Original Investigation

Integrated Medical-Behavioral Care Compared With Usual Primary Care for Child and Adolescent Behavioral Health
A Meta-analysis

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← Editorial

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IMPORTANCE Recent health care legislation and shifting health care financing strategies are transforming health and behavioral health care in the United States and incentivizing integrated medical-behavioral health care as a strategy for improving access to high-quality care for behavioral health conditions, enhancing patient outcomes, and containing costs.

OBJECTIVE To conduct a systematic meta-analysis of randomized clinical trials to evaluate whether integrated medical-behavioral health care for children and adolescents leads to improved behavioral health outcomes compared with usual primary care.

DATA SOURCES Search of the PubMed, MEDLINE, PsycINFO, and Cochrane Library databases from January 1, 1960, through December 31, 2014, yielded 6792 studies, of which 31 studies with 35 intervention-control comparisons and 13 129 participants met the study eligibility criteria.

STUDY SELECTION We included randomized clinical trials that evaluated integrated behavioral health and primary medical care in children and adolescents compared with usual care in primary care settings that met prespecified methodologic quality criteria.

DATA EXTRACTION AND SYNTHESIS Two independent reviewers screened citations and extracted data, with raw data used when possible. Magnitude and direction of effect sizes were calculated.

MAIN OUTCOMES AND MEASURES Meta-analysis with a random effects model were conducted to examine an overall effect across all trials, and within intervention and prevention trials. Subsequent moderator analyses for intervention trials explored the relative effects of integrated care type on behavioral health outcomes.

RESULTS Meta-analysis with a random-effects model indicated a significant advantage for integrated care interventions relative to usual care on behavioral health outcomes (d = 0.32; 95% CI, 0.21-0.44; P < .001). Moderator analyses indicated larger effects for treatment trials that targeted diagnoses and/or elevated symptoms (d = 0.42; 95% CI, 0.29-0.55; P < .001) relative to prevention trials (d = 0.07; 95% CI, −0.13 to 0.28; P = .49). The probability was 66% that a randomly selected youth would have a better outcome after receiving integrated medical-behavioral treatment than a randomly selected youth after receiving usual care. The strongest effects were seen for treatment interventions that targeted mental health problems and those that used collaborative care models.

CONCLUSIONS AND RELEVANCE Our results, demonstrating the benefits of integrated medical-behavioral primary care for improving youth behavioral health outcomes, enhance confidence that the increased incentives for integrated health and behavioral health care in the US health care system will yield improvements in the health of children and adolescents.

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Recent health care legislation and shifts in health care financing strategies are transforming medical and mental health care in the United States. Stimulated by statistics indicating that the United States ranks near the top on health care expenditures and the bottom among developed nations on indicators of health system access and quality,[1] the federal Patient Protection and Affordable Care Act offers both expanded coverage for uninsured populations and disease prevention and incentivizes integrated behavioral health (a broad term referring to mental health and substance abuse) and primary medical care.[2] The Patient Protection and Affordable Care Act identifies behavioral health treatment as an "essential health benefit," promoting improved care coordination among practitioners, models such as health homes, and the use of multidisciplinary practitioner teams to address whole-person needs in an efficient and cost-effective manner.[3] By providing increased insurance coverage for behavioral health, the Mental Health Parity and Addiction Equity Act (2008) further encourages innovation to enhance behavioral health.[2,4]

Effective behavioral health care is particularly critical for pediatric populations, with potentially large benefits over a lifetime. The leading causes of death in children and adolescents include unintentional injuries and suicide, both of which are all-too-frequent outcomes of risky behavior and behavioral health problems (eg, depression and substance use).[4,5] Moreover, many health behaviors that contribute to morbidity and mortality are established in childhood and adolescence (eg, obesity, depression, anxiety, and substance use),[2,4,6,7] underscoring the need for identification of and effective intervention for behavioral health to reduce current and long-term problems.

Because most US youth have access to primary care and see primary care practitioners (PCPs) annually,[8] integrated primary medical-behavioral health care models have a strong potential for improving access to and rates of care for behavioral health problems.[2,9,10] The term *integrated care* is used here to refer broadly to behavioral health care through primary care services.[11,12] This definition includes a range of diverse models aimed at unifying behavioral health and primary care,[11] such as integrating behavioral health expertise into primary care settings using consultation, web-based, telephone, and/or other resources; colocating behavioral health care in primary care clinics; and team-based collaborative care models.[12,13] There is strong evidence that supports the effectiveness of integrated primary medical and behavioral health care for adults, particularly for collaborative care models that emphasize behavioral health practitioners and PCPs working together to improve health and behavioral health.[13-16] This issue, however, has only begun to be explored in children and adolescents. To our knowledge, no systematic review has been conducted on the effectiveness of integrating behavioral health into primary care for youth populations.

We conducted a systematic review and meta-analysis of the literature to address the empirical question, "Does integrated behavioral health and primary medical care for children and adolescents lead to improved behavioral health outcomes compared with usual care?" Given the current emphasis on population health and increasing incentives for integrated

At a Glance

- The roots of many mental health, substance use, and behavioral problems that contribute to morbidity and premature death develop during childhood and adolescence.
- Results of this systematic meta-analysis of existing randomized clinical trials indicate that integrating care for mental health problems into primary medical care for children and adolescents leads to significant improvements in child and adolescent mental health.
- There were larger effects for treatment trials focused on diagnoses and/or elevated symptoms compared with prevention trials and for trials using collaborative care models.
- Results enhance confidence that current policies encouraging integrated medical-behavioral health care in the United States will yield improvements in the health and well-being of children and adolescents.

care models, this question has major policy, clinical, and practical implications. Aims of this article are to (1) report findings of a meta-analysis of randomized clinical trials (RCTs) comparing integrated care models for pediatric populations and usual care and (2) explore candidate moderator variables. Moderators examined included the following: youth age (1-21 years, defining adolescence broadly, which is consistent with many adolescent and pediatric programs and National Institutes of Health guidelines[17,18]), treatment of behavioral health problems vs prevention in general pediatric populations, mental health or substance use treatment, and whether the intervention used a collaborative care model or other less integrated care provision model. We predicted larger effects for treatment rather than prevention trials because prevention effects are typically more difficult to detect and for collaborative care interventions based on findings with adults.[14-16]

Methods

Eligibility Criteria

We aimed to include all RCTs that evaluated integrated behavioral health and primary care medical treatment for youth. Inclusion criteria were as follows: (1) evaluation of integrated care for behavioral health conditions relative to usual care (defined as primary care treatment as usual) or a comparator modeled after usual care (eg, referral to specialty services), allowing for some enhancements (eg, PCP education, screening feedback, recommendations for treatment, access to written or Internet materials, and medication treatment as usual); (2) collection of one or more behavioral health outcome measures; (3) recruitment through primary care; and (4) targeting of children and adolescents, defining adolescence broadly (through the age of 21 years), which is consistent with many adolescent and pediatric programs and National Institutes of Health guidelines.[17,18] Exclusion criteria were as follows: (1) study that targeted a chronic medical condition (eg, cancer and diabetes mellitus)[19] and (2) study did not meet prespecified methodologic quality standards, as indexed by a score less than 2 on the Jadad Scale for Reporting Clinical Trials.[20,21]

Search Methods

We searched MEDLINE, PsycINFO, PubMed, and the Cochrane Central Register of Controlled Trials for data sources (January 1, 1960, through December 31, 2014). Keywords included *primary care*, *integrated care*, *collaborative care*, and *colocated care* and were searched in combination with the keywords *child/children*, *adolescent/adolescence*, *youth/youths*, *pediatric*, *randomized controlled trial*, *intervention*, *prevention*, and *treatment*. We reviewed reference lists, articles that cited included studies, and review articles to identify studies that may have been missed in database searches. The search was limited by study type (RCT) comparing integrated primary medical-behavioral health care with usual care or comparisons that approximated usual care, publication in English, publication in peer-reviewed journals, and age (1-21 years).

Titles and abstracts of all identified articles were independently reviewed by 1 author (M.R.) and 1 of 2 trained reviewers (including J.W.), with a final assessment by 2 reviewers (J.R.A. and M.R.). This review eliminated duplicates, review articles, target participants older than 21 years, studies not involving primary care, and non-RCTs. Two authors (J.A. and M.R.) reviewed full texts of all remaining articles, with excellent interrater agreement (98.5%) on inclusion and exclusion; differences or concerns about inclusion were resolved through consensus with both authors. One study[22] was excluded for containing 2 active evidence-informed interventions and no usual care. Two others[23,24] were excluded because substantial subgroups of participants were recruited from settings other than primary care. Two studies[25,26] were excluded for a quasi-experimental design and another[27] for a Jadad score less than 2 (**Figure 1**). When study characteristics and/or data were not sufficiently reported, study investigators were contacted to obtain this information.

Data Extraction and Management

Data were extracted and coded for study, sample, and treatment characteristics as follows: age, sex, ethnicity, integrated care model, targeted diagnoses and problems, and methodologic rigor. Interventions were coded as treatment (youths were selected for a behavioral health diagnosis, parent-identified problem, and/or elevated symptoms) or prevention (universal intervention, screened for no or minimal substance use, or screened for elevated symptoms with exclusion for diagnosis and high symptoms) and collaborative care (team of behavioral health care professionals and PCPs worked collaboratively in fully or partly integrated system) vs other intervention models (eg, consultation and colocated care). Targeted behavioral health problems were coded as mental health or substance use, with mental health problems further categorized as emotional and internalizing problems (eg, depression and anxiety) or behavioral and externalizing problems (eg, conduct, attention, and hyperactivity).

Methodologic rigor was coded using 2 indicators: the Jadad score, a commonly used indicator of bias risk based on elements that correlate with bias,[28] and allocation concealment, which is whether the study explicitly described procedures for protecting knowledge of randomization and treatment allocation at enrollment.[29,30] Jadad scores (range, 0-5) are calcu-

Figure 1. Flow Diagram of Study Selection
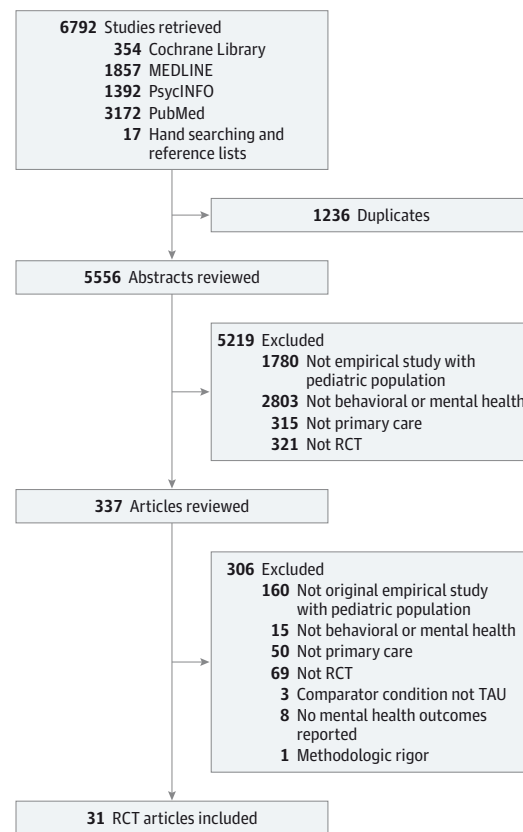
RCT indicates randomized clinical trial; TAU, treatment as usual.

lated by summing ratings of the adequacy of (1) randomization, (2) blinding, and (3) accounting for all participants, including withdrawals and dropouts. Total scores of 3 or greater are considered indicators of good methodologic quality. Allocation concealment was rated on a 3-point scale, with 1 indicating adequate (eg, computer-generated masked algorithm and opaque sealed envelopes); 2, unclear (ie, study authors did not clearly specify); and 3, inadequate (eg, open random number tables). Two authors (J.R.A. and M.R.) independently coded each study. Interrater agreement for study codes was excellent (range, 97%-100%); intraclass correlation coefficient for Jadad ratings was 0.990 (95% CI, 0.988-0.997). Disagreements were resolved through querying study authors when needed and consensus ratings by both raters.

Outcome Measures

We used the primary outcome identified in each study when stated. A mean effect size was calculated for studies with more than one designated primary outcome or when primary outcomes were not specified. When studies provided data for more than one posttreatment or follow-up time point, we used the specified primary acute treatment end point. When no end point was specified, we used the time point that immediately followed the end of treatment in the active intervention group.

We calculated separate effect sizes for studies that targeted substance use and reported outcomes individually (eg, smoking vs alcohol or prevention vs cessation).

Statistical Analyses

Data were analyzed using Comprehensive Meta-Analysis software, version 2.2.[31] Effect sizes were indexed using Cohen d, the standardized mean difference between intervention and comparator conditions ([Intervention Group Mean − Comparator Group Mean]/Pooled SD). Whenever possible, effect size calculations were made with raw data. When data reported used frequencies, significance tests, or other effect size measures, data were transformed to d values. Because most studies did not provide correlations between baseline and posttreatment outcomes, a moderate to large association between baseline and posttreatment scores on outcomes ($r = 0.50$) was assumed.[32,33] Five studies[34-38] provided sufficient information to impute correlations between baseline and posttreatment outcomes (range, 0.40-0.66). Sensitivity analyses substituting $r = 0.40$, $r = 0.60$, and $r = 0.66$ yielded similar results with no change in conclusions. Heterogeneity across studies was examined with the forest plot and Q and I^2 statistics. We chose a random-effects model given the heterogeneity of the included studies (eTable in the Supplement describes the individual studies).

An overall summary effect was calculated for all trials. Moderators[39-41] were also explored. For categorical variables, we estimated models analogous to analysis of variance comparing mean effect sizes for intervention vs usual care grouped by study classification on the potential moderator (treatment vs prevention, mental health vs substance use treatment, collaborative care vs other intervention type, emotional vs behavior problems, and children vs adolescents). For continuous variables (age), we used method-of-moments meta-regression, an approach analogous to regression analysis but using calculated effect sizes for each study as outcomes and continuous moderators as predictors. Because moderator analyses were exploratory and included few studies in some subgroups, we used a full random-effects model (pooling τ within groups with random effects to combine subgroups). In addition, because one study[34] provided some intervention in the control condition, sensitivity analyses were conducted excluding this study. Results were similar with no change in conclusions. Consequently, we include all studies in reported results.

Publication bias[31] was examined with the funnel plot and Egger test for bias. The Duval and Tweedie trim-and-fill method was used to account for potential unpublished studies and provided an adjusted summary effect for interventions. The Rosenthal fail-safe N and the Orwin fail-safe N were used for sensitivity analyses.

Results

Included Studies and Study Characteristics

Of the 6792 citations identified, 31 RCTs comparing interventions to usual care were included in the final analyses (Figure 1 and eTable in the Supplement).[34-38,42-67] One trial[57] separated effects for smoking abstinence and cessation groups; 3

other trials[54,65,66] included 2 intervention groups against a single usual care, yielding 35 intervention vs usual care comparisons and effect size calculations based on 13 129 participants. Within-study sample sizes ranged from 28 to 3111. Youth age varied, including children and adolescents.

Twenty-five of the 35 intervention-usual care comparisons were classified as treatment: 20 treatments for mental health and 5 for substance use. Five treatment comparisons evaluated collaborative care interventions; the others evaluated a range of different models (ie, enhancing primary care resources through PCP training, consultation, and/or computer-assisted support tools; colocated care with minimal integration; bibliotherapy; telephone coaching; and motivational interviewing). Intervention duration varied in the length of intervention period and number of sessions (range, 1-16). The acute follow-up period ranged from 1 to 20 months. Seventeen treatment trials were conducted in the United States, 2 in Australia, and 4 in Europe (eTable in the Supplement lists the trial details).

All treatment trials used interventions with some empirical support. The 5 collaborative care trials all used evidence-based cognitive-behavioral therapy (CBT) for depression (n = 3)[35,42,60] or behavior problems (n = 2)[50,52] and evidence-based medication algorithms. Among the other 18 treatment trials, evidence-based approaches included parenting (n = 8),[36,44,54,56,58,59,61,63] interpersonal psychotherapy for depression (n = 1),[38] CBT for anxiety or somatic concerns (n = 1),[37] CBT for behavior problems plus support for PCP medication management (n = 1),[51] and PCP communication training (n = 1).[67] Two other trials evaluated psychiatric consultation to support PCP-provided medication treatment for attention-deficit/hyperactivity disorder.[47,53] All 4 substance use treatment trials used motivational interviewing. One included PCP counseling with telephone follow-up by a peer counselor,[57] and the others involved brief interventions provided by others[43,46,65]; 3 had telephone follow-up,[43,46,57] and 1 had a computer-delivered component.[65]
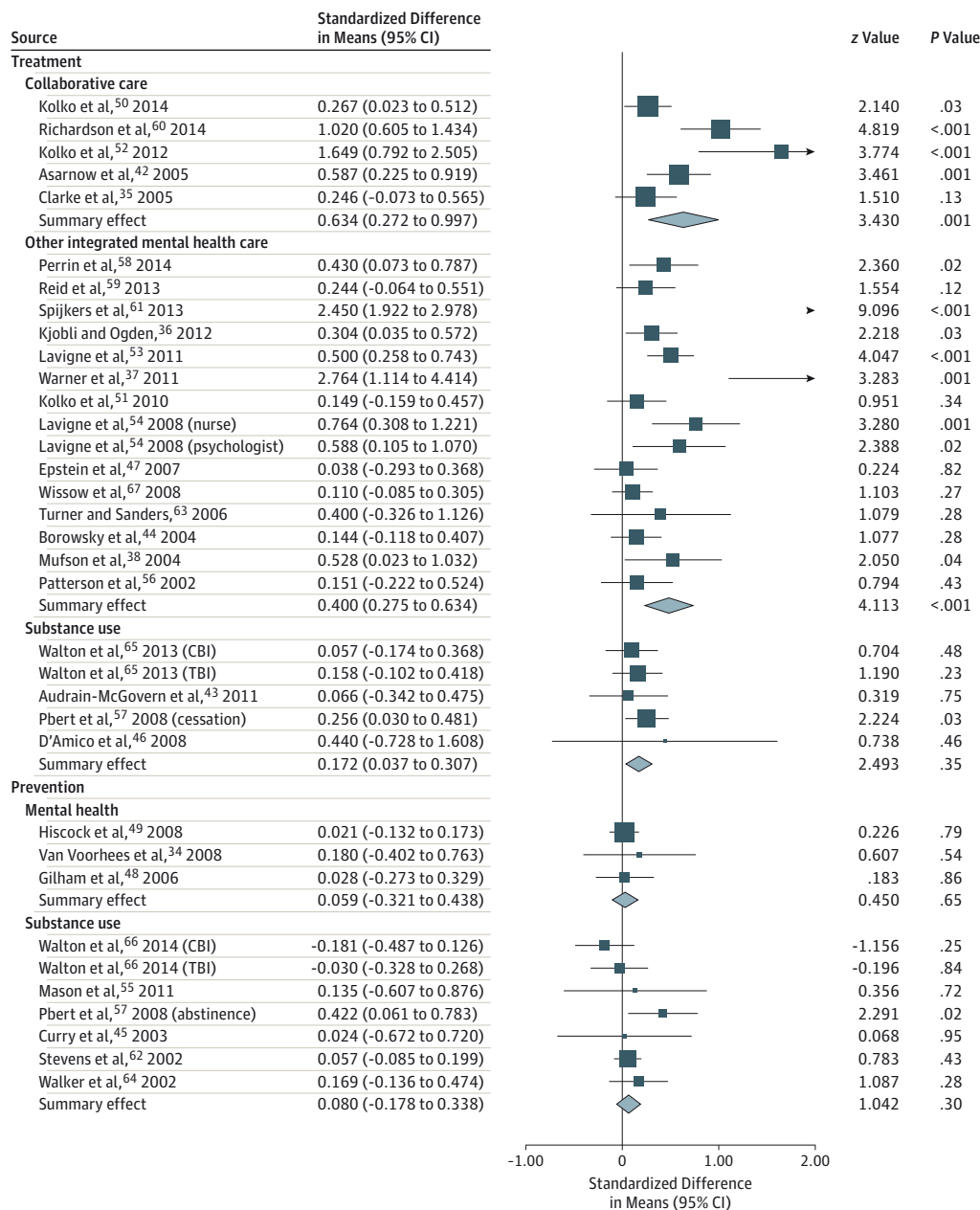
Ten comparisons (from 9 trials) evaluated prevention effects (1 trial[57] examined both prevention and treatment). Three prevention comparisons targeted mental health outcomes: 2 evaluated depression-prevention CBT,[34,48] 1 used Internet-provided CBT after brief PCP-provided motivational interviewing,[34] and 1 examined a parenting intervention for preventing behavior problems.[49] The other 6 trials (7 comparisons) targeted substance use through motivational interviewing and/or counseling.[45,55,57,62,64,66]

Across trials, control conditions varied in intensity and length, ranging from usual care without enhancements to enhanced usual care with referral to specialty services, brief advice from PCPs, and educational materials. Methodologic rigor varied across studies: a Jadad score of 3 or higher for 25 studies, Jadad score of 2 for 6 studies, and evidence of some allocation concealment for all studies.

Overall Effect Size Calculations

The overall summary effect comparing all interventions vs usual care resulted in a small and statistically significant effect ($d = 0.32$; 95% CI, 0.21-0.44; $P < .001$). The forest plot and Q and I^2 statistics indicated significant heterogeneity

Figure 2. Overall and Individual Study Effects

Source	Standardized Difference in Means (95% CI)	z Value	P Value
Treatment			
Collaborative care			
Kolko et al,[50] 2014	0.267 (0.023 to 0.512)	2.140	.03
Richardson et al,[60] 2014	1.020 (0.605 to 1.434)	4.819	<.001
Kolko et al,[52] 2012	1.649 (0.792 to 2.505)	3.774	<.001
Asarnow et al,[42] 2005	0.587 (0.225 to 0.919)	3.461	.001
Clarke et al,[35] 2005	0.246 (−0.073 to 0.565)	1.510	.13
Summary effect	0.634 (0.272 to 0.997)	3.430	.001
Other integrated mental health care			
Perrin et al,[58] 2014	0.430 (0.073 to 0.787)	2.360	.02
Reid et al,[59] 2013	0.244 (−0.064 to 0.551)	1.554	.12
Spijkers et al,[61] 2013	2.450 (1.922 to 2.978)	9.096	<.001
Kjobli and Ogden,[36] 2012	0.304 (0.035 to 0.572)	2.218	.03
Lavigne et al,[53] 2011	0.500 (0.258 to 0.743)	4.047	<.001
Warner et al,[37] 2011	2.764 (1.114 to 4.414)	3.283	.001
Kolko et al,[51] 2010	0.149 (−0.159 to 0.457)	0.951	.34
Lavigne et al,[54] 2008 (nurse)	0.764 (0.308 to 1.221)	3.280	.001
Lavigne et al,[54] 2008 (psychologist)	0.588 (0.105 to 1.070)	2.388	.02
Epstein et al,[47] 2007	0.038 (−0.293 to 0.368)	0.224	.82
Wissow et al,[67] 2008	0.110 (−0.085 to 0.305)	1.103	.27
Turner and Sanders,[63] 2006	0.400 (−0.326 to 1.126)	1.079	.28
Borowsky et al,[44] 2004	0.144 (−0.118 to 0.407)	1.077	.28
Mufson et al,[38] 2004	0.528 (0.023 to 1.032)	2.050	.04
Patterson et al,[56] 2002	0.151 (−0.222 to 0.524)	0.794	.43
Summary effect	0.400 (0.275 to 0.634)	4.113	<.001
Substance use			
Walton et al,[65] 2013 (CBI)	0.057 (−0.174 to 0.368)	0.704	.48
Walton et al,[65] 2013 (TBI)	0.158 (−0.102 to 0.418)	1.190	.23
Audrain-McGovern et al,[43] 2011	0.066 (−0.342 to 0.475)	0.319	.75
Pbert et al,[57] 2008 (cessation)	0.256 (0.030 to 0.481)	2.224	.03
D'Amico et al,[46] 2008	0.440 (−0.728 to 1.608)	0.738	.46
Summary effect	0.172 (0.037 to 0.307)	2.493	.35
Prevention			
Mental health			
Hiscock et al,[49] 2008	0.021 (−0.132 to 0.173)	0.226	.79
Van Voorhees et al,[34] 2008	0.180 (−0.402 to 0.763)	0.607	.54
Gilham et al,[48] 2006	0.028 (−0.273 to 0.329)	.183	.86
Summary effect	0.059 (−0.321 to 0.438)	0.450	.65
Substance use			
Walton et al,[66] 2014 (CBI)	−0.181 (−0.487 to 0.126)	−1.156	.25
Walton et al,[66] 2014 (TBI)	−0.030 (−0.328 to 0.268)	−0.196	.84
Mason et al,[55] 2011	0.135 (−0.607 to 0.876)	0.356	.72
Pbert et al,[57] 2008 (abstinence)	0.422 (0.061 to 0.783)	2.291	.02
Curry et al,[45] 2003	0.024 (−0.672 to 0.720)	0.068	.95
Stevens et al,[62] 2002	0.057 (−0.085 to 0.199)	0.783	.43
Walker et al,[64] 2002	0.169 (−0.136 to 0.474)	1.087	.28
Summary effect	0.080 (−0.178 to 0.338)	1.042	.30

Error bars indicate 95% CI. CBT indicates cognitive-behavioral therapy; TBI, traumatic brain injury. Because this figure breaks studies into finer categories than those in the overall moderator analyses, summary effect sizes may differ slightly.

(Q = 152.64, P < .001, I^2 = 77.73%), with the effect size for individual studies ranging from a d of −0.18[66] to 2.76.[37] See **Figure 2** for a summary of individual study effects and summary effects for categories of studies.

Moderators of Treatment Response

The **Table** details the analyses exploring candidate categorical moderators. Trial type was a statistically significant moderator of treatment outcome (Q_b = 7.93, P = .005; Table). Treatment trials had a small to medium statistically significant ef-

fect (d = 0.42; 95% CI, 0.29-0.55; P < .001), whereas the effect for prevention trials was weak and not statistically significant (d = 0.07; 95% CI, −0.13 to 0.28; P = .49). The forest plot and Q and I^2 statistics indicated significant heterogeneity among effect sizes across treatment trials (Q_w = 119.12, I^2 = 79.85%, P < .001). Prevention trials exhibited less heterogeneity (Q_w = 7.53, I^2 = 0%, P = .59). Indeed, only one of the prevention trials[57] had a small and statistically significant effect. Therefore, subsequent analyses examined moderators for treatment trials only.

Table. Results of Analyses Exploring Whether Outcomes Differed for Groups Based on Candidate Categorical Moderator Variables

Subgroup	No. of Treatment-Control Comparisons	Mean Effect Size (95% CI)	P Value for Effect Size	Q_w[a]	Q_b[b]	P Value for Q	I^2, %[c]
Trial type							
All comparisons	35	0.26 (−0.09 to 0.60)	.14	...[d]	7.93	.005	77.73
Treatment	25	0.42 (0.29 to 0.55)	<.001	119.12	...	<.001	79.85
Prevention	10	0.07 (−0.13 to 0.28)	.49	7.53	...	.59	0
Integrated care model[e]							
All comparisons	25	0.46 (0.26 to 0.67)	<.001	...	1.37	.24	79.85
Collaborative care	5	0.63 (0.28 to 0.98)	<.001	19.02	...	.001	78.97
Other interventions	20	0.40 (0.22 to 0.57)	<.001	95.34	...	<.001	80.07
Treatment target[e]							
All comparisons	25	0.37 (0.05 to 0.70)	.03	...	2.94	.09	74.34
Mental health	20	0.51 (0.34 to 0.69)	<.001	111.57	...	<.001	82.97
Substance use	5	0.17 (−0.18 to 0.52)	.35	1.29	...	.86	0
Age group[e]							
All comparisons	23	0.44 (0.27 to 0.61)	<.001	...	0.65	.42	79.20
Adolescents	9	0.36 (0.09 to 0.62)	.008	20.08	...	.01	60.16
Children	14	0.50 (0.29 to 0.71)	<.001	84.65	...	<.001	84.64

[a] Q_w is the degree of heterogeneity within each level of moderator.

[b] Q_b is the degree of overall heterogeneity between groups (computed based on χ^2 distribution).

[c] I^2 is the percentage of total variation among studies (overall moderator analysis) or within the level of moderator.

[d] Ellipses indicate not applicable.

[e] Examined only within treatment trials.

Integrated care model (collaborative care vs other) was not a statistically significant moderator (Q_b = 1.37, P = .24; Table). Collaborative care yielded a medium and statistically significant effect (d = 0.63, P < .001); other care models yielded a small and statistically significant effect (d = 0.40, P < .001). Q_w and I^2 statistics indicated significant heterogeneity within both collaborative care (Q_w = 19.02, I^2 = 78.97%, P < .001) and other trials (Q_w = 95.34, I^2 = 80.07%, P < .001).

Type of behavioral health problem targeted was not statistically significant as a moderator (Q_b = 2.94, P = .09, I^2 = 74.34%; Table). Treatments that targeted substance use had a weak effect (d = 0.17, P = .35) (Figure 2). Alternatively, treatments that targeted mental health problems had a medium statistically significant effect (d = 0.51, P < .001). There were statistically significant effects for treatment studies that targeted emotional (depression and anxiety: d = 0.71, P < .001) and behavioral (disruptive behavior and/or attention-deficit/hyperactivity disorder: d = 0.51, P < .001) problems; these effects did not differ significantly (Q_b = 0.62, P = .43, I^2 = 79.85%). One study[67] that targeted both emotional and behavior problems was excluded from these subgroup analyses.

Age was not a significant continuous (Q_M = 0.003, P = .96) or categorical moderator (children ≤12 years old vs adolescents ≥13 years old, Q_b = 0.65, P = .42, I^2 = 79.20%). Two studies were excluded from categorical[37,67] and continuous[43,56] moderator analyses because of missing data.

Methodologic rigor indexed by the Jadad score (Q_M = 1.12, P = .29, I^2 = 73.01%) and allocation concealment (Q_M = 0.01, P = .95, I^2 = 79.22%) were not statistically significant moderators.

Publication Bias

Publication bias, or effects associated with a greater likelihood of publication with significant outcomes, was examined for treatment trials. Visual inspection of the funnel plot and Egger test suggested that publication bias was significant (t = 3.34, P = .003). The Duval and Tweedie trim-and-fill method suggested that 3 studies were likely missing that would increase the effect (from d = 0.32 to imputed estimate of 0.39). The Rosenthal fail-safe N suggested that 803 studies with null findings would reduce the overall-effect P value to become nonsignificant. The Orwin fail-safe N suggested that 18 null studies would reduce the effect of d to less than 0.20. We did not examine publication bias for prevention trials because the summary effect was not statistically significant.

Discussion

This meta-analysis provides the first cross-study demonstration, to our knowledge, of the value of integrating behavioral health care within primary medical care for children and adolescents. Analyses across studies indicated a small and significant effect. Effects for treatment trials were stronger than those for prevention trials: the effect size for treatment trials fell in the small to medium range (d = 0.42), with a 66% probability that a randomly selected youth would experience better outcomes after receiving an integrated behavioral health intervention than a randomly selected youth receiving usual care.[68,69] Benefits of integrated medical-behavioral treatment were observed for interventions that target diverse mental health problems (depression, anxiety, and behavior). Al-

though there was variability in effects across studies, these overall results enhance confidence that integrated medical-behavioral primary health care will lead to improved youth outcomes. Results were weaker and not statistically significant for substance use treatment trials, with only one large trial (N = 2709) indicating a significant effect.[57] This trial included a practice-based intervention using the 5 A's model (ask, advise, assess, assist, arrange) recommended by the US Public Health Service clinical practice guideline and the American Academy of Pediatrics[70,71] that was provided by pediatric clinicians and followed by 1 visit and 4 telephone calls by older (18- to 21-year-old) peer counselors.

The summary effect for prevention trials was weak and not statistically significant. Only the prevention arm of the substance use intervention described above yielded a small significant effect,[57] underscoring the need for large samples and sufficient statistical power to detect prevention effects. Of note, some prevention trials revealed significant effects on key intermediate outcomes,[34,48,49] such as improved parenting. Over time, such outcomes might affect behavioral health outcomes. Adequately powered prevention trials with longer follow-up might clarify potential preventive effects of integrated medical-behavioral care.

As predicted, our results indicate the strongest effects for collaborative care interventions, with a mean d = 0.63, reflecting a 73% probability that a randomly selected youth would experience better outcomes after receiving collaborative care than a randomly selected youth receiving usual care.[68,69] Collaborative care programs provide team-based care in which PCPs, care managers, and mental health specialists work together to evaluate, treat, and monitor patient progress. Although a meta-analysis[14] of more than 79 RCTS, including 24 308 patients, supports the clinical effectiveness of collaborative care for adult depression and anxiety relative to usual care, the current meta-analysis is the first to extend these findings to youth and highlights the applicability and benefits of collaborative care across the developmental spectrum. These findings are likely to enhance implementation feasibility because similar approaches with developmental adaptation can be applied across age groups.

Overall, collaborative care had strong effects, with trials including evidence-based medication algorithms plus evidence-based psychotherapy. The other mental health treatment trials with significant individual effects used interventions with empirical support, such as Triple P,[61,63] Incredible

Years,[54,58] interpersonal psychotherapy,[38] guideline medication protocols,[53] and CBT for anxiety and somatic concerns.[37] This is a critical issue because integrating ineffective care may lead to minimal or no improvements in patient outcomes, and there is a need to *both* change organizational systems to support medical-behavioral health integration *and* improve care quality by integrating treatments with demonstrated efficacy and effectiveness and monitoring patient outcomes through registries, clinical dashboards, and/or other quality improvement strategies.

A limitation of this meta-analysis is the relatively small number of studies in pediatric samples that met methodologic standards for inclusion, highlighting a need for additional research to guide practice. Interventions were diverse, as were comparator usual care conditions. Effect sizes varied substantially across studies from nonsignificant to substantial and significant (d = 2.76).[37] Several factors likely contributed to variation in effects, including statistical power; intervention type, quality, and dose (substance use interventions were generally briefer than mental health interventions); and strength of usual care comparators (eTable in the Supplement). Statistical power was weak for moderator analyses because of the small number of RCTs integrating behavioral health into primary care. The meta-analysis results differed from some individual study reports because of differences in analytic approach (eg, meta-analysis weighted by sample sizes and pooled SDs, with no covariate adjustments). Moderator analyses depended on our category definitions, underscoring the need to review primary study articles for more detailed information.

Conclusions

Given the current transformation in the US health care system and increased incentives for integrated medical-behavioral health care, these data documenting the benefits of integrated care enhance confidence that we are on a course that will yield improvements in the lives of youth and families. These data also underscore the critical need to strengthen our research base, learn from the real-world experiments happening within our medical and behavioral health care systems, and achieve the triple aims of health care reform: to improve care and patient experience and outcomes of care while reducing per capita costs.

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