

Improving the Identification of Depression in Pediatric Primary Care

Meagan Coomer

Edson College of Nursing and Health Innovation, Arizona State University

Author Note

Meagan Coomer is a graduate student at the Edson College of Nursing and Health Innovation at Arizona State University. She serves as a Certified Pediatric Nurse in Northern Arizona in a private pediatric primary care practice.

She has no known conflicts of interest to disclose.

Correspondence concerning this paper should be addressed to Meagan Coomer, Edson College of Nursing and Health Innovation, Arizona State University, 550 N. 3rd Street, Phoenix, AZ 85004 email: mecoomer@asu.edu

Abstract

Introduction: Depression screening in the pediatric setting is a crucial part of the adolescent's examination. A standardized screening tool and protocol streamlines the process of assessing adolescents and minimizes the chances of serious mental health disorders going undetected and untreated. Evaluation of current evidence demonstrates the use of a standardized tool improves detection, diagnosis, and management of depression and other mental health illnesses.

Method: The Patient Health Questionnaire—modified for adolescents (PHQ9-A) was administered to all eligible adolescents, ages 12-18, during an annual well visit for a period of 6 weeks. Lewin's Change Theory guided a system change in the electronic health record, and the questionnaire results were documented and provided to the pediatric provider at the time of the appointment. A chart review was conducted to determine whether all eligible patients were administered the questionnaire and if a depression diagnosis or mental health referral had been made.

Results: Out of 76 eligible well visits, 65 (86%) patients completed the PHQ9-A. The average score was 5.29 ($SD = 6.49$) with a maximum score of 25. Out of those that completed screening, 11 (17%) had a positive PHQ9-A score resulting in 8 referrals to mental health services and 2 mental health diagnoses in the clinic.

Keywords: depression, screening, adolescents, pediatrics, mental health, primary care

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As mental health concerns arise around the country, the pediatric population must be at the forefront of its identification. Depression affects adolescents' ability to maintain friendships and relationships and affects their success in school and the community. Adolescents and teenagers may be unaware that they are experiencing depression or other mental health illnesses. This lack of knowledge makes identification and screening in the primary care setting vital in caring for the child and their family.

Problem Statement

Depression affects how a person functions and how they interact with the world. According to the 2020 Diagnostic and Statistical Manual of Mental Disorders (DSM-5), Major Depressive Disorder (MDD) is diagnosed when a patient experiences five or more of the following for at least two weeks: feelings of sadness, loss of interest or pleasure in usually enjoyable activities, changes in a person's appetite (sometimes leading to unintentional weight gain or loss), difficulty sleeping (unable to fall asleep or sleeping more than usual), fatigue or decreased energy, feelings of guilt and worthlessness, slowed movements or speech, purposeless activity like pacing or fidgeting, difficulty thinking and concentration, and finally, thoughts of death or suicide (American Psychiatric Association, 2020). Now more than ever, it is critical that adolescents and teenagers are screened for depression so that appropriate interventions can be taken. In 2020, 17% of children ages 12-17 reported at least one Major Depressive Episode (National Institute of Mental Health [NIH], 2022). Given the prevalence of depression and the dire clinical need for detection, the American Academy of Pediatrics (AAP) stresses that primary care providers must develop guidelines to screen, identify appropriately, and manage MDD in practice (Zuckerbrot et al., 2018). Increased rates of MDD, paired with disparities in available

mental health services, make routine screening of depression in adolescent patients an essential role of the pediatric healthcare provider.

Purpose and Rationale

The United States Preventive Services Task Force (USPSTF) recommends that adolescents and teenagers 12 years old and older be screened for MDD. Further, proper detection, diagnosis, and follow-up must be made by appropriate systems within a facility or practice (USPSTF, 2022). Recommendations for depression screening in the pediatric population must be implemented to capture those children suffering from MDD or other mental health conditions. The purpose of this paper is to investigate appropriate screening methods for depression and delve into evidence-based system changes that can be utilized in pediatric primary care. By determining what screening tools can be used and implemented into practice, children will directly benefit from depression detection and interventions to improve their overall health.

Background and Significance

Depression in the pediatric population must be appropriately recognized and addressed by pediatric health providers. Early identification of MDD and other mental health disorders leads to earlier treatment and a better provider-patient relationship. Trust can be developed, and patients can feel safe discussing their feelings and concerns. Identification of MDD in adolescents is crucial as those experiencing mental health disorders are vulnerable to feelings of exclusion in school, discrimination, and learning difficulties. Adolescents are also more likely to engage in high-risk behaviors, develop poor coping mechanisms, and exhibit impaired thought processes (World Health Organization, 2021). Providers who promote positive mental health through discussion and identification of issues positively impact lives. Early intervention can

reduce the negative impacts of depression and other mental illnesses (United States Department of Health and Human Services, n.d.). It is imperative for practices that do not currently screen for depression in adolescents to find a way to implement a system so that children can be protected. A child suffering from depression is at an increased risk for developing substance abuse disorders and is more likely to commit suicide (American Academy of Child and Adolescent Psychiatry, 2019).

Though the USPSTF recommends screening patients 12 years and older for depression (Siu, 2016), the majority of pediatric practices are not conducting routine and standardized screening for depression. One retrospective study revealed only 5.8% of age-eligible adolescents were screened for depression (Riehm et al., 2022). These numbers are inadequate and alarming. Reasons for insufficient screening may range from knowledge deficits, time constraints, or resistance to change. Implementation of a screening program aligned with the AAP Guidelines will help providers manage the care of an adolescent with depression, improving overall health and reducing the risk of long-term effects from unidentified and poorly managed depression (Zuckerbrot et al., 2018).

Depression in Adolescents and Teenagers

As rapid development continues into adolescence, the pediatric patient must closely be monitored for deviations in their health status, including their mental health. Growth in adolescence involves both the physical and mental aspects, and both should be considered. In 2021, the AAP issued a national emergency in children's mental health, noting that in addition to existing mental health challenges, the COVID-19 pandemic has been increasingly detrimental to the health of our adolescent population (AAP, 2021). School closures, health inequities, and physical isolation associated with the pandemic may have harmful consequences in the coming

years. In a population that is already vulnerable, these added stressors will only inflate an already severe problem in adolescents and teenagers.

Standardized Depression Screening as an Intervention

The first step to addressing adolescents' mental health issues involves adequate detection of mental health disorders. The use of a validated screening tool and standardized screening allows the provider to determine if the mental well-being of the adolescent is impaired, potentially requiring additional assessment, initiation of treatment, or referral to outside specialists (Frye et al., 2020; Zsomboky et al., 2020; Zuckerbrot et al., 2018).

There are various screening tools available for use in the clinic, and there is no firm recommendation for one to be used over another. Current AAP recommendations state that, while self-report with a validated tool is recommended, a parent-completed questionnaire can be done for screening, too—though the use of a parent-reported tool does not include questions regarding the individual's thoughts of suicide (Zuckerbrot et al., 2018). Screening tools commonly used in the pediatric setting that can be seen as reliable include the Patient Health Questionnaire-9 (PHQ-9) and the PHQ-9 modified for adolescents (PHQ-9A). Either tool has been deemed acceptable by the AAP, though the PHQ-9A has not been validated through research as of yet (Kemper et al., 2021; Zuckerbrot et al., 2018). Future research should be conducted to validate the PHQ-9A better, as the questions are adapted to be more relatable to adolescents as young as 12-years old.

Verbal Screening for Depression and Degree of Uncertainty

Implementing a standardized tool does not minimize what current practitioners may already be doing in the clinic. Verbal screening without a validated tool may open dialogue with patients and lead to detection, diagnosis, and treatment of depression. Many providers in clinics

without standardized screening may properly identify those adolescents struggling with depression. However, the risk of missed opportunities for detecting depression when a screening tool is not used is concerning. Offices using an interview technique may have adolescents answer without complete honesty. In contrast, offices that are screening with a valid tool before the provider/patient interaction is helpful for the provider to have a “heads up” of any mental health concerns. Further, using a valid tool with absolute cut-off scores creates a culture that normalizes mental health care discussion and offers more concrete processes to identify depression concerns (Kenny et al., 2021).

Issues and Gaps with Current Screening Method

Current screening methods that do not utilize a standard screening tool invite missed screening opportunities. While verbally addressing depression with an adolescent can occasionally result in open and honest dialogue, discussing it verbally without a tool may result in the screen being forgotten during the exam. Having a standardized screening tool done before the provider enters the room for the exam ensures that the provider can review the answers and address any concerns. With the increasing demand for mental health services paired with the shortage of mental health clinicians, gaps in inadequate screening should be addressed (Zuckerbrot, 2018). Completed depression screenings that are reviewed prior to the clinician entering a room for an exam guarantees that the subject of mental health is addressed and provides a safeguard for missed verbal discussions of depression and acts as a guide to address patient specific concerns.

Electronic Health Record Management Opportunities

Electronic Health Records (EHRs) can be adjusted to add different metrics that may be useful in capturing and tracking data. When implementing a standardized screen, system changes

may include inputting screening results into the EHR after patient completion. Recommendations for assessing and treating adolescent depression involve using tools to identify those with depression systematically (Knopf, 2018). Integration into the EHR can create fail-safes that ensure adequate screening and, thus, increased detection of mental health concerns.

Documentation of the screening in the EHR also provides the office with an opportunity to evaluate charts quickly and measure quality improvement initiatives.

Improved Detection of Depression in Pediatric Setting

Improved data collection with better screening in the clinic will increase the identification of those adolescents and teens with signs of depression. Better identification of depression will lead to improved mental health care delivered to the adolescent or teen. Adolescents' mental health can be improved and better managed in the primary care setting through better screening processes. Depending on the clinician's training, a diagnosis of depression may occur, initiation of pharmaceuticals may be warranted, or mental health resources can be given to the family and appropriately followed up at a later date as recommended by the provider. Detection in the primary care setting allows for a holistic treatment approach that improves care delivered to adolescents and teens.

Internal Data

In a rural private pediatric practice in the southwestern United States, adolescents and teenagers are not routinely screened for depression using a validated screening tool. An estimated 10-20 patients aged 12-18 are seen weekly for yearly well-child visits (WCC's). These numbers are noted to increase in the late spring and summer months as parents schedule visits to accommodate necessary vaccinations for the upcoming school year as well as ensuring readiness to participate in sports. The clinic focuses on precise and punctual care and emphasizes the

importance of health promotion and disease prevention. While practice providers screen patients verbally for depression, the system is inconsistent and increases the incidence of missed opportunities to detect and treat depression. Practice stakeholders indicate a desire to improve the screening process and implement routine screening for depression at all WCC's. This implementation will reinforce the clinic's desire to improve health promotion and disease prevention.

PICOT Question

Given the current AAP guidelines that recommend routine depression screening, it is important to determine if there are impacts on the mental health services that youth receive as a result of screening. A review of the current literature led to the clinically relevant PICOT question: In the adolescent population (**P**), does the use of a standardized depression screening tool (**I**), compared with no screening (**C**), impact mental health care and patient referrals (**O**)?

Search Strategy

A thorough review of current evidence was conducted through the following databases: PsychINFO, PubMed, and Cumulative Index of Nursing and Allied Health Literature (CINAHL) to better understand the subject matter. These databases offer extensive information pertaining to the medical and nursing fields.

Keyword Selection

All databases were searched using the following keywords: *depression screening, PHQ9, adolescent, teen or teenager, children, treatment, therapy, and counseling*. To broaden the search, *PHQ9 modified for adolescents* was also used, though this keyword change did not change the publications offered.

Initial and Final Search Yields

The PsychINFO database was the first search conducted and initially included the keywords *screening OR PHQ9 OR depression screening, adolescent OR teen* OR children, and treatment OR therapy OR counseling*. This search yielded 3118 results. The search was then conducted while excluding the terms *postpartum OR perinatal, ADHD OR Autism*, and finally the broad keyword *screening* was eliminated. This final search resulted in 10 publications.

A CINAHL database search was conducted using the final PsychINFO search criteria. This yielded 25 results, all with different methodology types. An attempt was made to narrow the search to any randomized controlled trials (RCTs) and generated one result that was deemed inconsistent in answering the PICOT question.

Finally, PubMed was utilized for the search and yielded nine results using the same keywords and criteria. The search did specify the keywords *depression screening OR PHQ9* to be listed in the title, which led to the more concise results number.

Limitations, Inclusion, and Exclusion Criteria

Filters were applied in all three databases to limit the results to publications from the last five years. Inclusion criteria included adolescents and teenagers. There were no exclusions based on race or gender. Exclusion criteria in the database searches included the terms *postpartum, perinatal, ADHD, and autism*. These terms were explicitly excluded after initial searches revealed high yields of publications containing abstracts that were irrelevant to the PICOT question.

It should be noted that initial searches to yield only RCTs or high levels of evidence did not produce publications applicable to the PICOT question. In a 2017 systematic review of depression screening outcomes in adolescents, no RCT evidence was found to support or refute

the benefit of depression screening for adolescents (Roseman et al., 2017). Given this information, many of the publications focus on retrospective studies and support screening based on practice guidelines instead of a higher level of evidence. Given that the AAP recommends the use of standardized depression screening, RCTs comparing the outcomes from adolescents being screened with a tool like the PHQ-9 and those not being screened at all could be deemed unethical.

Critical Appraisal and Synthesis of Evidence

The evidence from the exhaustive search revealed varying evidence that confirms the necessity of the topic. The use of rapid critical appraisal tools by Melnyk and Fineout-Overholt (2019) was used to evaluate the evidence and ensure the usefulness of the research. Levels of evidence range from level II to level V, with design types including quality improvement (QI), Quasi-experimental studies, retrospective reviews, longitudinal cohort studies, and a mixed-methods study (Appendix A, Tables A1 and A2). The search revealed no RCTs applicable to this population, consistent with research conducted by Riehm and colleagues that confirm no RCTs currently exist that evaluate depression screening of adolescents in a primary care setting (2022).

Out of the studies identified, all except one specified the use of a validated depression screening tool (See Appendix A, Tables A1 and A2). Even more helpful, studies either increased depression screening, detected depression in adolescents, or both. Another significant outcome revealed that 9 of the 10 studies specifically integrated the use of the EHR in their interventions (See Appendix A, Tables A1 and A2). Evidence reveals that improved depression screening is feasible across a variety of settings, including pediatric primary care.

The PHQ-9 and PHQ-9A were the tools primarily used in the evidence, with one study not specifying a specific tool and one study using both the PHQ-9 and the Generalized Anxiety

Disorder- 7 items (GAD-7) (See Appendix A, Tables A1 and A2). Regardless of the tool used, the evidence correlates improved screening with its use. In addition to detecting depression, two studies specifically identified the risk of suicidality using screening and a standardized tool (Farley et al., 2020; Kemper et al., 2021). Further, the research settings varied from site locations, including primary care clinics, schools, and hospital settings. The research was conducted in all parts of the United States, making it generalizable and applicable to primary care sites everywhere (See Appendix A, Tables A1 and A2).

The majority of the research revealed screening is feasible, improves diagnosis, and sparks conversation between provider and patient that may increase rapport and establish trust. Screening with a tool and integration into the EHR is achievable and can improve the care and management of adolescents suffering from symptoms of depression or anxiety. Outcomes of the research ranged from medication initiation to referrals to mental health professionals (See Appendix A, Tables A1 and A2). These outcomes demonstrate that implementing a screening tool leads to further care for adolescents and their health. Providers who review the evidence will be encouraged to see depression screening is directly correlated to improved mental health outcomes.

Application of Lewin's Change Theory

Implementing a standardized depression screening tool in the clinic will require a practice change. Lewin's theoretical framework will provide guidance and facilitate the change of current depression screening to the implementation of a protocol consistent with the AAP Guidelines for Adolescent Depressions in Primary Care (GLAD-PC). Lewin's model describes three simple steps which organizations can use to modify their strategies processes and structures by: unfreezing, change, and refreezing (Hussain et al., 2018; Petiprin, 2020). An organization that is

comfortable performing tasks a certain way may have difficulty “letting go of old habits” and adopting newer processes. Lewin describes the unfreezing step in his Change Theory to reduce resistance to change and eliminate the group conformity that has been established (Petiprin, 2020). Once the group is open to change and no longer confined to previous ways, the process of change will occur. A newfound desire to change allows the group to quickly implement new protocols or methods and create a more productive environment. Once the change has been made, the group may enter the refreezing stage—that is, concretely adhering to the change by making it a new habit or standard of care (Petiprin, 2020).

Given the overwhelming internal evidence that demonstrates a change in current practice is needed, implementing standardized depression screening utilizing Lewin’s Change Theory will facilitate the staff’s success as they navigate a system transformation. The theory allows the team to “unlearn” what has previously been done and employ a new, research-based method for improving the detection of depression in adolescents. After the project implementation, the system should undergo a refreezing process to establish the new change as their new standard of care.

Implementation Framework

The use of the Plan-Do-Check-Act (PDCA) cycle allows the practice to implement change with the help of Lewin’s Change Theory. The American Society for Quality (ASQ) describes that the utilization of the PDCA cycle promotes quality improvement and allows for the implementation of a practice change while ensuring evaluation occurs that proves its usefulness in practice (n.d.). The first steps using the PDCA cycle include planning for the intervention and then implementing the changes that have been guided by the research (ASQ, 2022). After the implementation, the results should be analyzed and further adjusted until the

outcome is desired. Once the desired outcome is reached, the facility can freeze the new methods/protocols (See Appendix B, Figures B1 and B2).

Implications for Practice Change

Evidence reveals that implementing a depression screening tool in practice improves detection and management. The use of standardized screening and utilization of the EHR can be accomplished with the use of Lewin's Change Theory and the PDCA cycle (See Appendix B, Figures B1 and B2). Evaluation of the practice change will continue to occur routinely to ensure positive effects of its implementation and allow for adjustments based on the findings (ASQ, 2022).

The initial project proposal included the implementation of the PHQ-9A for all adolescents 12-18 years of age at their annual wellness exam. To properly implement screening, a staff training session was held for all office staff members, nurses, medical assistants, and health care providers. Education included the definition of depression, the significance of the problem, and reasons for screening. For this process to be successful and sustainable, the entire practice demonstrated their investment in this project. Patient completion of the PHQ-9A was only successful because of the development of a practice-wide systematic process for administering, scoring, and managing the tool. Data collected determined if the desired outcome of increased depression screening during the WCC was reached during this project.

Front office staff members administered the printed tool to the qualified adolescents at check-in and then presented the completed tool to the back-office staff member responsible for rooming the patient. The back-office staff member then input the results of the tool into the EHR for the provider to review before entering the room. This step was crucial so that positive screens

were not missed, and conversation regarding the score occurred during the exam. The provider then determined the next steps and recommended any necessary follow-up.

Benefits to the organization include increased detection of depressive symptoms, leading to thorough care and superior management. Standardized depression screening allows the practice to confidently follow GLAD-PC guidelines to identify, assess, and manage depression in the primary care setting (Zuckerbrot et al., 2018). Most importantly, the benefits to the adolescent population of the practice change are overwhelming when guided by the evidence. The use of the PHQ-9A can facilitate conversations surrounding mental health and encourage the provider to discuss the results with the adolescent. Successful management of depressive symptoms may occur in the clinic or can be referred to a mental health specialist. This management, after identification, reduces gaps in the adolescent's health care and facilitates health promotion for the individual (Davis & Leon, 2022).

Methods

This project was approved by the Institutional Review Board (IRB) at Arizona State University (ASU) and occurred at a private pediatric practice. To ensure protection of human subjects, the clinic ensured a signed copy of privacy practices was on file that informed the parent or guardian that data collected can be used for research purposes only. All data collected in the project was de-identified to the co-investigator. All eligible WCC appointments were given a PHQ9-A questionnaire to complete. Patients were excluded if they did not read and understand the English language or if they had a documented developmental delay or other disability that excluded them from completing the questionnaire deemed by the clinician scheduled to see them for their WCC. The project reviewed charts for PHQ9-A completion,

scores, and patient demographics over a 6-week timeframe and included three total providers who participated in the administration and evaluation of the PHQ9-A.

Data was collected using the EHR auditing system. All well visits with a completed PHQ9-A were coded with a Current Procedural Terminology (CPT) code of 96127—defined as “Brief emotional/behavioral assessment” as well as an International Classification of Diseases, 10th Revision (ICD-10) Z13.31, “Encounter for screening for depression” (American Academy of Family Physicians, 2020). This data collection determined if the desired outcome of increased depression screening during the WCC was reached throughout the course of the project. Data was then analyzed at the completion of the 6-week project. There was no outside funding of this project, and no conflicts of interest to disclose.

Results

Data for this project was analyzed using Intellectus Statistics™ software. Demographic information, the number of PHQ9-A screens performed, total PHQ9-A scores, and whether any diagnoses or mental health referrals were made were collected through descriptive statistics. Summary statistics, frequencies, and percentages were also calculated using Intellectus Statistics™ software.

Frequencies and Percentages

Post-intervention data was collected on 76 eligible charts over a period of 6 weeks using a chart review tool. Of the 76 charts, 50% were male ($n=38$), 49% were female ($n=37$), and one patient identified as non-binary. 51% ($n=39$) of patients were enrolled in the Arizona Health Care Cost Containment System (AHCCCS), Arizona’s form of Medicaid. The remaining patients were enrolled in private insurance plans ($n=33$) or uninsured ($n=4$). It was observed that the

average age of patients completing the screening was 14 years old ($SD = 1.72$, $Min = 12$, $Max = 17$).

PHQ9-A Completed Screening

Charts were reviewed to determine the number of eligible patients that completed the PHQ9-A questionnaire. Out of 76 eligible visits, 86% ($n=65$) completed a PHQ9-A questionnaire. Of the 11 patients who did not complete the screening, 82% ($n=9$) had no reason stated for not completing the screening and only 18% ($n=2$) was due to parental refusal.

PHQ9-A Scores and Severity

It was observed that the average PHQ9-A score for all total screens completed was 5.29 ($SD = 6.48$, $Min = 0$, $Max = 25$). Those scoring ≥ 11 on the PHQ9-A are considered a positive screen for depression. Of all patients who completed a PHQ9-A questionnaire, 17% ($n=11$) were considered positive. The average score of those who screened positive was 17.91 ($SD = 4.76$) with a minimum score of 11 and a maximum score of 25.

Diagnoses and Mental Health Referrals

The project guided clinicians to consider a diagnosis of MDD or refer a patient to mental health if they scored ≥ 11 on the PHQ9-A questionnaire. Of the total positive screens, 12% ($n=8$) were referred to a mental health specialist. Only 2 patients received a mental health diagnosis and neither of these were related to MDD but instead were diagnoses of anxiety. These 2 patients were included in the patients who also received mental health referrals.

The chart audit revealed that 3 patients who had a positive PHQ9-A screen did not have any documented intervention pertaining to possible MDD. These patients were not diagnosed with a mental health disorder nor were they referred to a mental health provider. The total PHQ9-A scores for these patients were 11, 13, and 19, respectively.

Clinical Significance

While no statistical significance was revealed after the implementation of the project, the project is clinically significant to practice and the care of adolescents. Of those screened with the PHQ9-A, 17% had a positive score indicating a possible MDD diagnosis. This directly correlates with the most current statistics provided by the NIH (2022). Using a standardized tool like the PHQ9-A ensures screening and captures a large number of adolescents experiencing symptoms of MDD. Feedback from office staff is also positive and staff report that the use of the tool allows for an easier discussion on mental health—opening doors and reducing stigmas as hypothesized.

Impact of the Project and Sustainability

As screening continues, patients begin to see that answering these questions are a standard part of the WCC. Families begin to associate PHQ9-A screening with other routine health management tools used during the WCC and view discussions on mental health as a regular part of the annual exam. Standardized screening using the PHQ9-A has also normalized the discussion of depression for staff and allows them to be more aware of mental health concerns patients might have. Integration of the PHQ9-A screening into the EHR establishes a sustainable project and continues as it was implemented. Using Lewin's Change theory, the project site has completed the refreezing process and maintains the project today.

Discussion

There is overwhelming evidence that screening for depression in the adolescent population increases detection and can facilitate interventions to improve mental health. The pediatric primary care provider is essential in assessing the adolescent's mental health status and acting appropriately. Without a standardized tool, depression screening during an exam through

casual dialogue may not reveal the patient's true feelings, and screening may not happen altogether. A depression screening tool allows the adolescent to respond more honestly to questions that may be sensitive to be asked about in person while also promoting an environment of holistic care. When adolescents know that their primary care provider routinely screens their mental health status, a shift in their outlook on mental health occurs. Adolescents who perceive their provider to be interested in their mental health by routinely screening in the office may increase dialogue and reduce stigmas often seen when talking about depression and suicidality.

For mental health concerns to be addressed, the provider must adequately screen and be prepared to manage any symptoms that are revealed appropriately. Without using a standardized tool, depression detection may not happen, and proper services and interventions will not take place. Adolescents experiencing undiagnosed and unmanaged depression may suffer from familial conflicts, difficulties maintaining relationships with friends, struggling in school, self-medicating with alcohol or illicit substances, and engaging in risky activities with dire consequences and poor outcomes. Practices and providers who follow the research that shows that identifying depression in the health care setting is possible and practical, will improve mental health outcomes and foster a healthy view of mental health in the adolescent population.

Limitations

While most patients completed the PHQ9-A, it is imperative to increase the rates of screening to prevent missing those suffering from depression or other mental health disorders. Unfortunately, some eligible patients were not screened without a documented reason. This oversight may have impacted the number of adolescents with positive PHQ9-A screens. Another limitation is related to language barriers and should be addressed by the clinic. Further, while many patients who screened positive received a mental health referral, only two patients received

a diagnosis related to their mental health. This is likely due to time constraints of the WCC and affects the way a clinician is able to accurately diagnoses MDD or other mental health disorders while maintaining timely and efficient appointments throughout the day.

Recommendations for Further Study

Follow-up should be conducted at the 6-month mark to assess screening rates and determine if management strategies for positive screens has increased in numbers. It would also be prudent to assess the staff's morale and discuss their thoughts on how the topic of mental health has changed subjectively. Screening should further be extended to all encounters with adolescents and teenagers whether they are presenting for their WCC or not. It can also be argued that increasing the time of WCC appointments may lead to increased management in the primary care setting and this should be explored in the future.

Conclusion

The time to address depression in adolescents is now. High incidences of MDD in this age group, paired with low documented levels of standardized screening in primary care, indicate a significant need for change. Through implementation of standardized depression screening using the PHQ9-A, providers can adhere to national recommendations and improve the care they deliver to these vulnerable populations. Screening with the PHQ9-A is feasible, easily integrated into the EHR, and promotes positive discussions surrounding mental health. These conversations reduces the stigma and encourages patients to discuss their feelings and concerns with their families and health care providers. Better identification leads to proper diagnosis and management of mental health disorders—improving the quality of care our young people receive.

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Appendix A

Evaluation and Synthesis Tables

Table A1
Evaluation Table for Quantitative Studies

| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|---|---|---|---|---|--|---|---|--|
| <p>Bose et al., (2021). Implementation of universal adolescent depression screening: Quality improvement outcomes</p> <p>Country: USA</p> <p>Funding: Not specified</p> <p>Bias: None specified</p> | <p>Donabedian Quality Implementation and Evaluation Model</p> | <p>Design: QI with pre/posttest data</p> <p>Purpose: Improve identification and management of adolescent depression through the use of PHQA</p> | <p>N:184 n:86 (CG) n:98 (EG)</p> <p>Demographics: Patients 12-18yrs CG: 43 M, 43 F, AA 14.6yrs EG: 54 M, 44 F, AA 14.5yrs</p> <p>Over 80% insured through SMP</p> <p>Setting: Private ped practice in Midwest</p> <p>Exclusion: prior hx of depression</p> | <p>IV1: Rates of depression screening</p> <p>DV1: depression dx</p> <p>DV2: mental health referrals</p> <p>DV3: pharmaceutical tx of depression</p> | <p>Tools: PHQA</p> <p>Validity/ Reliability: sensitivity 0.73, specificity 0.94</p> <p>Use of EHR for retrospective data collection and measurement of CPT codes post-implementation</p> | <p>Statistical Tests Used: exact Pearson chi-square test</p> | <p>DV1: at 0.05 level, pre/post difference ($p=0.0017$)</p> <p>DV2: at 0.05 level, pre/post difference ($p=0.207$)</p> <p>DV3: at 0.05 level, pre/post difference ($p=0.1234$) *not statistically significant, but clinically significant</p> | <p>LOE: V, QI</p> <p>Strengths: Feasible, overcame perceived barriers</p> <p>Weakness: Possibility of data loss, 25.6% of adolescents not screened with no reason documented</p> <p>Feasibility: Improved screening rates from 0% to 74.4% in clinic with failed QI measures</p> <p>Application: offers implications to start routine screening with PHQA at WCC visits</p> |

Key: AA – Average age; AAP—American Academy of Pediatrics; ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; CDC –Centers for Disease Control and Prevention; CG – Control group; CI –Confidence interval; CLIMB –Consultation Liaison in Mental Health and Behavior; CPT – current procedural terminology; DV – Dependent variable; DX – diagnosis; EG – Experiment group; EHR – electronic health record; F – Females; GAD-7 – Generalized anxiety disorder-7 item; HX – History; ID –Intellectual disability; IV –Independent variable; LOE – level of evidence; M – Males; MDD – Major Depressive Disorder; NIMH –National Institute of Mental Health; PCP –Primary care provider; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; QI-Quality Improvement; RX –Prescription; SMP – State Medicaid program; SPSS – Statistical package for the social sciences; TX – treatment; UPL – Upper Payment Limit; WCC – well child check

| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|---|--|---|--|---|--|---|--|--|
| <p>Feiden (2021). Identifying anxiety and depression in adolescents through primary care screening.</p> <p>Country: USA</p> <p>Funding: Not specified</p> <p>Bias: None specified</p> | No theoretical or conceptual framework noted | <p>Design: Quasi-experimental with pre/posttest data</p> <p>Purpose: Identification of depression and anxiety through use of PHQ-9 and/or GAD-7</p> | <p>N: 44</p> <p>Demographics: Patients 12-18yrs 17 M, 26 F; Predominately white (96.9 %)</p> <p>Setting: Rural primary care clinic</p> <p>Exclusion: Prior dx anxiety or depression</p> <p>Attrition: Not discussed</p> | <p>IV1: Administration of standardized tool</p> <p>DV1: GAD-7 score</p> <p>DV2: PHQ-9 score</p> | <p>Tools: GAD-7 and PHQ-9</p> <p>Validity/Reliability: GAD-7: sensitivity 0.83, specificity 0.84 PHQ-9: sensitivity 0.73, specificity 0.94</p> | <p>Statistical Tests Used: paired <i>t</i> tests, Pearson correlation coefficient, Wilcoxon signed rank test</p> | <p>DV1: pre/post correlation ($r=0.911$, $P<.001$); scores ($t(42) = 7.049$, $P<.001$)</p> <p>DV2: pre/post correlation ($r=0.907$, $P<.001$); ($t(42) = 7.353$, $P<.001$)</p> | <p>LOE: II</p> <p>Strengths: feasible, helped with early detection</p> <p>Weaknesses: small sample size, no long term follow up</p> <p>Feasibility: tools were graded and then entered into EHR</p> <p>Application: can be easily replicated in practice regardless of demographics</p> |
| <p>Chowdhury & Champion (2020). Outcomes of depression screening for adolescents accessing pediatric primary care-based services.</p> | Donabedian model | <p>Design: Data analysis, retrospective review</p> <p>Purpose: To assess outcomes of screening,</p> | <p>N: 1213 adolescents</p> <p>Demographics: Patients 11-16yrs (55.7% 11-13yrs, 20.6% 14-15, 23.7% 15-16yrs), non-Hispanic white (60.7%), Hispanic (31.5%),</p> | <p>IV1: PHQ-9 given</p> <p>DV1: adolescents with depression</p> <p>DV2: adolescents with mild to high symptoms</p> | <p>Tools: PHQ-9</p> <p>Validity/Reliability: sensitivity 0.73, specificity 0.94</p> <p>Use of EHR for retrospective data collection</p> | <p>Statistical Tests Used: SPSS</p> | <p>DV1: 600</p> <p>DV2: 96</p> <p>DV3: 42</p> | <p>LOE: III</p> <p>Strengths: Screening utilized EHR and easy to track, ideal location for screening</p> <p>Weaknesses: Inconsistent screening, referrals not followed</p> |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|---|--|---|--|---|--|---|--|---|
| <p>Country: Primary care setting</p> <p>Funding: Not specified</p> <p>Bias: None specified</p> | | refinement of protocols | <p>Asian (4.5%), Black (2.2%), and mixed (1.0%); F 50.5%, M 49.5%</p> <p>Setting: Pediatric primary care clinic in southwestern US</p> <p>Exclusion: Comorbidities or chronic illness</p> <p>Attrition: Not discussed</p> | DV3: Referrals made to mental health practitioners | | | | <p>through, limited documentation</p> <p>Feasibility: Highlights needs for implementation and need for follow up</p> <p>Application: Can replicate use of validated tool in primary care</p> |
| <p>Riehm et al. (2022). Diagnoses and treatment after depression screening in primary care among youth</p> <p>Country: USA</p> <p>Funding: Author supported by a</p> | No theoretical or conceptual framework noted | <p>Design: Longitudinal Cohort Study</p> <p>Purpose: To examine associations of screening with treatment uptake and to determine if associations are dependent on the</p> | <p>N: 57,732 (matched sample from 248,354 reviewed charts)</p> <p>n1: 43,299 (not screened)</p> <p>n2: 14,433 (screened)</p> <p>Demographics: 12-18yrs, continuously enrolled in insurance</p> | <p>IV1: Depression screening</p> <p>DV1: Depression dx</p> <p>DV2: mood related dx</p> <p>DV3: mental health medication</p> | <p>Tools: Not specified</p> <p>Validity/Reliability: Use of EHR for data collection and measurement of CPT codes</p> | <p>Statistical Tests Used: Propensity score matching, log-binomial regression models</p> | <p>Risk ratio (95% CI) Not screened, screened</p> <p>DV1: 1.30 (1.11, 1.52)</p> <p>DV2: 1.17 (1.08, 1.27)</p> <p>DV3: 1.11 (0.82, 1.53)</p> <p>DV4: 1.13 (0.98, 1.31)</p> | <p>LOE: IV</p> <p>Strengths: large number or participants, statistically significant improvement in diagnosis of depression and mood-related disorders</p> <p>Weaknesses: Primarily surveyed</p> |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|--|---|----------------------------|--|---------------------------|---------------------------------|---------------|--|---|
| service award from the NIMH and award from Canadian Institutes of Health Research Bias: None specified | | sex of the adolescent | (Medicaid, marketplace, or commercial insurance) n1: AA: 13.68, F: 49.4%, M: 50.6% n2: AA: 13.69, F: 49.4%, M: 50.6% Setting: rural, urban, and small town, largest numbers acquired from Pennsylvania, West Virginia, and Delaware Exclusion: Hx depression diagnosis, antidepressant therapy, or psychotherapy in last 6 months Attrition: Not discussed | DV4: psychotherapy | | | Participants who were screened for depression were 30% more likely to be diagnosed with depression and 17% more likely to be diagnosed with mood-related dx; there was no association between being screened and being prescribed medications or psychotherapy | eastern U.S. adolescents and cannot be generalized to entire country; any mental health resources accessed outside of insurance was not counted Feasibility: screening can improve diagnosis, EHR use can track CPT codes used Application: Easily replicated |

Key: AA – Average age; AAP—American Academy of Pediatrics; ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; CDC –Centers for Disease Control and Prevention; CG – Control group; CI –Confidence interval; CLIMB –Consultation Liaison in Mental Health and Behavior; CPT – current procedural terminology; DV – Dependent variable; DX – diagnosis; EG – Experiment group; EHR – electronic health record; F – Females; GAD-7 – Generalized anxiety disorder-7 item; HX – History; ID –Intellectual disability; IV –Independent variable; LOE – level of evidence; M – Males; MDD – Major Depressive Disorder; NIMH –National Institute of Mental Health; PCP –Primary care provider; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; QI-Quality Improvement; RX –Prescription; SMP – State Medicaid program; SPSS – Statistical package for the social sciences; TX – treatment; UPL – Upper Payment Limit; WCC – well child check

| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|--|--|---|--|--|--|---|--|---|
| <p>Bhatta et al., (2018). Outcomes of depression screening among adolescents accessing school-based pediatric primary care clinic services</p> <p>Country: Southwestern, USA</p> <p>Funding: Not specified</p> <p>Bias: None specified</p> | <p>Donabedian model with integration of the PDSA cycle</p> | <p>Design: Retrospective chart review</p> <p>Purpose: Improve identification and management of adolescent depression through use of PHQ-9</p> | <p>N1: 256 N2: 144 (given PHQ-9)</p> <p>Demographics: 12-18yrs, F=137, M=119, 93% Hispanic</p> <p>Setting: school based primary care clinic</p> <p>Exclusion: those accessing clinic for vaccines or sports physical only</p> | <p>IV1: PHQ-9 given</p> <p>DV1: Score <10</p> <p>DV2: Score >= 10</p> <p>DV3: Mental health referral given</p> | <p>Tools: PHQ-9</p> <p>Validity/ Reliability: Sensitivity 89.5%, Specificity 78.8% in detecting MDD in adolescents</p> | <p>Statistical Tests Used: Use of SPSS 24.0 software; Pearson’s chi-squared analysis tested associations</p> | <p>DV1: 126</p> <p>DV2: 18</p> <p>DV3: 15 (3 refused)</p> | <p>LOE: III</p> <p>Strengths: identified youth at risk for MDD, prompted patient/provider conversation</p> <p>Weakness: staff failed to administer 44% of the time</p> <p>Feasibility: Screen is quick and EHR prompts increase staff compliance for administration of tool</p> <p>Application: initiation of screening allows youth to be aware of MDD symptoms, early identification can decrease cost and time taking to get MDD dx</p> |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|---|---|---|--|--|--|--|--|--|
| <p>Farley et al., (2020). Identification and management of adolescent depression in a large pediatric care network.</p> <p>Country: USA</p> <p>Funding: Not specified</p> <p>Bias: None noted</p> | <p>No theoretical or conceptual framework noted</p> | <p>Design: Retrospective, data analysis</p> <p>Purpose: To examine depression identification and follow up care</p> | <p>N1: 10,713 N2: 6923 completed screens</p> <p>Demographics: 16-yr WCC (15.5-16.5 years old) M=50.31%, F=49.69% White: 58.72%, Black/African American: 27.71%, Asian 2.73%; Hispanic or Latino: 5.11%, non-Hispanic 94.66% Setting: Large pediatric health care facility and 27 PPCC in the mid-Atlantic US</p> <p>Exclusion: all WCC outside the 16yr</p> | <p>IV1: Screening done</p> <p>DV1: Normal range PHQ-9-M</p> <p>DV2: Subthreshold score</p> <p>DV3: threshold score</p> <p>DV4: suicide risk</p> | <p>Tools: PHQ-9-M</p> <p>Validity/ Reliability: sensitivity 0.73, specificity 0.94</p> | <p>Statistical Tests Used: Descriptive statistics calculated by research team through EHR to determine sociodemographic characteristics and thresholds of PHQ-9-M</p> | <p>DV1: 5129 (74.1%)</p> <p>DV2: 1331 (19.2%)</p> <p>DV3: 466 (6.7%)</p> <p>DV4: 597 total (99 in DV1, 230 in DV2, and 268 in DV3 group)</p> | <p>LOE: III</p> <p>Strengths: Integrated into EHR, screening prompted provider/patient conversations about mental health</p> <p>Weakness: inconsistency of buy-in at practices, workflow issues decreasing time for staff to administer screen</p> <p>Feasibility: Screening is achievable in primary care setting</p> <p>Application: Can be replicated and useful in multiple settings and generalized to other age groups0</p> |

Key: AA – Average age; AAP—American Academy of Pediatrics; ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; CDC –Centers for Disease Control and Prevention; CG – Control group; CI –Confidence interval; CLIMB –Consultation Liaison in Mental Health and Behavior; CPT – current procedural terminology; DV – Dependent variable; DX – diagnosis; EG – Experiment group; EHR – electronic health record; F – Females; GAD-7 – Generalized anxiety disorder-7 item; HX – History; ID –Intellectual disability; IV –Independent variable; LOE – level of evidence; M – Males; MDD – Major Depressive Disorder; NIMH –National Institute of Mental Health; PCP –Primary care provider; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; QI-Quality Improvement; RX –Prescription; SMP – State Medicaid program; SPSS – Statistical package for the social sciences; TX – treatment; UPL – Upper Payment Limit; WCC – well child check

| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|--|---|---|--|--|---|---|---|---|
| <p>Kenny et al., (2021). All hands on deck: Addressing adolescent depression in pediatric primary care.</p> <p>Country: USA Funding: UPL funds from Colorado Department Healthcare Policy and Finance and University of Colorado School of Medicine</p> <p>Bias: None stated</p> | <p>No theoretical or conceptual framework noted</p> | <p>Design: Mixed Methods</p> <p>Purpose: identify prevalence of depression using PHQA, characterize interventions, identify reasons for improved PHQA scores at follow up</p> | <p>N: 2,107 (screened) N2: 277 (elevated PHQA)</p> <p>Demographics: 11-18yrs, all sick visits and WCC, AA=13.3, F=48%, M=:52%, 28% Spanish as primary language, 88% enrolled in Medicaid</p> <p>Setting: PPCC in large children’s hospital network, urban</p> <p>Exclusion: patients with ASD or ID</p> | <p>IV1: PHQA use</p> <p>DV1: Elevated PHQA</p> <p>DV2: Referrals or interventions done by PCP for elevated PHQA</p> <p>DV3: Change in PHQA score</p> <p>Definitions: Elevated PHQA: score of 10+ and/or elevated item no. 9 asking about suicidal ideation)</p> | <p>Tools: PHQA, use of EHR</p> <p>Validity/ Reliability: sensitivity 0.73, specificity 0.94</p> | <p>Statistical Tests Used: chi-square analyses, ATLAS.ti software for developing codes for descriptive statistics, continuous change scores used to calculate difference in PHQA from visit 1 to visit 2</p> | <p>DV1: 277 (13%)</p> <p>DV2: Referral to CLIMB (57%), already receiving treatment (15%), counseling without referral to CLIMB (13%), no action taken (12%)</p> <p>DV3: average change score 6.4 points (CLIMB referral positively correlated with improved PHQA ($r=.20$, $p <.01$))</p> | <p>LOE: II</p> <p>Strengths: CLIMB referral for those with elevated PHQA resulted in improved PHQA at follow up, PHQA use identified those at risk for MDD</p> <p>Weakness: missed screening because of inadequate procedures in office, incongruence between provider interventions</p> <p>Feasibility: identification with PHQA can lead to intervention that improves mental health, trained staff can reduce missed opportunities for screening</p> <p>Application: can be replicated,</p> |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|--|---|---|---|---|--|--|--|---|
| | | | | | | | | generalizability in Spanish-speaking population |
| <p>Leslie & Chike-Harris, (2018). Patient-administered screening tool may improve detection and diagnosis of depression among adolescents.</p> <p>Country: USA</p> <p>Funding: No financial support received</p> <p>Bias: No conflicts of interest noted</p> | <p>No theoretical or conceptual framework noted</p> | <p>Design: QI with pre/post data</p> <p>Purpose: Determine if detection, dx, and management of depression can be aided by use of depression screening tool vs. no formal screening protocol</p> | <p>N: 359 n: 282 (pre) n: 77 (post)</p> <p>Demographics: 11-21yrs</p> <p>Setting: PPCC in rural South Carolina</p> <p>Exclusion: No exclusions noted, all patients presenting to clinic were screened</p> | <p>IV1: PHQA administration</p> <p>DV1: PHQA score >9</p> <p>DV2: Dx with depression</p> <p>Definitions: PHQA score >9 indicates moderate depressive symptoms</p> | <p>Tools: PHQA</p> <p>Validity/Reliability: sensitivity 0.73, specificity 0.94</p> | <p>Statistical Tests Used:</p> <p>None used or specified. Authors used simple mathematic calculations for percentages based on data gathered in the EHR</p> | <p>DV1: 8 (10%), post</p> <p>DV2: 15 (5%) in pre data, 15 (17%) in post data</p> | <p>LOE: V</p> <p>Strengths: Use of tool identified depression in subjects, thus aiding in further assessment and evaluation</p> <p>Weakness: Only 1 provider out of the 5-provider practice participated; inadequate breakdown of demographics making it difficult to generalize; some incongruence in dx of depression and PHQA score in post data; poor statistical analysis</p> <p>Feasibility: Not generalizable but study is easy to</p> |

Key: AA – Average age; AAP—American Academy of Pediatrics; ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; CDC –Centers for Disease Control and Prevention; CG – Control group; CI –Confidence interval; CLIMB –Consultation Liaison in Mental Health and Behavior; CPT – current procedural terminology; DV – Dependent variable; DX – diagnosis; EG – Experiment group; EHR – electronic health record; F – Females; GAD-7 – Generalized anxiety disorder-7 item; HX – History; ID –Intellectual disability; IV –Independent variable; LOE – level of evidence; M – Males; MDD – Major Depressive Disorder; NIMH –National Institute of Mental Health; PCP –Primary care provider; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; QI-Quality Improvement; RX –Prescription; SMP – State Medicaid program; SPSS – Statistical package for the social sciences; TX – treatment; UPL – Upper Payment Limit; WCC – well child check

| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|---|--|---|--|--|--|---|---|---|
| | | | | | | | | replicate to see if it can be generalized Application: Tool can be implemented in practice with well-designed protocol that can eliminate the strain on staff and increase use in clinics |
| Kemper et al., (2021). Depression and suicide-risk screening results in pediatric primary care. Country: USA Funding: No external funding | No theoretical or conceptual framework noted | Design: Cohort study, observational Purpose: To evaluate extent of positive depression screening using PHQA or ASQ | N: 803 Demographics: 12-20yrs, 41.3% M, 58.7% F, Medicaid 79.3% Setting: 12 PPCC in Columbus, Ohio Exclusion: Prior hx of depression, self-harm, or antidepressant use within 6mo | IV1: PHQA use IV2: ASQ use DV1: Positive screen for depression or other mental illness DV2: Positive screen for MDD DV3: Positive ASQ screen Definitions: PHQA positive | Tools: PHQA and ASQ Validity/Reliability: PHQA: sensitivity 0.73, specificity 0.94; ASQ: sensitivity 96.9%, specificity 87.6% | Statistical Tests Used: chi-squared tests and Fisher’s exact tests; Stata 16 used for analyses | DV1: 453 (56.4%) DV2: 198 (24.7%) DV3: 169 (21.1%) | LOE: III Strengths: Questions are consistent, achievable in large health care setting Weakness: Subjects were from single health care system so concerns for generalizability, follow-up care was not standardized, Feasibility: Shows high prevalence of depression |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|--|---|---|--|--|--|---|---|---|
| <p>Bias: One author receives grant support for suicide prevention from NIMH and CDC, no other conflicts of interest noted</p> | | | | <p>for depression or other mental illness included response of 2 or 3 in questions 1-8 or any response in question 9; Positive screen for MDD was score ≥ 10; Positive ASQ screen includes any affirmative response to any questions</p> | | | | <p>symptoms and need for screening</p> <p>Application: Use of either tool shows improvement in detection of mental health concerns</p> |
| <p>Harder et al., (2019). Improving adolescent depression screening in pediatric primary care.</p> <p>Country: USA</p> <p>Funding: State of Vermont</p> | <p>PDSA used in participating practices</p> | <p>Design: QI</p> <p>Purpose: Assess the outcome of QI on screening in PPCC</p> | <p>N: 39 practices, 1564 adolescents n: 21 with 772 adolescents (CG) n: 17 with 792 adolescents (EG)</p> <p>Demographics: 12-18yrs</p> <p>CG: Combination of Family practices and PPCC; M=49%,</p> | <p>IV1: Implementation of QI collaborative</p> <p>DV1: Screening for depression</p> <p>DV2: Screening for depression using tool</p> | <p>Tools: PHQ9</p> <p>Validity/Reliability: sensitivity 0.73, specificity 0.94</p> | <p>Statistical Tests Used: Chi-square analysis</p> | <p>DV1: EG: 712 (90%); CG: 579 (75%) ($p < .001$)</p> <p>Adolescents 3.5x more likely to be screened in EG (95%CI, 1.14-10.98, $p = .03$)</p> | <p>LOE: V</p> <p>Strengths: Increased rates of depression screening, 1 year later adolescents still being screened with validated tools</p> <p>Weakness: Practices self-reported participation and</p> |

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| Citation | Theoretical/ Conceptual Framework | Design/ Method/ Purpose | Sample/Setting | Variables | Measurement/ Instrumentation | Data Analysis | Results/ Findings | Level of Evidence; Application to practice; Generalization |
|----------------------|---|----------------------------|--|--|---------------------------------|---------------|--|--|
| Bias: None disclosed | | | F=51%; Medicaid: 40% EG: 17 PPCC; M=47%, F=53%; Medicaid=33% Setting: Primary care practices in Vermont Exclusion: Patients not enrolled in practice in 2012, missing data on questionnaire, practice with few eligible patients | Definitions: QI collaborative consisted of educating practices in EG to improve screening and provided education on guidelines and tools from AAP mental health toolkit | | | DV2: EG: 607 (77%); CG: 246 (32%) ($p<.001$) Adolescents 37.5x more likely to be screened with validated tool in EG (95%CI, 7.67-183.48, $p<.0005$) | there were no control samples; limited generalizability Feasibility: Screening after QI increased to 97% from 34% in the EG Application: Study shows that collaboration with professionals to address improvement from office systems change and provider education improves screening |

Key: AA – Average age; AAP—American Academy of Pediatrics; ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; CDC –Centers for Disease Control and Prevention; CG – Control group; CI –Confidence interval; CLIMB –Consultation Liaison in Mental Health and Behavior; CPT – current procedural terminology; DV – Dependent variable; DX – diagnosis; EG – Experiment group; EHR – electronic health record; F – Females; GAD-7 – Generalized anxiety disorder-7 item; HX – History; ID –Intellectual disability; IV –Independent variable; LOE – level of evidence; M – Males; MDD – Major Depressive Disorder; NIMH –National Institute of Mental Health; PCP –Primary care provider; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; QI-Quality Improvement; RX –Prescription; SMP – State Medicaid program; SPSS – Statistical package for the social sciences; TX – treatment; UPL – Upper Payment Limit; WCC – well child check

Table A2
Synthesis Table

| Study (Author, year) | Bose et al., (2021) | Feiden (2021) | Chowdhury & Champion (2020) | Riehm et al., (2022) | Bhatta et al., (2018) | Farley et al., (2020) | Kenny et al., (2021) | Leslie & Chike-Harris (2018) | Kemper et al., (2021) | Harder et al., (2019) |
|----------------------------|---------------------|--------------------------|--------------------------------|--------------------------------------|-------------------------------------|---------------------------|----------------------|------------------------------|--------------------------------------|--|
| Design LOE | QI; V | Quasi-experimental; II | Retrospective review; III | Longitudinal Cohort Study; IV | Retrospective review; III | Retrospective review; III | Mixed Methods; II | QI; V | Cohort Study, Observational; III | QI; V |
| Sample | | | | | | | | | | |
| <i>n subjects</i> | 184 | 44 | 1213 | 57,732 | 256 | 10,173 | 2,107 | 359 | 803 | 1564 |
| <i>Age Group</i> | 12-18yrs | 12-18yrs | 11-16yrs | 12-18yrs | 12-18yrs | 16yr | 11-18yrs | 11-21yrs | 12-20yrs | 12-18yrs |
| <i>Exclusions</i> | Hx depression | Hx depression or anxiety | Comorbidities, chronic illness | Dx depression, antidepressant tx, PT | Access of clinic for vaccines or SP | WCC outside 16yr | Dx of ASD or ID | None | Hx depression, self-harm, or med use | Patients not enrolled in practice 2012 |
| Setting | | | | | | | | | | |
| <i>Type of Practice</i> | Private clinic | Private clinic | Private Clinic | Various | School Clinic | Large HCO and PPCC | PPCC | PPCC | PPCCs | PPCCs, clinics |
| <i>Area in the US</i> | Midwest | Rural | Southwest | East Coast | Southwest | Mid-Atlantic | Urban | Rural | Ohio | Vermont |
| Interventions | | | | | | | | | | |
| <i>PHQA</i> | X | | | | | | X | X | X | |
| <i>PHQ-9</i> | | X | X | | X | | | | | X |
| <i>GAD-7</i> | | X | | | | | | | | |
| <i>Use of EHR</i> | X | X | X | X | X | X | | X | X | X |
| <i>PHQ-9-M</i> | | | | | | X | | | | |
| <i>ASQ</i> | | | | | | | | | X | |
| Outcomes/ Themes | | | | | | | | | | |
| <i>Increased screening</i> | X | X | X | X | X | X | | X | | X |
| <i>Detected Depression</i> | | X | X | X | X | X | X | X | X | |
| <i>Evidence of MDD</i> | | | | | | | X | | X | |
| <i>Referrals to MH</i> | | | X | X | X | | X | | | |
| <i>MH medication use</i> | | | | X | | | | | | |
| <i>Mood related Dx</i> | | | | X | | | | | | |
| <i>Suicide Risk</i> | | | | | | X | | | X | |
| <i>Score change</i> | | | | | | | X | | | |

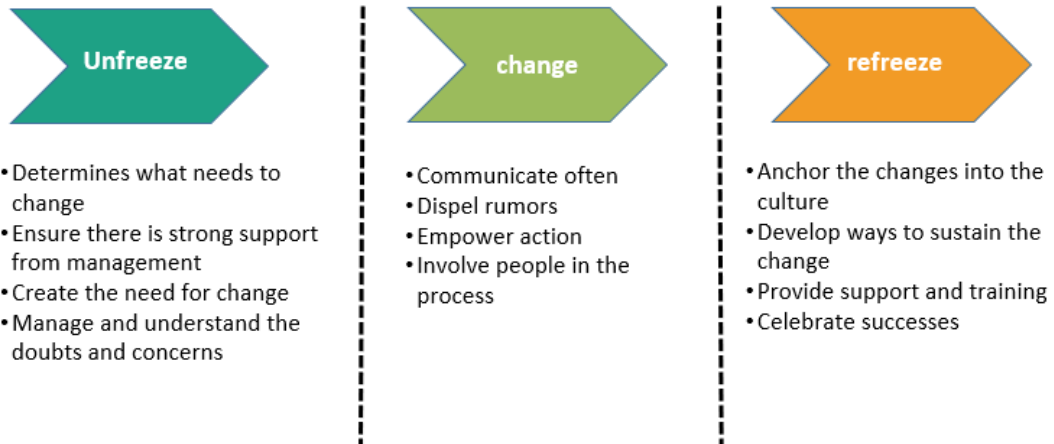
ASD – Autism Spectrum Disorder; ASQ –Ask Suicide-Screening Questions; DX –Diagnosis; GAD-7 – Generalized anxiety disorder-7 item; HCO –Health care organization; HX –History; ID –Intellectual disability; LOE Level of Evidence; MDD –Major Depressive Disorder; MH –Mental Health; PDSA –Plan-Do-Study-Act; PHQA -Patient Health Questionnaire-9 modified for Adolescents; PHQ-9 – Patient health questionnaire-9 item; PHQ-9-M -Patient Health Questionnaire-9 modified for Teens; PPCC – Pediatric Primary Care Clinic; PT –Psychotherapy; QI –Quality Improvement; SP –Sports Physical; SPSS –Statistical package for the social sciences; TX—Treatment; WCC –Well Child Check

Appendix B

Models and Frameworks

Figure B1
Lewin's Change Theory

LEWIN'S CHANGE MODEL Lewin's Three Stage Change Process



(Techno PM—Project Management Templates, 2021)

Figure B2
Plan-Do-Check-Act Cycle



(American Society for Quality, 2022)