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Permalink

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Journal

JAMA Pediatrics, 174(5)

ISSN

2168-6203

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Publication Date

2020-05-01

DOI

10.1001/jamapediatrics.2020.0023

Peer reviewed



HHS Public Access

Author manuscript

JAMA Pediatr. Author manuscript; available in PMC 2021 May 01.

Published in final edited form as:

JAMA Pediatr. 2020 May 01; 174(5): 487–498. doi:10.1001/jamapediatrics.2020.0023.

Key Components of Effective Pediatric Integrated Mental Health Care Models:

A Systematic Review

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Additional Contributions: Linda O'Dwyer, MA, MSLIS, AHIP (Galter Health Sciences Library & Learning Center, Northwestern University, Feinberg School of Medicine), performed the systematic literature search. No compensation was received outside of usual salary.

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Abstract

IMPORTANCE—Emerging evidence suggests that integrated care models are associated with improved mental health care access and outcomes for youths (children 12 years and adolescents 12–21 years) served in pediatric primary care settings. However, the key components of these complex models remain unexamined.

OBJECTIVE—To identify and describe the key components of effective pediatric integrated mental health care models.

EVIDENCE REVIEW—The PubMed, Embase, PsycINFO, and Cochrane Controlled Register of Trials electronic databases were searched for relevant peer-reviewed articles published between January 1, 1985, and April 30, 2019. Articles were restricted to those published in the English language. Eligible articles reported original data on youths 17 years or younger, implemented an integrated mental health care model in a pediatric primary care setting, and assessed the model's association with primary outcomes (eg, mental health symptom severity) and secondary outcomes (eg, functional impairment and patient satisfaction). Articles that specified some degree of systematic coordination or collaboration between primary care and mental health professionals were included in the final review. Two independent reviewers extracted data on study design, model type, model components, level of integration, and outcomes. Study quality was assessed using the Jadad scale. Data were analyzed between January 1, 2018, and May 31, 2019.

FINDINGS—Eleven randomized clinical trials involving 2190 participants were included. Three studies focused on youths with depression, 3 on youths with attention-deficit/hyperactivity disorder, and 5 on youths with behavioral disorders. Most studies (9 of 11) implemented either the collaborative care model (n = 3), a slightly modified version of the collaborative care model (n = 2), or colocated care (n = 4). The most commonly reported components of effective pediatric integrated mental health care models were population-based care, measurement-based care, and delivery of evidence-based mental health services; all 3 components were present in studies reporting clinical improvement of mental health symptoms. Other model components, such as treatment-to-target or team-based care, were common in studies reporting specific outcomes, such as functional impairment.

CONCLUSIONS AND RELEVANCE—This review is the first to date to systematically search and qualitatively synthesize information on the key components of effective pediatric integrated mental health care models. This knowledge may be especially useful for pediatric primary care administrators in the selection of an integrated care model for their setting.

Mental health disorders are among the most common health concerns in children and adolescents.¹ Current estimates indicate that 13% to 20% of US children aged 3 to 17 years will experience a mental health disorder in a given year,² with the most prevalent diagnoses being attention-deficit/hyperactivity disorder (ADHD) (6.8%), behavioral problems (3.5%), anxiety (3.0%), and depression (2.1%). Effective treatments exist, yet more than 50% of youths in need do not receive treatment,^{3,4} and when treatment is received, it is often suboptimal (eg, of insufficient duration).^{5–7} Children belonging to racial/ethnic minority

groups, from low-income families, and without health insurance are the least likely to ever receive treatment.³ Untreated or under-treated mental health needs during childhood and adolescence are associated with more severe psychosocial impairment during adulthood as well as substance use disorders, physical comorbidities, increased risk of suicide, and greater use of health care services throughout the life course.⁸

Low treatment rates have been associated with multiple factors, including stigma,^{9,10} cost,¹¹ and a national shortage of child and adolescent psychiatrists.¹² One approach to improving treatment access and engagement is the integration of mental health services into pediatric primary care settings. More than 70% of youths 18 years and younger see a primary care practitioner (PCP) each year,¹³ and parents and adolescents feel relatively comfortable disclosing mental health issues in the primary care setting.^{14,15} This approach could be particularly effective for youths who face significant barriers to accessing specialty mental health services, including youths from low-income families and youths living in rural areas where such services are lacking.¹¹ To provide integrated services, primary care and mental health professionals collaborate to systematically address patients' physical and mental health needs.¹⁶ Models of integration vary in scope, from minimal communication and coordination between professionals working in separate systems or locations to highly coordinated team-based care provided within the same practice.^{17,18}

Evidence for integrated mental health care for pediatric populations is limited compared with adult populations. Yet, a 2015 meta-analysis by Asarnow et al¹⁹ reported that integrated care has advantages compared with standard care in improving mental health outcomes for children and adolescents; the greatest effects were seen for treatment interventions that used collaborative care models (CCMs).

These findings highlight the effectiveness of integrated mental health care models for pediatric populations; however, implementing these models with complete fidelity can be challenging for resource-limited primary care practices given their complexity. Most models are composed of multiple components, and it is unclear which components are essential for improving outcomes.²⁰ Thus, additional information about which specific model components are associated with meaningful clinical outcomes could help pediatric primary care administrators choose models that best meet the needs of their population and level of resources. Such information is not typically reported in systematic reviews and meta-analyses of multicomponent interventions²¹ and was absent from the meta-analysis by Asarnow et al.¹⁹ Although a handful of studies have used meta-regression analyses to parse the most effective components of integrated mental health care models for adults, specifically the CCM,^{22–24} findings are inconsistent, and it is unknown if these findings can be extrapolated to pediatric populations.

We conducted a systematic review of pediatric integrated mental health care models to synthesize information regarding the type of model implemented, the level of integration, and the specific model components. We also identified which model components were associated with statistically significant improvements in mental health and other secondary outcomes.

Methods

Literature Search

A systematic literature search was performed by a professional research librarian using the PubMed, Embase, PsycINFO, and Cochrane Controlled Register of Trials databases. The search included literature published between January 1, 1985, and April 30, 2019. A combination of controlled vocabulary specific to each database (eg, MEDLINE medical subject headings [MeSH]) and free text terms (eg, integrated care, collaborative care, and colocated care) was used to identify studies that examined pediatric integrated mental health care models of any type. The full list of search terms is presented in eTable 1 in the Supplement. The search was limited to peer-reviewed journals published in the English language. Electronic database searches were supplemented by manual searches of reference lists from eligible studies and the meta-analysis performed by Asarnow et al.¹⁹

We included studies meeting the following criteria: (1) youths younger than 18 years with a primary mental health diagnosis; (2) randomized clinical trials, clinical trials, or quasi-experimental designs with 100 or more participants per group that compared integrated mental health care with standard care or enhanced standard care; and (3) involvement of some level of systematic collaboration or coordination between pediatric primary care and mental health specialty professionals, which conformed with the definition of integrated care developed by the Agency for Health Care Research and Quality Integration Academy.¹⁶

We excluded studies that (1) focused only on adults (aged ≥ 18 years), (2) were conducted outside the United States, (3) did not occur in pediatric primary care settings, (4) did not have a primary or secondary outcome related to improving mental health (eg, reduced symptom severity), and (5) did not meet the Agency for Health Care Research and Quality definition of integrated care (eg, included models that did not involve PCPs in some way). Studies solely focused on youths with substance use disorders that did not meet the Agency for Health Care Research and Quality definition of integrated care were also excluded.

Study Selection

One author (J.Y.) screened titles and abstracts of identified articles. Screening was followed by a review of full texts by 2 authors (J.Y. and A.H.) to assess eligibility for inclusion. Discordance was analyzed and disagreements resolved by discussion between the 2 authors (J.Y. and A.H.).

Data Extraction

Two authors (J.Y. and A.H.) used a standardized form to independently extract the following information from eligible studies: (1) study characteristics, such as publication year, location, study design, number of participants, and targeted mental health disorders; (2) participant characteristics, such as age range and race/ethnicity; (3) intervention characteristics, such as integrated care model type, model components, and level of integration; (4) primary and secondary outcomes; and (5) statistically significant findings. For studies with more than one associated article, the primary article was cited as the main reference, although data were extracted from all available articles. The authors' extraction

forms were compared for consistency, and any differences were resolved by discussion or referral to a third author (C.M.L.).

The coding of integrated care model components was informed by the key components of effective integration developed by Kroenke and Unutzer²⁵ and the practice integration profile developed by Macchi et al²⁶ (Table 1). Both resources incorporated aspects of the CCM, which is a specific approach to integrated care that was initially developed to treat depression in older adults.²⁷ The CCM focuses on defined patient populations, the delivery of evidence-based treatments, measurement-based practice, treatment-to-target (eg, the Texas medication algorithm²⁸), and team-based care that involves a care manager and a psychiatric consultant. Trained PCPs and behavioral health specialists (eg, clinical psychologists and clinical social workers) collaborate to provide evidence-based medication or psychosocial treatments supported by regular psychiatric case consultation and treatment adjustment for patients who are not improving as expected. A care manager facilitates care coordination and communication between health care professionals and patients and their families. Ample data support the clinical and cost effectiveness of the CCM in adult populations,^{22,29–32} and data are beginning to accrue in pediatric populations.¹⁹

We considered a model component to be present if it was specifically mentioned, regardless of the level of detail reported. For components with multiple defining characteristics, such as psychiatric consultation, studies reporting at least one characteristic were considered to have met the criteria for that component (Table 1).

We used the standard framework for levels of integrated care developed by the Substance Abuse and Mental Health Services Administration and the Health Resources and Services Administration¹⁷ to code the level of integration (eFigure 1 in the Supplement). This framework conceptualizes integration as a continuum, ranging from separate mental health and primary care systems with minimal coordination to integrated systems, in which mental health clinicians and PCPs function as a team in a shared practice setting.¹⁷ When fully implemented, the CCM represents highly integrated care. Elements that are used to characterize the level of integration include: (1) communication (frequency and type), (2) practice location (on-site, off-site, and remote), and (3) practice change (eg, shared workflows and medical records systems). Integration levels range from 1 to 5, with level 1 indicating minimal on-site collaboration; level 2 indicating basic collaboration at a distance; level 3 indicating basic on-site collaboration; level 4 indicating close on-site collaboration with some system integration; and level 5 indicating close on-site collaboration approaching an integrated practice.

We categorized study outcomes as follows: (1) clinical (eg, reduced symptom severity and disease remission), (2) health-related quality of life (physical or mental), (3) functional impairment, (4) patient satisfaction with care (youth-reported and/or parent-reported), and (5) care quality (eg, receipt of treatment, treatment adherence, and treatment completion). These outcome categories are congruent with the triple aim of health care reform³³: to improve patient experience (which includes quality and satisfaction) and outcomes of care while reducing per capita costs. We deemed a study to be successful for a particular outcome if

that outcome was associated with significant improvement in the intervention condition compared with the control condition.

Assessment and Synthesis

Two authors (J.Y. and A.H.) independently assessed the quality of randomized clinical trials using the Jadad scale,^{34,35} which measures the methodological quality of randomized clinical trials on a scale of 0 to 5, with 0 indicating very poor and 5 indicating rigorous quality. Each clinical trial was scored on randomization (2 possible points), blinding (2 possible points), and description of withdrawals or dropouts (1 possible point). Discrepancies were reconciled through discussion.

Descriptive statistics were used to summarize main study characteristics. We also applied the distillation method proposed by Chorpita et al³⁶ and Becker et al³⁷ to synthesize evidence for efficacious pediatric integrated mental health care models to facilitate decision-making regarding implementation. This method was originally developed to summarize the literature on treatment engagement practices in child and adolescent mental health services research. Distillation involves identifying the key components within effective multicomponent (ie, bundled) interventions and aggregating this information across interventions to examine how frequently or commonly the components are applied. Distillation is also used to examine which components or combinations of components are associated with specific study outcomes.³⁵ We used distillation to describe common model components in studies that reported statistically significant outcomes. Data were analyzed between January 1, 2018, and May 31, 2019.

Results

Studies and Characteristics

The literature search returned 6564 articles, of which 98% were excluded after duplicates were removed (eFigure 2 in the Supplement). Of the 76 remaining articles, 11 studies involving 2190 participants met the inclusion and exclusion criteria.^{38–48} All studies were randomized clinical trials. Three studies examined adolescents with depression,^{38,39,47} 3 studies focused exclusively on children with ADHD,^{40,41,45} and the remaining 5 studies focused on children with behavioral disorders (Table 2).^{42–44,46,48} Eight studies focused on children 12 years and younger, and 3 studies focused on adolescents (age range, 12–21 years). A total of 974 of 2190 participants were nonwhite (mean [SD], 44.5% [31.9%]; range, 9%–87%). The participants were predominantly girls (516 of 671 participants; mean [SD], 76.9% [3.0%]) in studies examining depression and mostly boys (984 of 1519 participants; mean [SD], 64.3% [5.7%]) in studies examining behavioral disorders and ADHD.

All studies recruited patients from primary care clinics. The most common control condition was enhanced standard care, which varied across studies and ranged from facilitated referrals to off-site specialty mental health services to PCP training in recognizing and treating depression. The intervention duration of active treatment ranged from 4 weeks to 6 months. Follow-up assessments ranged from 4 to 18 months.

Studies took place in a variety of health care delivery settings, including pediatric primary care clinics affiliated with academic institutions, managed care organizations, and community-based clinics. Between 1 and 24 practices participated in each study.

Six studies (54.5%) scored 3 of 5 points on the Jadad scale, and 5 studies (45.5%) scored 2 of 5 points (eTable 2 in the Supplement). The most likely source of potential bias in all studies was the inability to blind patients and health care professionals to group allocation, which is a common issue in multicenter, service-based interventions. However, outcomes assessment was blinded in all studies.

The primary study outcome measured in all 11 studies was clinical improvement, which was defined as reduced symptom severity. Seven studies reported a significant association between the intervention and symptom severity.^{38,42,43,45–48} Nine studies reported an association between the intervention and a significant improvement in an additional secondary outcome (eg, health-related quality of life).^{23,38,39,41–43,45,46,48}

Models, Integration, and Components

Three studies fully implemented the CCM (Table 3).^{40,43,47} These studies systematically identified all eligible patients with a particular mental health condition, delivered evidence-based treatments, implemented measurement-based care and treatment-to-target, and had a care manager and a psychiatric consultant. Two studies implemented a slightly modified version of the CCM that included all components, with the exception of a psychiatric consultant.^{38,39}

Four studies implemented colocated care,^{42,44,46,48} in which mental health specialists were embedded within primary care settings but practiced independently using a traditional referral model. Of the 2 remaining studies, 1 implemented collaborative consultation, in which remotely located psychiatrists advised PCPs regarding the provision of evidence-based ADHD medication therapy,⁴¹ and the other implemented a hybrid approach, in which a remotely located psychiatrist and in-clinic mental health specialists delivered evidence-based treatment to children with ADHD and their caregivers.⁴⁵

The 5 studies that implemented the CCM or a slightly modified CCM were identified as highly integrated (level 4 or 5).^{38–40,43,47} In these studies, mental health specialists (including the psychiatric consultant in studies that implemented the full CCM) and PCPs practiced team-based care in the same setting, and team members communicated regularly using various methods, such as weekly meetings, individual consultation and supervision, written feedback, regularly scheduled case reviews, and health information technology. Studies that implemented colocated care or remote consultative services were not as highly integrated (levels 1–3), primarily owing to the infrequency of communication between PCPs and mental health specialists or minimal PCP involvement in the youths' mental health treatment.^{41,42,44–46,48}

All 11 studies reported population-based and measurement-based care using validated instruments (Table 4). The most commonly provided mental health services in pediatric primary care were patient self-management or psychoeducation (9 studies [81.8%]) and

brief psychological intervention (10 studies [90.9%]), although psychotropic prescribing by PCPs was also very common (8 studies [72.7%]). Brief psychological intervention predominantly consisted of cognitive behavioral therapy^{49–54} (CBT; 10 studies [90.9%]). Eight studies (72.7%) implemented treatment-to-target (ie, adjusting the treatment plan based on symptom measures). Six studies (54.5%) included a psychiatric consultant, 40–43,45,47 and 6 studies (54.5%) had a care manager.^{38–40,42,43,47}

Model Components

The frequency of model components varied by statistically significant study outcomes (Table 4). Seven studies reported a positive association between the intervention and clinical outcomes (symptom severity). All 7 studies reported the provision of population-based care, measurement-based care, and evidence-based mental health services. Brief psychological intervention was reported in all 7 studies, and psychotropic therapy was reported in 5 studies (71.4%). Other commonly reported components were treatment-to-target (5 studies [71.4%]), care management (4 studies [57.1%]), and psychiatric consultation (4 studies [57.1%]).

Two studies reported a positive association between the intervention and functional impairment. Both studies reported the use of population-based care, measurement-based care, evidence-based mental health services, treatment-to-target, psychiatric consultation, and health information technology.

Two studies reported a positive association between the intervention and mental or physical quality of life. Both studies implemented population-based care, measurement-based care, evidence-based mental health services, treatment-to-target, care management, and psychiatric consultation. Four studies reported a positive association between the intervention and patient satisfaction with treatment. All studies reported the use of population-based care, measurement-based care, evidence-based mental health services, treatment-to-target, and care management. Psychiatric consultation was also common (3 studies [75.0%]).

Five studies reported a statistically significant improvement in various care quality measures favoring the intervention. The most common components found in all 5 studies were population-based care, measurement-based care, evidence-based mental health services, and treatment-to-target followed by care management (4 studies [80.0%]) and psychiatric consultation (4 studies [80.0%]). Planned communication was also common (3 studies [60.0%]).

Based on their high-frequency use in models that were associated with improvements in primary and secondary outcomes, the key model components appear to be population-based care, measurement-based care, and evidence-based mental health services. Treatment-to-target and care management may be key to achieving significant improvements in secondary outcomes, including health-related quality of life, patient satisfaction, and care quality. Psychiatric consultation appears to be important for reducing impairment and improving care quality outcomes.

Discussion

The integration of mental health and medical services in pediatric primary care settings has generated increased interest and enthusiasm in recent years given the potential for improvements in population health, care quality, and patient experience while containing costs. However, implementation may be hindered by the complexity of integrated care models, which are composed of multiple components and are typically tested as a package. Information about the relative association of individual components of integrated care models with outcomes may help pediatric primary care practices implement a model that is tailored to meet the mental health needs of patients while matching the level of available resources for implementation.

In this systematic review of the literature on pediatric integrated mental health care models, we identified the common components of efficacious models. We used the distillation method of Chorpita et al³⁶ and Becker et al³⁷ to assess which components were associated with statistically significant primary and secondary outcomes. Despite variation in model type, mental health diagnosis, intervention comparator, and level of integration, our review indicated that the most common model components across the 11 included studies were population-based care, measurement-based care, and evidence-based mental health services. These 3 components were present in all 7 studies reporting significant improvement in primary (clinical) outcomes.

Our descriptive results are consistent with a previous meta-regression analysis of the use of the CCM for adults with depression, which found that clinical trials that included empirically supported psychological interventions with or without antidepressant medication appeared to be associated with improvements in depression symptoms more than clinical trials that did not include psychological treatment.²³ In addition, clinical trials that used systematic methods to identify patients with depression reported increased access to antidepressant medication, which is a measure of care quality. Findings from a recent systematic review on psychoeducation interventions for the prevention and management of adolescent depression indicated that psychoeducation is associated with effective improvement in patients' treatment adherence and the reduction of symptoms.⁵⁵

A care manager and treatment-to-target were present in all studies reporting significant improvement in secondary outcomes, including patient satisfaction, health-related quality of life, and care quality. The care manager addresses several factors that have been reported to enhance patient satisfaction with care, including (1) consideration of patient and family needs, (2) communication with professionals, (3) patients' access to information, (4) support in self-management activities, (5) involvement in care planning, and (6) help with transitions between various health professionals and practitioners.⁵⁶ Qualitative results from a clinical trial of CCM for adult patients with depression indicated high satisfaction with the care manager, whom clinical trial participants described as "caring, sincere, understanding, professional, and encouraging."^{57(p294)} A care management intervention for adults with depression consisting of continuous contact between the care manager and patients, a structured management plan, and behavioral activation was associated with improvements in

quality of life, service satisfaction, and greater adherence to antidepressant medication treatment.⁵⁸

Psychiatric consultation was present in studies reporting significant improvement in care quality outcomes, such as antidepressant medication rates⁴⁷ and treatment completion rates.⁴³ A recent study indicated that including a weekly psychiatric case review as part of a CCM intervention for adults with depression was associated with higher rates of new depression medications in patients who had not achieved clinically significant improvement after 8 weeks of treatment.⁵⁹ The lower frequencies with which other components (health information technology, planned communication, and shared treatment plans) are included in successful models may reflect the early state of the literature with regard to testing models with these particular components.

Limitations

The results of this systematic review are limited by several factors. First, despite the use of a comprehensive systematic search strategy that included frequently used terms for integrated care, the identification of integrated mental health care interventions remained challenging because a single definition of integrated mental health care does not currently exist. Other researchers have highlighted the importance of using a standardized definition for integrated mental health care to allow for replication and comparison across studies.⁶⁰ An additional challenge is the lack of commonly accepted criteria for identifying specific model components. The strengths of this review include the use of an a priori definition of integrated mental health care to identify eligible studies and the use of published criteria to systematically code model components.

Second, information on model components reported in the published studies was often limited. The lack of detail and specification create a challenge to assess whether a given component had been implemented. Future studies of these complex models should strive for greater consistency and detail in the reporting of model components.

Third, the small number of clinical trials precluded our ability to perform meta-regression analysis to identify potential moderating factors of individual model components associated with outcomes. Previous meta-regression analyses of the CCM for adults with depression have included 30 or more clinical trials.^{22,23,61}

Fourth, this review was limited to published studies that examined models of integration for youths with a subset of mental health disorders (ie, depression and conduct-related disorders). As a result, the findings may not be generalizable to youths with neurodevelopmental disorders (eg, autism or intellectual disabilities), feeding and eating disorders, anxiety disorders, and substance use disorders. The meta-analysis by Asarnow et al¹⁹ included 4 studies of youths with substance use disorders. However, none of these studies qualified as integrated care according to the Agency for Health Care Research and Quality definition we used for this review.¹⁶ Future research on pediatric integrated mental health care models should target a broader population of youths with behavioral health needs in pediatric primary care.^{62,63}

Conclusions

To our knowledge, this review is the first to examine which components of pediatric integrated mental care models are associated with improvement in outcomes of interest to pediatric primary care practices and their patients. Results suggest that population-based care, measurement-based care, and the delivery of evidence-based mental health services in pediatric primary care are the most common model components in efficacious studies. Other components (eg, treatment-to-target or team-based care) may be additionally important to the improvement of specific outcomes (eg, functional impairment). Although further research examining the specific association of individual model components with outcomes is needed, these findings can be used to inform next steps regarding implementation. Guidelines for implementing the CCM exist,^{64,65} and reports on lessons learned from implementation of the CCM in adult primary care settings are growing.^{66,67} Implementation clinical trials examining the CCM and other models of integration in pediatric primary care settings are an important next step.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Conflict of Interest Disclosures: Dr Yonek reported receiving grants from the National Institute on Drug Abuse and the National Institute of Mental Health during the conduct of the study. Dr Harrison reported receiving grants from the National Institute on Drug Abuse during the conduct of the study. Dr Mangurian reported receiving grants from the California Health Care Foundation and the National Institutes of Health during the conduct of the study; receiving grants from the California Office of Statewide Planning and Development and the Doris Duke Charitable Foundation and personal fees from the American Academy of Pediatrics, the American Psychiatric Association, the New England Journal of Medicine, and Uncommon Bold; and being a founding member of TIME'S UP Healthcare (with no financial compensation) outside the submitted work. Dr Tolou-Shams reported receiving grants from the National Institute on Drug Abuse during the conduct of the study. No other disclosures were reported.

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Key Points

Question

What are the key components of effective pediatric integrated mental health care models?

Findings

In this systematic review of 11 randomized clinical trials involving 2190 participants, population-based care, measurement-based care, and evidence-based mental health services were identified as the most common components of effective pediatric integrated mental health care models. Other model components (eg, treatment-to-target and team-based care) may also be important to address specific outcomes (eg, functional impairment).

Meaning

Findings suggest that 3 pediatric primary care integration model components have the strongest evidence base for improving clinical outcomes, and pediatric primary care administrators may use this information when selecting a model for their delivery system.

Table 1.

Integrated Mental Health Care Model Components

| Collaborative Care Model Component^a | Definition |
|---|---|
| Population-based care | Systematic efforts by a health care System to identify all of its patients with a particular disease, provide appropriate treatment, and track outcomes. These efforts are often facilitated by use of a disease registry. |
| Measurement-based care ^a | Use of validated tools to identify patients with a particular mental health condition and assess treatment response. |
| Treatment-to-target ^a | Specific systems in place to identify and intervene with patients who are not responding to treatment according to a predefined threshold (eg, the Texas medication algorithm ²⁵). |
| Team-based care | Key features of team-based care for the CCM include care management provided by a designated care manager and a psychiatric consultation. |
| Care management | A care manager (eg, a nurse, social worker, or other health care professional) who performs the following tasks: <ul style="list-style-type: none"> • maintains a disease registry; • provides disease-based education; • tracks treatment adherence and clinical response; and • serves as liaison between the PCP, the behavioral health specialist (eg, a clinical psychologist or psychiatric consultant), and patients and their families. |
| Psychiatric consultation | A consultation comprises the following: <ul style="list-style-type: none"> • provides guidance directly to the PCP or a care manager regarding initial treatment plan or patients who are not adequately responding to treatment, especially medication therapy; • conducts occasional in-person or remote video sessions with selected patients; and • provides referrals to specialty care for patients with complex situations. |
| Evidence-based mental health Services | Services include the following: <ul style="list-style-type: none"> • brief psychological interventions (eg, cognitive-behavioral therapy, motivational interviewing, behavioral activation, or problem-solving treatment)^d; • psychotropic prescribing (by the PCP); • patient self-management/psychoeducation^b; and • referrals to specialty care for patients with complex situations.^b |
| Other components ^b | Components may include: <ul style="list-style-type: none"> • shared treatment plans (developed jointly by behavioral health specialist and PCP and accessible to both professionals); |

| Collaborative Care Model Component ^a | Definition |
|---|---|
| | <ul style="list-style-type: none"><li data-bbox="227 157 267 420">• planned team meetings, in which the behavioral health specialist and PCP exchange information about patient care and treatment progress; and<li data-bbox="227 420 267 1795">• referrals to nonclinical community resources.^b |

Abbreviations: CCM, collaborative care model; PCP, primary care practitioner.

^aInformation obtained from Kroenke and Unutzer.^{2,5}

^bInformation obtained from Macchiet al.^{2,6}

Table 2.

Characteristics of the 11 Included Randomized Clinical Trials

| Study | Participants, No. | | | Sample Characteristics | | | | Study Outcomes | | | Significant Intervention Effect on Primary Outcome ^a | Study Quality, Jadad Score ^b | |
|--------------------------------------|-------------------|--------------------|---------------|------------------------|--|-------------------|--------------------|--|---|--------------------------------|--|---|-----------|
| | Total | Intervention Group | Control Group | Study Duration | Target Population | Age, Mean (SD), y | Sex, No. (%) | Race/Ethnicity, No. (%) | Study Setting | Primary | | | Secondary |
| Asanow et al. ³⁸ 2009 | 418 | 211 | 207 | 18 mo | Adolescents aged 13–21 y with depression | 17.2(2.1) | Female, 326 (78.0) | Hispanic, 234 (56.0); mixed, 57 (13.6); black, 56 (13.4); white, 53 (12.7); other, 13(3.1); Asian, 5 (1.2) | 6 Primary care practices (2 public sector, 2 managed care, 2 academic medical center) | Depression symptom improvement | Mental health-related QoL, satisfaction with mental health care, care quality (delivery of evidence-based depression treatments, ie, CBT and antidepressant medication) | Yes | 3 |
| Clarke et al. ³⁹ 2005 | 152 | 75 | 77 | 12 mo | Adolescents aged 12–18 y with depression | 15.3(1.6) | Female, 117 (77.0) | White, 131(86.2); nonwhite, 21 (13.8) | Kaiser Permanente Northwest HMO in Portland, Oregon | Depression symptom improvement | Functional impairment, other emotional/behavioral symptoms, care quality (ie, improved medication adherence), mental health-related QoL, patient satisfaction with care, health care use | No | 3 |
| Richardson et al. ⁴⁷ 2014 | 101 | 51 | 50 | 12 mo | Adolescents aged 13–17 y with depression | 15.3(1.3) | Female, 73 (72.3) | White, 70 (69.3); other/multiracial, 24 (23.8); black, 5 (5.0); Asian, 2 (2.0) | 9 Urban primary care clinics in the Group Health System in Washington | Depression symptom improvement | Functional impairment; patient satisfaction with treatment; care quality (delivery of evidence-based treatments for | Yes | 2 |

| Study | Participants, No. | | | | Sample Characteristics | | | | Study Outcomes | | | Significant Effect on Primary Outcome ^a | Study Quality, Jadad Score ^b |
|-----------------------------------|-------------------|-----------------------------|---------------|----------------|---|-------------------|------------------|--|--|-----------------------------------|---|--|---|
| | Total | Intervention Group | Control Group | Study Duration | Target Population | Age, Mean (SD), y | Sex, No. (%) | Race/Ethnicity, No. (%) | Study Setting | Primary | Secondary | | |
| Epstein et al. ⁴¹ 2007 | 146 | 59 | 87 | 12 mo | Children in grades 1–5 with ADHD | 7.8 (1.5) | Male, 93 (24.7) | White, 116 (79.5); black, 24 (16.4); other, 5 (3.4); not reported, 1 (0.7) | 12 Community-based pediatric practices affiliated with Children's Hospital in Pittsburgh, Pennsylvania | ADHD symptom improvement | Care quality (delivery of evidence-based ADHD treatment strategies) | No | 3 |
| Kolko et al. ⁴² 2010 | 163 | 83 | 80 | 12 mo | Children aged 6–11 y with externalizing problems and their caregivers | 8.1 (1.6) | Male, 106 (65.0) | White, 130 (79.8); nonwhite, 33 (20.2) | 6 Pediatric primary care practices in Pittsburgh, Pennsylvania | Externalizing symptom improvement | Internalizing symptoms, functional impairment, patient satisfaction with care; care quality (ie, treatment initiation and completion rates) | Yes | 2 |
| Kolko et al. ⁴³ 2014 | 321 | 161 | 160 | 18 mo | Children aged 5–12 y with externalizing problems and their caregivers | 8.1 (1.9) | Male, 207 (64.5) | White, 247 (76.9); black, 56 (17.4); multiracial, 16 (5.0) | 8 Pediatric primary care practices in Pittsburgh, Pennsylvania (7 children's community pediatric practices, 1 general academic pediatric practice affiliated with Children's Hospital of Pittsburgh) | Externalizing symptom improvement | Internalizing symptoms, functional impairment, patient satisfaction with care; care quality (ie, treatment initiation and completion rates), health-related QoL | Yes | 3 |
| Lavigne et al. ⁴⁴ 2008 | 117 | 49 Nurses, 37 psychologists | 31 | 12 mo | Children aged 3–6 y with ODD and their caregivers | 4.6 (1.0) | Male, 62 (53.0) | White, 88 (75.2) | 24 Practices in Chicago (3 serving low-income families, 21 private) | ODD symptom improvement | NA | No | 2 |

| Study | Participants, No. | | | Sample Characteristics | | | | Study Outcomes | | | Significant Intervention Effect on Primary Outcome ^a | Study Quality, Jadad Score ^b | |
|---------------------------------------|-------------------|--------------------|--|------------------------|--|-------------------|------------------|---|---|---------------------------------------|---|---|-----------|
| | Total | Intervention Group | Control Group | Study Duration | Target Population | Age, Mean (SD), y | Sex, No. (%) | Race/Ethnicity, No. (%) | Study Setting | Primary | | | Secondary |
| Myers et al. ⁴⁵ 2015 | 223 | 112 | 111 | 25 wk | Children aged 5.5–12.9 y with ADHD and their caregivers | 9.3 (2.0) | Male, 163 (73.1) | White, 204 (91.5) | 7 Primary care practices in Washington and Oregon (4 outreach clinics); 1 SCH-affiliated specialty clinic; 1 large pediatric practice, 1 frontier community mental health center) | ADHD symptom improvement | ADHD-related role performance, functional impairment | Yes | 2 |
| Perrin et al. ⁴⁶ 2014 | 273 | 89 | 61 (Waiting list); 123 (non-randomized intervention condition) | 12 mo | Children aged 2–4 y with externalizing problems and their caregivers | 2.8 (0.6) | Male, 170 (62.3) | White, 203 (74.4); black, 34 (12.5); other, 32 (11.7); Asian, 4 (1.5) | 7 Private practices and 4 federally qualified health centers in eastern Massachusetts | Improvement in externalizing symptoms | NA | Yes | 3 |
| Schilling et al. ⁴⁸ 2016 | 120 | 80 | 40 | 16 wk | Children aged 2–6 y with externalizing problems and their caregivers | 4.1 (1.3) | Male, 76 (63.3) | Black, 84 (70.0); white, 30 (25.0); Hispanic, 19 (15.8); other, 6 (5.0) | 1 Urban primary care clinic affiliated with a large children's hospital | Improvement in externalizing symptoms | Parenting capacity | Yes | 3 |
| Silverstein et al. ⁴⁰ 2015 | 156 | 78 | 78 | 12 mo | Children aged 6–12 y with ADHD and their caregivers | 8.7 (2.1) | Male, 107 (68.6) | Black, 94 (60.3); Hispanic, 42 (26.9); white, 20 (12.8) | 2 Urban primary care pediatric practices serving low-income populations (1 within an academic medical center, 1 community health center) | ADHD symptom improvement | Oppositional symptoms, social skills | No | 3 |

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Abbreviations: ADHD, attention-deficit/hyperactivity disorder; CBT, cognitive behavioral therapy; HMO, health maintenance organization; NA, not applicable; ODD, oppositional defiant disorder; QoL, quality of life; SCH, Seattle Children's Hospital.

[#] $P < .05$.

^q The Jadad score range is 0 to 5 points, with higher scores indicating higher methodologic quality.

Table 3.

Characteristics of 11 Pediatric Integrated Mental Health Care Interventions

| Study | Integrated Care Model | Level of Integration ^a | Intervention Condition (Integrated Care) | Control Condition |
|--|--------------------------------------|-----------------------------------|--|---|
| Asarnow et al., ³⁸ 2009 | Modified CCM ^b | 4 | Care managers (psychotherapists with master's or doctoral degrees) supported PCPs in evaluation and management of depression and provided CBT. Care managers were trained in CBT and care management Services (eg, patient evaluation, education, medication and psychosocial treatment, and linkage with specialty mental health Services). PCPs were trained in depression evaluation, management, and pharmacological and psychosocial treatment. | Enhanced standard care (treatment by PCP, who was provided with 1–2 h of training in recognizing and treating depression) |
| Clarke et al., ³⁹ 2005 | Modified CCM ^b | 4 | On-site mental health specialists (psychologists with master's degrees) and the PCP jointly treated patients with depression in the primary care clinic rather than referring them to specialty mental health Services. Medication management was led by the PCP. Mental health specialists provided CBT, psychoeducation about SSRI medications, and monitoring of treatment progress. | Treatment as usual (depression medication delivered according to the nonexperimental protocol) |
| Richardson et al., ⁴⁷ 2014 | CCM | 5 | Care managers (RNs) trained in depression management provided psychoeducation on depression, helped the youths and parent choose treatment (CBT, medication therapy, or both), delivered CBT, and monitored treatment progress. | Enhanced standard care (adolescents and their PCPs provided with depression screening results; adolescents could self-refer to mental health care) |
| Epstein et al., ⁴¹ 2007 | Collaborative consultation Service | 2 | Psychiatrist-assisted PCPs in using titration testing to determine optimal dosages of ADHD medication and in monitoring medication efficacy and adverse effects during medication maintenance. | Treatment as usual |
| Kolko et al., ⁴² 2010 | Colocated care | 3 | Care managers (RNs) delivered child and caregiver CBT and monitored treatment progress for CBT and ADHD medication therapy. Psychiatrist provided ADHD medication recommendations to PCP. | Enhanced standard care (nurse-facilitated referral to an off-site mental health professional) |
| Kolko et al., ⁴³ 2014 | CCM | 4 | Care managers (social workers with master's degrees) coordinated and delivered behavioral health Services (child and caregiver CBT for children with behavior problems and ADHD medication guidance). | Enhanced standard care (psychoeducation about the child's disorder, clinical recommendations based on the initial evaluation, and referral to an off-site mental health professional) |
| Lavigne et al., ⁴⁴ 2008 | Colocated care | 1–2 | Primary care nurses or clinical psychologists provided parenting skills training to caregivers of children with ODD. | Enhanced standard care (bibliotherapy plus standard treatment in the pediatric setting) |
| Myers et al., ⁴⁵ 2015 | Telehealth coordinated Service model | 2 | Psychotherapists provided in-person behavioral training to caregivers of children with ADHD. Psychiatrists provided evidence-based pharmacological care for children with ADHD through videoconferencing. | Enhanced standard care (treatment by PCP augmented with a single telepsychiatry consultation) |
| Perrin et al., ⁴⁶ 2014 | Colocated care | 1–2 | Clinical psychologists or social workers delivered parenting skills training to caregivers of children with disruptive behavioral problems. Trainings were cofacilitated by pediatric staff members. | Waiting-list control |
| Schilling et al., ⁴⁸ 2016 | Colocated care | 1–2 | Licensed mental health professionals delivered parenting skills training to caregivers of children with disruptive behavioral problems. | Waiting-list control |
| Silverstein et al., ⁴⁰ 2015 | CCM | 5 | Lay care managers (without previous formal mental health training or clinical experience) used motivational interviewing principles to overcome barriers to assessing ADHD symptom severity and served as liaisons between practitioners on | Basic collaborative care (care delivered by a care manager who did not receive training to address common reasons for protracted |

| Study | Integrated Care Model | Level of Integration ^a | Intervention Condition (Integrated Care) | Control Condition |
|-------|-----------------------|-----------------------------------|--|--|
| | | | care delivery team (1 child psychiatrist, 1 developmental-behavioral pediatrician, and 1 PCP). | symptoms and only provided follow-up visits via telephone) |

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; CBT, cognitive behavioral therapy; CCM, collaborative care model; ODD, oppositional defiant disorder; PCP, primary care practitioner; RN, registered nurse; SS RI, selective serotonin reuptake inhibitor.

^aCorresponds to the standard framework for levels of integrated health care from the Substance Abuse and Mental Health Services Administration and the Health Resources and Services Administration¹⁷ (eFigure 1 in the Supplement). Level 1 indicates minimal on-site collaboration; level 2, basic collaboration at a distance; level 3, basic on-site collaboration; level 4, dose on-site collaboration with some system integration; and level 5, dose on-site collaboration approaching an integrated practice.

^bA modified version of the CCM that does not include all requisite components, such as a psychiatric consultant.

Table 4. Pediatric Integrated Mental Health Care Model Components by Significant Study Outcomes

| Model Component | Total Studies (N = 11) | Outcomes ^d | | | | | | Care Quality (n = 5) ^b |
|---|------------------------|---------------------------|-------------------------------|--|--|--|----------|-----------------------------------|
| | | Clinical Symptoms (n = 7) | Functional Impairment (n = 2) | Health-Related Quality of Life (n = 2) | Parent/Youth Satisfaction With Treatment (n = 4) | | | |
| CCM | | | | | | | | |
| Population-based care | 11 (100) | 7 (100) | 2 (100) | 2 (100) | 4 (100) | | 5 (100) | |
| Measurement-based care | 11 (100) | 7 (100) | 2 (100) | 2 (100) | 4 (100) | | 5 (100) | |
| Treatment-to-target | 8 (72.7) | 5 (71.4) | 2 (100) | 2 (100) | 4 (100) | | 5 (100) | |
| Evidence-based mental health Services | 11 (100) | 7 (100) | 2 (100) | 2 (100) | 4 (100) | | 5 (100) | |
| Brief psychological intervention | 10 (90.9) | 7 (100) | 2 (100) | 2 (100) | 4 (100) | | 4 (100) | |
| CBT ^c | 10 (90.9) | NA | NA | NA | NA | | NA | |
| MI | 1 (9.1) | NA | NA | NA | NA | | NA | |
| Family-based CBT or MI (youths and parent) | 2 (18.2) | NA | NA | NA | NA | | NA | |
| Medication therapy | 8 (72.7) | 5 (71.4) | 2 (100) | 2 (100) | 4 (100) | | 5 (100) | |
| Patient self-management/ psychoeducation | 9 (81.8) | NA | NA | NA | NA | | NA | |
| Referral to specialty mental health | 5 (45.5) | NA | NA | NA | NA | | NA | |
| Referral to nonclinical community resources | 2 (18.2) | NA | NA | NA | NA | | NA | |
| Team-based care | | | | | | | | |
| Care manager | 6 (54.5) | 4 (57.1) | 1 (50.0) | 2 (100) | 4 (100) | | 4 (80.0) | |
| Psychiatric consultation | 6 (54.5) | 4 (57.1) | 2 (100) | 0 | 3 (75.0) | | 4 (80.0) | |
| Other | | | | | | | | |
| Shared treatment plan | 4 (36.4) | 2 (28.6) | 1 (50.0) | 1 (50.0) | 2 (50.0) | | 2 (40.0) | |
| Planned communication | 4 (36.4) | 2 (28.6) | 1 (50.0) | 1 (50.0) | 2 (50.0) | | 3 (60.0) | |
| Health information technology | 6 (54.5) | 3 (42.9) | 2 (100) | 1 (50.0) | 1 (25.0) | | 2 (40.0) | |

Abbreviations: CBT, cognitive behavioral therapy; CCM, collaborative care model; MI, motivational interviewing; NA, not applicable.

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^aIncludes studies reporting a statistically significant association between the intervention and each outcome category.

^bCare quality outcomes may include initiation of evidence-based pharmacological or psychological treatments, treatment adherence, or treatment completion.

^cThe CBT programs included the Adolescent Coping with Depression Course,⁴⁹ Alternatives for Families: A Cognitive Behavioral Therapy,^{50,51} Primary Care Triple P,⁵² The Incredible Years,⁵³ and PrCare⁴⁸ (an adaptation of the child-adult relationship enhancement [CARE] intervention⁵⁴ for primary care settings).