 2023).

Accessibility and Usability

The SOLVD application is designed with a focus on accessibility and usability for adolescents. This application aims to transform smartphones into quantitative mental health sensors while ensuring a user-friendly interface. This design approach is intended to facilitate ease of use for adolescents and their parents, allowing them to use the app without requiring extensive technical knowledge (Cao et al., 2020). The BeMe application is designed with a strong emphasis on accessibility and usability to ensure that adolescents can effectively engage with its features (Prochaska et al., 2023).The Appa Health application was developed with a focus on accessibility and usability, especially in response to the increasing demand for adolescent mental health services following the COVID-19 pandemic. In-person mental health services often cannot meet this demand, particularly for adolescents from underserved populations. This application aims to reduce barriers to care by providing a web-based platform where adolescents can connect with mentors of their choice (Giovanelli et al., 2023).

Sustainability

The health care visit (WCV) study and CBT application intervention suggest that integrating self-monitoring tools and electronic screening systems can enhance sustainability by providing ongoing support and engagement for participants. Moreover, the findings indicate the potential to scale these interventions within school environments to promote ongoing health promotion activities among adolescents (Nagamitsu et al., 2022). Participant sustainability in the study (Ng et al., 2024) can be inferred from the fact that 70% of screened families provided informed consent, and 85% of those included completed the 28-day data collection period and follow-up visits. This high completion rate indicates strong engagement and commitment from participants, which is vital for the sustainability of the study. However, it is important to note that the study acknowledges limitations, such as focusing on a population with generally mild depressive symptoms, and participation tends to cease once a child's condition improves. This raises questions about the sustainability of participation among adolescents with more severe symptoms, who may require more intensive support and intervention.Participant sustainability in the SOLVD-Teen study can be assessed through their adherence to study protocols and trial completion rates. Of the 13 adolescents initially recruited, 11 completed the study, indicating a strong retention rate. The average compliance for submitting daily evaluations via the SOLVD application was 79.0% for adolescents and an impressive 95.7% for parents. This high compliance rate suggests that participants find the study manageable and are willing to engage with the technology used to monitor depression symptoms (Cao et al., 2020).

Screening

This study employs several screening tools to assess participants' mental health, with a primary focus on depressive symptoms. The main screening tool mentioned is the Patient Health Questionnaire for Adolescents (PHQ-A), which is used to assess levels of depression among adolescents. The PHQ-8 is an 8-item questionnaire that evaluates depressive symptoms over the past two weeks, with scores ranging from 0 to 24 to measure depression symptoms among participants. Additionally, the study may combine other measures to evaluate secondary outcomes such as anxiety and overall well-being, although specific tools for these outcomes are not detailed in the provided citations (Prochaska et al., 2023), (Li et al., 2022). The Generalized Anxiety Disorder Questionnaire (GAD-7) is a 7-item questionnaire

used to measure levels of anxiety. This tool assesses symptoms experienced in the past two weeks, with scores ranging from 0 to 2. The Perceived Stress Scale (PSS-4) is a scale consisting of 4 items that assess the level of stress reported by participants over the past month. Scores range from 0 to 16, with higher scores indicating greater perceived stress. The Well-Being Index or The World Health Organization-Five Well-Being Index (WHO-5) is used to assess overall well-being over the past two weeks, ranging from 0 to 25, which is then multiplied by 4 to produce a well-being score between 0 and 100. A score ≤50 indicates poor well-being, and a score <28 suggests depression (Prochaska et al., 2023).These screening tools provide valuable insights into the mental health status of adolescents, allowing a comprehensive assessment of their clinical functions, including anxiety, depression, stress, and overall well-being.

CONCLUSION

Smartphone-based education and screening for depression can enhance support sustainability for adolescents. The importance of using smartphone applications in education and screening for depression in adolescents shows that technology-based applications can be effective tools for supporting adolescent mental well-being by providing easier access and reducing stigma associated with mental health services.Additionally, the study results indicate that programs like Appa Health are well-received by adolescents and show positive evaluations in reducing symptoms of depression and anxiety. However, there are some limitations to consider, such as the small sample size and the fact that the cost-effectiveness of the developed applications has not been evaluated, necessitating further research to explore real-world usage as well as the sustainability of effects and lack of follow-up, which could affect the generalization of results. Therefore, further development and in-depth research are needed to ensure the effectiveness and sustainability of these application-based interventions. High participant engagement shows potential to enhance interventions in school settings.

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