Collaborative Care to Improve the Management of Depressive Disorders

A Community Guide Systematic Review and Meta-Analysis

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Context: To improve the quality of depression management, collaborative care models have been developed from the Chronic Care Model over the past 20 years. Collaborative care is a multicomponent, healthcare system–level intervention that uses case managers to link primary care providers, patients, and mental health specialists. In addition to case management support, primary care providers receive consultation and decision support from mental health specialists (i.e., psychiatrists and psychologists). This collaboration is designed to (1) improve routine screening and diagnosis of depressive disorders; (2) increase provider use of evidence-based protocols for the proactive management of diagnosed depressive disorders; and (3) improve clinical and community support for active client/patient engagement in treatment goal-setting and self-management.

Evidence acquisition: A team of subject matter experts in mental health, representing various agencies and institutions, conceptualized and conducted a systematic review and meta-analysis on collaborative care for improving the management of depressive disorders. This team worked under the guidance of the Community Preventive Services Task Force, a nonfederal, independent, volunteer body of public health and prevention experts. *Community Guide* systematic review methods were used to identify, evaluate, and analyze available evidence.

Evidence synthesis: An earlier systematic review with 37 RCTs of collaborative care studies published through 2004 found evidence of effectiveness of these models in improving depression outcomes. An additional 32 studies of collaborative care models conducted between 2004 and 2009 were found for this current review and analyzed. The results from the meta-analyses suggest robust evidence of effectiveness of collaborative care in improving depression symptoms (standardized mean difference [SMD]=0.34); adherence to treatment (OR=2.22); response to treatment (OR=1.78); remission of symptoms (OR=1.74); recovery from symptoms (OR=1.75); quality of life/functional status (SMD=0.12); and satisfaction with care (SMD=0.39) for patients diagnosed with depression (all effect estimates were significant).

Conclusions: Collaborative care models are effective in achieving clinically meaningful improvements in depression outcomes and public health benefits in a wide range of populations, settings, and organizations. Collaborative care interventions provide a supportive network of professionals and peers for patients with depression, especially at the primary care level.

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Context

Depressive disorders are a major contributor to the burden of disease in high-income countries[1] and lead all diseases as a cause for years of life lived with disability (YLD).[1] In the U.S., 14.8 million adults (6.7% of the population) experience major depressive disorder.[2] Further, approximately 1.5% of the adult U.S. population experience dysthymic disorder every year—a chronic illness in the depression spectrum that is less severe than major depressive disorder.[2]

The prevalence of major depressive disorder is 50% higher among women than men,[3] as is the burden of disease.[1] The prevalence of Major Depressive Episode (MDE) in 2008 among people aged ≥18 years was found to be highest among those who identified themselves as multiracial, followed by whites, Hispanics, American Indian or Alaska Natives, blacks, and Asians.[4] Among youth aged 12–17 years, the prevalence of MDE was estimated to be 8.3%.[4] Direct medical costs, suicide-related mortality costs, and productivity losses from depression totaled $83.1 billion in the U.S. in 2000.[5] Although 10.6 million adults reported an unmet need for mental health services in 2008,[4] most people with depressive symptoms seek treatment at the primary care level, where they might not receive appropriate care.[6] Hence, the quality of depression care in the primary care system needs to be improved.

Various approaches have been employed to improve the quality of care for chronic diseases. Notable among these is the Chronic Care Model,[7,8] which has improved the management of chronic diseases such as diabetes, especially at the primary care level.[9,10] The Chronic Care Model has been adapted to improve the management of depressive disorders, leading to the development of the collaborative care model,[11] a multicomponent, healthcare system–level intervention that uses case managers to link primary care providers, patients, and mental health specialists. Collaborative care models typically include case managers, who support primary care providers with functions such as patient education, patient follow-up to track depression outcomes and adherence to treatment, and adjustment of treatment plans for patients who do not improve.

Primary care providers receive consultation and decision support from mental health specialists (i.e., psychiatrists and psychologists). This collaboration is designed to (1) improve routine screening for and diagnosis of depressive disorders; (2) increase provider use of evidence-based protocols for the proactive management of diagnosed depressive disorders; and (3) improve clinical and community support for active client/patient engagement in treatment goal-setting and self-management.

Primary care providers are usually responsible for routine screening and diagnosis of depressive disorders, prescribing antidepressants, and referring patients to mental health specialists as needed. Mental health specialists provide clinical advice and decision support to primary care providers. These processes are frequently coordinated and supported by technology-based resources such as electronic medical records, telephone support, and provider reminder mechanisms.

Systematic reviews of the literature have found evidence to support the effectiveness of collaborative care models in improving health outcomes related to depressive disorders.[12,13] This review builds on that foundation and provides current evidence on effectiveness of collaborative care in reducing the burden of depressive disorders, as assessed by an expansive range of depression outcomes. Using methods developed by the Guide to Community Preventive Services,[14,15] various moderators of effectiveness that can influence outcomes (e.g., patient and provider characteristics; geographic location) and be beneficial to a community interested in implementing this intervention were examined. Hence, this review offers an opportunity to assess the state of the evidence on effectiveness in an active research area as well as the variables that influence the applicability and generalizability of these collaborative care models to various populations and settings.

Guide to Community Preventive Services

The systematic review in this report was conducted under the oversight of the independent, nonfederal Community Preventive Services Task Force (the Task Force). The Task Force continues to develop, expand, and update the *Guide to Community Preventive Services* (the *Community Guide*) with the support of DHHS in collaboration with public and

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private partners. The CDC provides staff support to the Task Force for development of the *Community Guide*. Previous topics reviewed, as well as background information on methods and development of the *Community Guide*, are available at www.thecommunityguide.org.

Healthy People 2020 Goals and Objectives

Several *Healthy People 2020* goals and objectives[16] are relevant to this review.

- "Reduce the suicide rate" (Mental Health and Mental Disorders [MHMD]-1);
- "Reduce the proportion of persons who experience major depressive episodes" (MHMD-4) among adolescents (MHMD-4.1) and among adults aged 18 years and older (MHMD-4.2);
- "Increase the proportion of adults aged 18 years and older with major depressive episodes who receive treatment" (MHMD-9.2);
- "Increase depression screening by primary care providers" (MHMD-11).

Information from Other Advisory Groups

The U.S. Preventive Services Task Force (USPSTF), which provides recommendations for clinical practice, recommends screening for depression in adults and adolescents when systems are in place for efficient diagnosis, treatment, and follow-up for depressive disorders.[17,18] Collaborative care models address all these aspects of care.

The American Psychiatric Association recently released an update to its practice guideline for the treatment of major depressive disorders,[19] providing evidence-based recommendations on the use of antidepressants and psychotherapy, somatic, and other forms of therapy. The guidelines cover a range of situations including treatment-resistant depression, postpartum depression, and comorbid illnesses.

Evidence Acquisition

Community Guide methods (www.thecommunityguide.org/about/methods.html) were used to conduct this systematic review and meta-analysis to determine the effectiveness of collaborative care in improving management of depressive disorders. These methods have been described in detail elsewhere.[14,20] Briefly, for this review, a coordination team ("the team") was constituted, including subject matter experts on mental health and mental illness from various agencies, organizations, and academic institutions together with qualified systematic reviewers. The team worked under the oversight of the Task Force.

For each *Community Guide* review topic, a team conducts a review by (1) developing a conceptual approach to identify, organize, group, and select interventions for review; (2) developing an analytic framework depicting interrelationships among interventions, populations, and outcomes; (3) systematically searching for and retrieving evidence; (4) assessing and summarizing the quality and strength of the body of evidence of effectiveness; (5) translating evidence of effectiveness into recommendations; (6) summarizing data about applicability (i.e., the extent to which available effectiveness data might apply to diverse population segments and settings), economic impact, and barriers to implementation; and (7) identifying and summarizing research gaps.

The Task Force receives the results of the review process, which include (1) effectiveness and consistency of the intervention in improving health outcomes and preventing disease; (2) quality of the body of evidence in terms of design and execution; (3) additional benefits and potential harms and barriers to implementation; (4) applicability or generalizability of the intervention to a comprehensive range of populations and settings; and (5) information on economic efficiency. The Task Force also takes into account the public health importance of the overall effect estimates to reach decisions on making recommendations on using the intervention for practice and policy.

Conceptual Approach and Analytic Framework

The conceptual approach developed by the team to determine the effectiveness of collaborative care is represented in the analytic framework (Figure 1). The team hypothesized that the model would organize a collaborative arrangement among primary care providers, case managers, and mental health specialists (i.e., psychiatrists and psychologists). This collaborative arrangement enables processes for primary care providers to improve their screening practices and the quality of care for depressive disorders while receiving case management support from case managers and clinical decision support and clinical advice from mental health specialists. This arrangement also facilitates the active involvement of clients/consumers/patients ("patients") in their own care and treatment plans (i.e., self-care). These systemic changes are expected to lead to improved results across a wide range of depression-related outcomes.

Outcome Measures Used to Determine Effectiveness

Consistent with research that describes the course of depression and treatment,[21] the team examined the following widely used depression outcomes: "depression symptom improvement," "response to treatment," "remission," and "recovery." Additional primary health outcomes also were examined: "screening and diagnosis," "adherence to treatment," and "health-related quality of life and functional status," deemed suitable to facilitate formation of a judgment on intervention effectiveness. One secondary outcome, "satisfaction with care," also was examined. Other outcomes that were directly relevant to depression-related morbidity and mortality were likewise eligible for this review.

Primary Health Outcomes

Depression symptom improvement. Depression symptoms typically are measured with standardized depression scales. Some examples of scales used in the field include the Structured Clinical Interview (SCID); the Beck Depression Inventory (BDI); the Patient Health Questionnaire (PHQ-9); and the Symptom Checklist (SCL-20 and SCL-90). Decision rules were developed to determine scale selection when more than one depression scale was reported.[22–25] Scales were selected in the following order: SCID,[26] BDI,[27] and PHQ-9.[28,29]

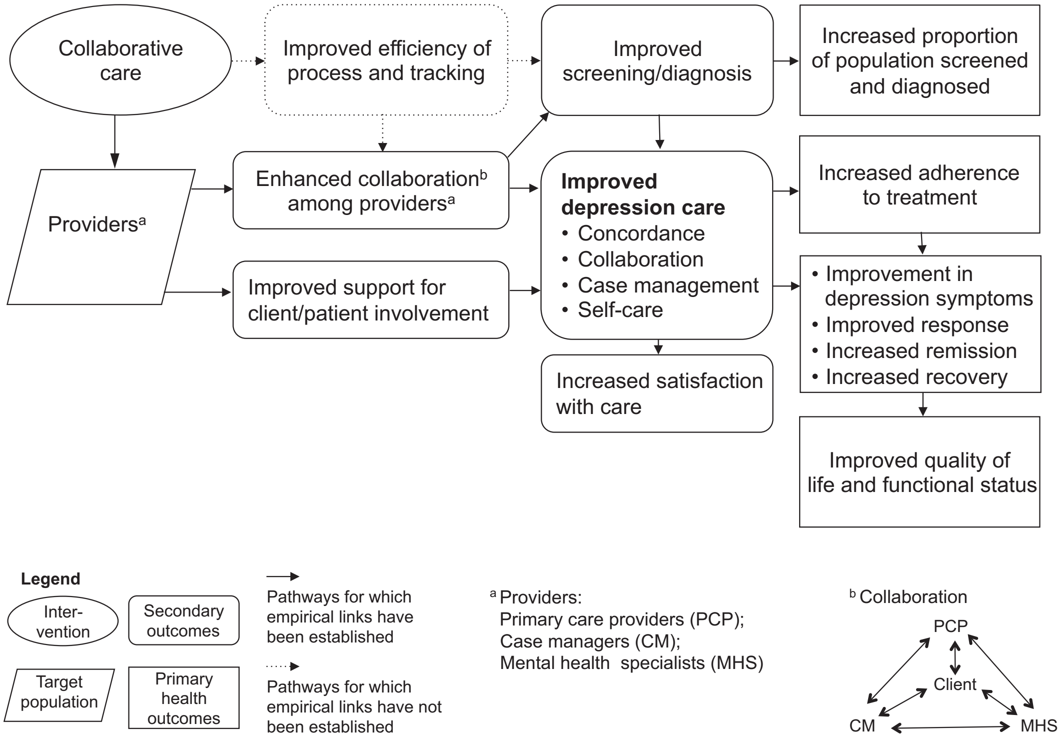

Figure 1. Analytic framework depicting hypothesized collaborative care impact on screening, treatment, and outcomes of depressive disorders

Response to treatment. Response to treatment was generally defined by the commonly accepted convention of reduction in depressive symptoms of ≥50% from baseline.[30] However, results of studies of people with severe depression or treatment-resistant depression, and those that defined "response" based on a lower degree of improvement (e.g., 25% improvement from baseline), also were included.[30]

Remission and recovery. To achieve remission, a commonly accepted criterion states that a "virtual" absence of depressive symptoms must be attained.[30] This is defined by the absence of depression symptoms or scores below suggested cutoff points on a depression scale. A patient who is in remission for 4 consecutive weeks is considered to have recovered.[30] Because researchers often use these terms interchangeably and without clearly defining them, the team defined and analyzed three analogous outcomes to remission and recovery, based on the follow-up period from the beginning of treatment. These were (1) remission reported at <6 months; (2) remission reported at 6 months; and (3) remission reported at or close to 12 months (considered a proxy for recovery).

Adherence to treatment. Adherence to treatment was defined as the proportion of patients following an agreed-upon treatment plan, which could include medication and/or other forms of treatment, such as psychotherapy. Because of the challenges of assessing adherence, proxies (e.g., evidence of filled prescriptions or of receiving or taking a therapeutic dose) were accepted.

Health-related quality of life and functional status. Health-related quality of life is "an individual's or group's perceived physical and mental health over time."[31] Functional status is "the extent to which an individual can function to meet basic needs, conduct his/her regular roles, and preserve health and wellness."[32,33] Reported outcomes that measured both quality of life and functional status include the Short Form Health Survey–36 or some variant, EuroQol, and the Functional Assessment of Cancer Therapy–G.

Some examples of measures of functional status alone include the Health of Nations Outcome Scales 65+, the Social Adaptation Self-evaluation Scale, and Patient Global Impression. If authors reported more than one subscale for this outcome measure, then mean effects were calculated. Because these tools have been validated for use in assessing health-related quality of life and functional status, the team pooled the effects reported by individual studies using these tools to estimate the impact of collaborative care models on this outcome.

Secondary Outcome

Satisfaction with care. Satisfaction with care is "a patient's perception of (1) the quality of healthcare providers, (2) access to services, (3) communication with providers and administrative staff, and (4) the success of their treatment."[34,35] This outcome could be assessed via standardized instruments, such as the Patient Satisfaction Index or the Client Satisfaction Questionnaire, or by other researcher-developed measures of patient satisfaction.

Search for Evidence

Electronic searches were conducted in the following databases: The Cochrane Library; MEDLINE; Embase; ERIC; NTIS (National Technical Information Service); PsycINFO; CABI; LILACS; CINAHL; and Dissertation Abstracts International. Hand-searches were conducted of five journals, published in the 10 years preceding the review and identified by the team as the most relevant to the field and this intervention. Also included were unpublished papers, conference proceedings, reports, books, and book chapters identified by team members and other subject matter experts. The initial literature search was conducted in April 2008 with an updated search in February 2009. Search terms are available at www.thecommunityguide.org/mentalhealth/SS-collab-care.html.

Criteria for Inclusion

Studies were considered for inclusion in this systematic review if they

- were written in English;
- evaluated collaborative care interventions that included at least a case manager, primary care provider, and mental health specialist with collaboration among these roles;
- evaluated interventions targeted to patients with a diagnosis of major depression, minor depression, or dysthymia, without comorbid psychoses;
- were conducted in a high-income nation[a];
- compared a group of people who had been exposed to the intervention with a group of people who had not been exposed or who had been less exposed (these comparisons could be concurrent or in the same group over time); and
- measured and reported a primary health outcome of interest as described above.

Assessment of Quality and Summarizing the Body of Evidence on Effectiveness

Two reviewers read and evaluated each study that met the inclusion criteria using an adaptation of the standardized abstraction form for *Community Guide* reviews (available at www.thecommunityguide.org/library/ajpm355_d.pdf), and disagreements were resolved by consensus between reviewers or among the entire review team. Reviewers were not blinded to author or journal names. Each study was assessed for suitability of study design and threats to validity.[14] Based on the number of threats to validity, studies were characterized as having good (0–1 limitation); fair (2–4 limitations); or limited (≥5 limitations) quality of execution.[14,15]

Studies with limited quality of execution were not included in the summary of the intervention effect. Studies with good or fair execution were considered qualifying studies and were included in the analyses. Bodies of evidence of effectiveness are characterized as strong, sufficient, or insufficient on the basis of the number of available studies, the suitability of study designs for evaluating effectiveness, the quality of execution of the studies, the consistency of the results, and the effect estimates.[14]

Reviewers abstracted data describing collaborative care intervention elements, participant characteristics, study characteristics, and study results using SRS, version 4.0. Nine study authors were contacted by e-mail when data were missing or when numbers reported in text did not match data reported in tables or figures. All nine authors responded. Information also was abstracted on applicability, potential harms, additional benefits, and barriers to implementation of collaborative care interventions. Additionally, efforts were undertaken to identify research gaps and research needs in this field.

Economic Evaluation

Evaluations of economic efficiency are conducted only when sufficient or strong evidence of effectiveness of an intervention has been established. The methods and findings of the economic evaluation of collaborative care interventions are described in an accompanying article.[36]

Data Analysis Methods

Calculation of estimated effect sizes for each study. Estimated effect sizes for this review were expressed as standardized mean difference with a correction factor (Hedges' g[37]) for those outcomes that were measured as a mean score, and OR for outcomes reported as proportions. Calculation of 95% CIs and adjustment for baseline data were done for all studies with sufficient information reported. When necessary, reported results were transformed so that Hedges' g values ≥ 0 and ORs >1.0 indicate effects in the favorable direction.

Meta-analyses. Meta-analyses were conducted on each outcome variable to assess effectiveness of the collaborative care model. Estimated effect sizes for individual studies were aggregated using the random effects model to calculate an overall weighted mean effect estimate (Hedges' g or OR) with a corresponding 95% CI. The random effects model was chosen a priori because interventions, populations, and contexts vary substantially in community-based interventions.[38] Homogeneity tests also were conducted using the Q statistic[38] and the I^2 statistic.[39] I^2 values can range from 0% to 100%, and in this review values >50% were considered indicative of substantial heterogeneity.[39] A combination of Microsoft Excel and Comprehensive Meta-Analysis, version 2.2050, was used for estimated effect size calculation and meta-analyses.

Subgroup analyses. Between-study analyses were conducted for several effect modifier variables to (1) assess whether they are associated with increased or decreased intervention effects and (2) explore potential sources of heterogeneity for each outcome.

Sensitivity Analyses Methods

Publication bias analyses. A funnel plot for each outcome was inspected visually to examine the data for evidence of publication bias.[40] Next, the Begg and Mazumdar rank–correlation coefficient[41] was calculated to determine bias through correlation of the effect estimate and the SE. Last, Orwin's fail-safe N analysis[42] was performed for the "depression symptom improvement" outcome to assess whether the estimated effect could be attributable to publication bias. A Hedges' g of 0.1 was set as the trivial effect for this analysis, which determines the number of studies with null or contrary results needed to overturn the observed overall effect estimate.[43,44]

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[a] World Bank high-income economies are as follows: Andorra, Antigua and Barbuda, Aruba, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Cyprus, Czech Republic, Denmark, Equatorial Guinea, Estonia, Faeroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong (China), Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Republic of Korea, Kuwait, Liechtenstein, Luxembourg, Macao (China), Malta, Monaco, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Portugal, Puerto Rico, Qatar, San Marino, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, U.S., Virgin Islands (U.S.).

Table 1. Meta-analyses results from Bower et al.[12] collaborative care systematic review compared to similar outcomes from *Community Guide* systematic review

	Bower (2006)[12]		*Community Guide*	
	1966[a]–2004		2004[b]–2009	
Outcome name	Study arms, *n*	Effect estimate (95% CI)	Study arms, *n*	Effect estimate (95% CI)
Depression symptom improvement	34	SMD 0.24 (0.17, 0.32)	28	SMD[c] 0.34 (0.25, 0.43)
Adherence	28	OR 1.92 (1.54, 2.39)	10	OR 2.22 (1.67, 2.96)

[a]Search period: 1966–2004; Earliest collaborative care study was from 1993.
[b]Studies from 2004 not in Bower et al.[12]
[c]Hedges' *g* was used as standardized mean difference metric.
SMD, standardized mean difference

One-study-removed sensitivity analyses. A one-study-removed sensitivity analysis was performed on each outcome to examine how the overall weighted mean effect estimate and CIs changed when an effect size from any one individual study was removed and, thus, identify individual studies that overly influence the summary effect estimate.[45]

Evidence Synthesis

A total of 8354 potentially relevant titles and abstracts obtained from the literature search and review of reference lists were screened. Of these, full-text versions of 1057 published articles and reports were obtained and 226 papers and reports relevant to collaborative care were identified. These included papers reporting individual study results as well as reviews of several collaborative care interventions.

One such review was a systematic review and meta-analysis conducted by Bower et al.[12] that identified 37 RCTs on collaborative care, published between 1993 and 2004. Two outcomes comparable to the current systematic review were assessed and found to provide robust evidence on effectiveness of collaborative care for depression (Table 1). Given the similarity of the current systematic review to the previous review by Bower et al.,[12] only the 33 studies[22–25,46–74] published during or after 2004 were included in the current systematic review. All studies in the current review were of greatest design suitability, and a majority were RCTs in which allocation of patients to collaborative care or usual care was randomized with researchers blinded to this allocation. All but one study[61] had good or fair execution. Thus, 32 studies with 39 study arms qualified for analysis.

Descriptive Results

The characteristics of the study populations are shown in Table 2. Studies evaluated included a range of populations and contextual factors reflecting the widespread practice of collaborative care in a variety of settings.

Results from Meta-Analyses

Primary health outcomes. All primary health outcomes demonstrated improvement, and forest plots were generated to demonstrate results of the meta-analyses using Comprehensive Meta-Analysis® (Figure 2 is the forest plot for "depression symptom improvement"). The overall weighted mean effect estimates for depression symptom improvement, response to treatment, remission at <6 months, remission at 6 months, recovery at 12 months, and adherence to treatment were in the favorable direction and of sufficient size to be considered meaningful for improving health (Table 3). Health-related quality of life/functional status was also in the favorable direction but had a smaller effect estimate. Substantial heterogeneity for many of the outcomes was found, with $I^2 > 50\%$. The primary source of this heterogeneity appears to be three outlier studies.[24,49,54] Sensitivity analyses conducted with these studies removed resulted in slightly smaller effect estimates and a reduction in heterogeneity ($I^2 < 50\%$). No other sources of heterogeneity were identified.

Only one study in the review, Reiss-Brennan et al.,[64] provided data on the effectiveness of collaborative care for improving depression screening rates within a large health system that implemented collaborative care. The rates of detection of true depression for adults and children were slightly higher for collaborative care clinics compared to usual care.

Secondary outcomes. The overall weighted mean effect estimate was in the favorable direction and significant for "satisfaction with care" (Table 3), with no indication of heterogeneity issues.

Additional evidence. Reported outcomes from three studies that could not be combined with the primary or

Table 2. Baseline demographic characteristics from all studies that qualified for analysis

Characteristic	Category	Study arms, *n*
Age group (years)	Teen (13–21)	1
	Adult (22–64)	25
	Older adult (≥65)	8
	Unknown	5
Gender	Majority female	30
	Majority male	5
	Unknown	4
Race/ethnicity	Majority white	15
	Majority Latino	3
	Majority African-American	1
	Unknown	20
SES	Majority low	4
	Majority mid-high	3
	Unknown	32
History of depression	Previously and newly diagnosed	24
	Previously diagnosed only	9
	Newly diagnosed only	6
Depression diagnosis	Mixed	30
	Major depression only	7
	Minor depression/dysthymia	1
	Unknown	1
Comorbidities[a]	Cardiac disease	7
	Stroke	3
	Diabetes	4
	Cancer	2

[a] Multiple responses possible

Note: n=39 study arms (32 studies)

secondary outcomes are presented briefly here. Gallo et al.[58] found a lower 5-year mortality rate for collaborative care patients than usual care, which was mostly attributable to reduction in cancer mortality. Wells and colleagues[74] found that improvements in depression symptoms measured 9 years after a 6–12-month intervention did not persist. Joubert et al.,[60] the only prevention study included in the review, tested the effectiveness of collaborative care for preventing depression in stroke patients and found significantly fewer depression symptoms at 12 months for those receiving collaborative care.

Subgroup Analyses

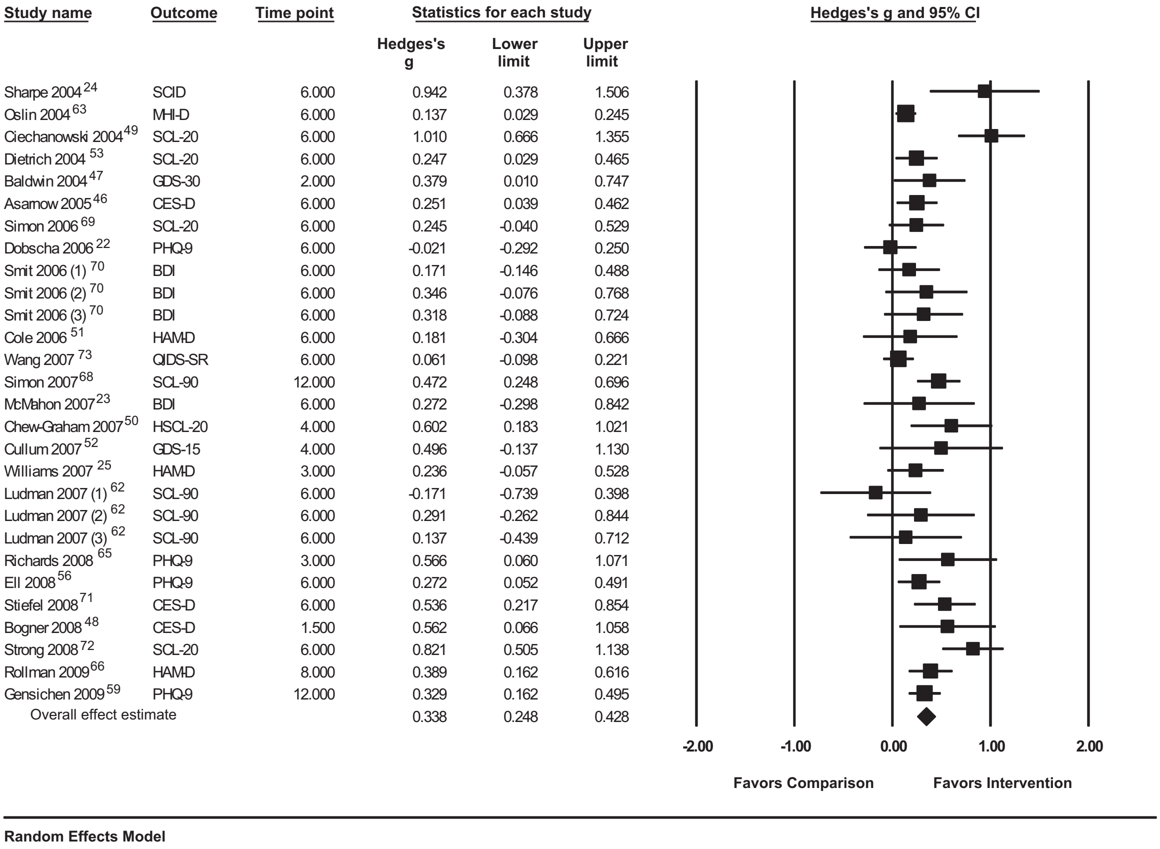
To examine the effect of potential effect modifiers, subgroup analyses were conducted for the "depression symptom improvement" outcome. When the outlier studies described previously were removed from these analyses, few differences were found among the subgroups. Results were similar for the following potential modifiers and are not shown: country, amount of case management, intervention length, amount of training for providers, study design, quality of execution, and type of comparison group. Significant differences were found between different categories with sufficient numbers of studies within the following variables: organization, case manager, and collaborative care components (Tables 4 and 5), and are described below. Differences found in variables with one or two studies in categories may not be reliable and will not be discussed.

Type of organization. Collaborative care models were implemented in a variety of organizations including those affiliated with academic institutions, community-based organizations, MCOs, preferred provider organization or similar organizations, universal healthcare settings (outside the U.S.), and the Veterans Administration (VA) centers. Interventions implemented by community-based organizations demonstrated the largest effects, and those in VA settings demonstrated the smallest effects.

Type of case manager. Types of case managers included registered nurses, master's-level mental health workers, and social workers, with registered nurses being used most frequently in this role. The effect estimates were largest for nurses and smallest for master's-level mental health workers. Master's-level mental health workers were typically recent graduates of master's programs in psychology with limited clinical experience.

Collaborative care components. No differences related to the individual elements of collaborative care were found, except for a smaller effect estimate for interventions that included "support for self-care" as an element. This finding is explained partially by the outlier study.[49] However, information from the included studies on the intensity and duration of these components within collaborative care interventions is insufficient to draw any reliable conclusions.

A negative relationship was found between number of collaborative care elements and depression symptom improvement in the meta-regression (slope$=-0.09$ SDs/element, $p=0.0006$). However, this relationship appears to be nonlinear, with lower effect estimates at either end of the distribution. Effect estimates were largest for studies with four to five collab-



Study name	Outcome	Time point	Hedges's g	Lower limit	Upper limit
Sharpe 2004[24]	SCID	6.000	0.942	0.378	1.506
Oslin 2004[63]	MHI-D	6.000	0.137	0.029	0.245
Ciechanowski 2004[49]	SCL-20	6.000	1.010	0.666	1.355
Dietrich 2004[53]	SCL-20	6.000	0.247	0.029	0.465
Baldwin 2004[47]	GDS-30	2.000	0.379	0.010	0.747
Asarnow 2005[46]	CES-D	6.000	0.251	0.039	0.462
Simon 2006[69]	SCL-20	6.000	0.245	-0.040	0.529
Dobscha 2006[22]	PHQ-9	6.000	-0.021	-0.292	0.250
Smit 2006 (1)[70]	BDI	6.000	0.171	-0.146	0.488
Smit 2006 (2)[70]	BDI	6.000	0.346	-0.076	0.768
Smit 2006 (3)[70]	BDI	6.000	0.318	-0.088	0.724
Cole 2006[51]	HAM-D	6.000	0.181	-0.304	0.666
Wang 2007[73]	QIDS-SR	6.000	0.061	-0.098	0.221
Simon 2007[68]	SCL-90	12.000	0.472	0.248	0.696
McMahon 2007[23]	BDI	6.000	0.272	-0.298	0.842
Chew-Graham 2007[50]	HSCL-20	4.000	0.602	0.183	1.021
Cullum 2007[52]	GDS-15	4.000	0.496	-0.137	1.130
Williams 2007[25]	HAM-D	3.000	0.236	-0.057	0.528
Ludman 2007 (1)[62]	SCL-90	6.000	-0.171	-0.739	0.398
Ludman 2007 (2)[62]	SCL-90	6.000	0.291	-0.262	0.844
Ludman 2007 (3)[62]	SCL-90	6.000	0.137	-0.439	0.712
Richards 2008[65]	PHQ-9	3.000	0.566	0.060	1.071
Ell 2008[56]	PHQ-9	6.000	0.272	0.052	0.491
Stiefel 2008[71]	CES-D	6.000	0.536	0.217	0.854
Bogner 2008[48]	CES-D	1.500	0.562	0.066	1.058
Strong 2008[72]	SCL-20	6.000	0.821	0.505	1.138
Rollman 2009[66]	HAM-D	8.000	0.389	0.162	0.616
Gensichen 2009[59]	PHQ-9	12.000	0.329	0.162	0.495
Overall effect estimate			0.338	0.248	0.428

Figure 2. Forest plot for "improvement in depression symptoms"

Note: Forest plots for other outcomes are not shown.

BDI, Beck Depression Inventory; CES-D, Center for Epidemiologic Studies Depression Scale; GDS, Geriatric Depression Scale; HAM-D, Hamilton Depression Rating Scale; HSCL, The Hopkins Symptom Checklist; MHI-D, Medical and Health Information Directory; PHQ, Patient Health Questionnaire; QIDS-SR, Quick Inventory of Depressive Symptomatology (self-report); SCID, Structured Clinical Interview; SCL, Symptom Checklist

orative care components compared to those with three or more than five components.

Publication Bias and Sensitivity Analyses

No evidence of publication bias was found based on either visual inspection of the funnel plot for the "depression symptom improvement" outcome or the Begg and Mazumdar rank correlation coefficients, which were nonsignificant. The Orwin's fail-safe N calculation for the "depression symptom improvement" outcome was fairly robust, as 11 additional studies finding no effect are needed to reduce the effect estimate from an SMD of 0.34 to below 0.10 (the specified trivial amount). In addition, no studies in this systematic review were found to overly influence the results for each outcome in the one-study-removed analyses.

Discussion

Developed from the Chronic Care Model, collaborative care has become an accepted strategy of effectively coordinating depression care in many health systems. This systematic review demonstrates that this intervention significantly decreased overall depression symptoms in patients receiving collaborative care as compared to usual depression care. Collaborative care is now in its second generation of practice and research, and organizations and providers are examining more efficient and cost-effective ways to implement and deliver collaborative care.

Applicability

Populations targeted in this review were mostly adults (aged 20–64 years) and older adults (aged ≥65 years), mostly white, with over-representation of African Americans and under-representation of other minorities. In the few studies that specifically targeted certain populations (adolescents,[46] African Americans,[48] and Latinos[54,56]), the results were similar to the overall effect estimate. Information on the SES of patients from included studies was sparse, but results from two studies in low-income populations with depression[54,56] suggest collaborative care interventions in such populations work as effectively as in an economically mixed population.

Table 3. Summary of findings for all outcomes: collaborative care versus usual care

Outcome	Study arms, *n*	Effect estimate[a] (95% CI)	Translation[b,c]
Depression symptom improvement	28	SMD=0.34 (0.25, 0.43)	Meaningful effect
Adherence	10	OR=2.22 (1.67, 2.96)	Meaningful effect
Response	14	OR=1.78 (1,42, 2.23)	Meaningful effect
Remission (<6 months)	5	OR=2.37 (1.72, 3.25)	Meaningful effect
Remission (6 months)	9	OR=1.74 (1.14, 2.63)	Meaningful effect
Recovery (12 months)	5	OR=1.75 (1.17, 2.61)	Meaningful effect
Quality of life (includes functional status)	15	SMD=0.12 (0.05, 0.20)	Small effect
Satisfaction with care	11	SMD=0.39 (0.26, 0.51)	Meaningful effect

[a] All effect estimates significant at $p<0.05$

[b] Meaningful effect—deemed to be of sufficient magnitude to be of public health benefit by Community Preventive Services Task Force and by subject matter experts

[c] Small effect—effect in favorable direction, but unclear if of sufficient magnitude to be of public health benefit

SMD, standardized mean difference (Hedges' *g*)

In most studies, physicians were the primary care providers; the few studies that used other professionals (e.g., nurses and physician assistants) in this role, however, reported similar effects.[47,53,69] Nurses served as case managers in most studies in the review. Social workers[56] and master's-level mental health workers[23,62,73] also served in this role in some instances. The effect estimate from studies using master's-level mental health workers was smaller than the overall estimate, a finding probably explained by the need for further skills development for this level of professional in fulfilling the role of case manager.

Many interventions in this review included specific training for case managers, although the nature of this training was diverse across studies. Care should be taken by organizations wishing to implement collaborative care to ensure that training is adequate for individuals assuming these roles, along with an emphasis on effective communication among providers. Psychiatrists and psychologists most frequently served as the mental health specialists in the collaborative care model. Authors in the two studies using physicians or nurses with advanced training in this role reported comparable results.[25,46]

Most studies reviewed were conducted in the U.S., but similar effects were found in studies conducted in other countries. Results also indicate that collaborative care interventions are effective when implemented by a variety of organizations, including MCOs; academic medical centers; community-based organizations; the VA system; and universal health coverage systems (e.g., the National Health Service in the United Kingdom). The effect estimate for the VA studies[22,63] was in the favorable direction but somewhat smaller in magnitude than the overall estimate. Usual care in the context of the VA may very well be different from usual care in other situations (i.e., with greater integration of primary care and behavioral health care), and veterans presenting with depression may have higher rates of comorbidities, such as substance abuse and posttraumatic stress disorder (PTSD) than other populations. It is also important to note that other VA-based studies of collaborative care have reported estimated effect sizes similar to the overall effect estimate from this review,[75] but results were published outside the search period for this review and hence were not included in the analyses.

Studies included in this review suggest that collaborative care is relevant and effective in a range of settings that span and link outpatient and inpatient care. Less evidence was available for collaborative care models that also included settings not directly related to health care. Two studies that included home-based care[49,50] reported effects similar to the overall estimate, and one study that included a worksite component found a smaller, but favorable, effect.[73]

Other Benefits and Potential Harms

Only two studies listed additional benefits that patients received from collaborative care interventions. One was a positive impact on patient job retention and productivity,[73] and the other was improved adherence to treatment for comorbid illness.[54] Only one study listed a potential harm from the intervention from a long-term (9 years post-intervention) perspective.[74] Patients who were part of a collaborative care cohort emphasizing improvement in medication management were found to have more difficulty coping with stressful events 9 years after the intervention ceased compared with the control group and another collaborative care cohort that mainly received psychotherapy.

Barriers to Implementation

Reported barriers to implementation of collaborative care interventions varied. They included patient reluc-

Table 4. Subgroup analyses from studies that reported depression symptom improvement

Variable	Category	Study arms, *n*	Stratified estimate (Hedges' *g*)
Age	Adult	19	0.31
	Older adult	6	0.46
	Teen	1	0.25
Gender	Majority female	22	0.36
	Majority male	4	0.24
Race/ethnicity	Majority white	8	0.3
	Majority African-American	1	0.56
	Majority Latino	2	0.26
SES*	Low	1	0.27
	Majority low	1	1.02
	Majority mid-high	3	0.09
Organization*	MCO	10	0.29
	Universal	9	0.46
	VA	2	0.11
	Academic	2	0.38
	CBO	2	0.82
Setting*	Clinic	18	0.31
	Hospital	5	0.33
	Clinic/hospital	2	0.37
	Clinic/home	1	0.6
	Home	1	1.01
	Worksite	1	0.06
Case manager*	RN+	18	0.37
	Mental health worker	5	0.08
	MD/RN and/or others	3	0.1
	Social worker	1	0.27
	RN/social worker+	1	1.02
Primary care provider*	MD	21	0.42
	RN	2	0.29
	Physician's assistant	1	0.25
Mental health specialist	Psychiatrist and/or psychologist and others	15	0.34
	Psychiatrist/psychologist	10	0.36
	MD and/or RN	2	0.25

Note: Data were not available for all variables for all studies.
*$p<0.05$
CBO, community-based organization; RN, registered nurse; VA, Veterans Affairs

Table 5. Collaborative care intervention components for studies that reported the outcome of depression symptom improvement

Variable	Study arms, *n*	Hedges' *g*
Patient education		
No	7	0.48
Yes	21	0.30
Support for self-care*		
No	9	0.53
Yes	19	0.25
Provider education		
No	8	0.31
Yes	20	0.35
Provider feedback		
No	9	0.39
Yes	19	0.32
Provider oversight		
No	4	0.33
Yes	24	0.34
Evidence-based guidelines		
No	10	0.43
Yes	18	0.30
Use of telephone		
No	4	0.35
Yes	24	0.33
Use of technology		
No	18	0.38
Yes	10	0.25

*$p < 0.05$

tance to enroll,[23,74] low patient appointment attendance,[52,54,55] limited insurance coverage for mental health care,[73] locating organizations in the community that offer depression care at such nonconventional points-of-care as the home setting and the worksite,[55,57,73] training specialists from other fields in collaborative care for patients with depression comorbid with other chronic illnesses,[54] and difficulties reaching patients who preferred face-to-face over telephone contact for counseling and care management.[50]

Research Issues

An important research need identified from this systematic review concerns the essential training and background required of key members of the collaborative care team (e.g., requisite skill levels for case managers and intervention-specific training for case managers and primary care providers).[24,48,50] Other needs include information on the optimal frequency and intensity of case management sessions and the utility of additional sessions for patients who do not improve.[22,49]

Studies are also needed to ensure that collaborative care models are consistently effective in improving the management and reducing the impact of depressive disorders among children and adolescents and when targeted to minorities, those of low SES, and those with comorbid conditions. Only one study examined the effect of collaborative care on improving the quality of screening practices.[64] Research studies that focus on improving depression screening at the primary care level through collaborative care will be vital to implementers of these models. Gaining more robust information and knowledge on these aspects will inform the effective practice of collaborative care in the community.

Limitations

Care-seeking behavior for mental illness is frequently hindered by societal and cultural stigmas, which often present the greatest obstacle to any mental health intervention. Although collaborative care models provide motivation and support to depressed patients who have entered the healthcare system, it is unclear how these interventions can motivate untreated people with depression to initiate care-seeking. It might well be outside the purview of collaborative care interventions to influence this initial care-seeking behavior for depression at the community level.

The potential for selection bias when interpreting the results from studies in the present review must be considered. Researchers might recruit only patients with “major depression” or “severe depression” into studies, which increases the possible amount of improvement in depression symptoms. Alternatively, implementers might recruit patients with minor symptoms, increasing the chances of remission or recovery. The interventions represented in the present review included patients with the entire spectrum of depressive disorders, from dysthymia to major depression, reflecting the real-world picture of patients seeking care for different levels and types of depressive disorders and symptoms. None of the studies provided information on the existence of “double depression,” that is, a major depressive episode complicating underlying dysthymia, in participants. Further, sensitivity analyses did not reveal differential effects by severity of depression.

Sources for other biases, including attrition bias and referral bias, were identified to the extent possible in the quality scoring process and were not found to be factors skewing the results from studies within this evidence base. According to *Community Guide* methods,[14,15] all but one study had good or fair quality of execution. Hence, excluding the one study with limited quality of execution from analysis was unlikely to have affected the generalizability of findings.

Other potential limitations could include the use of the existing review,[12] which included only RCTs, and comparing it with evidence identified by the search in the update interval, which included both RCTs and other study designs with concurrent comparison groups; restricting studies to those written in English; and ending the search in 2009. Given the large number of studies identified by both reviews (i.e., 37 and 33 studies, respectively), the robust effect estimates reported by both reviews, and results from Orwin's fail-safe N calculation for the depression symptom improvement outcome, it is highly unlikely that the generalizability of the findings is affected by this update approach and by ending the search in 2009. Further, excluding non-English studies is reported to have little impact on overall effect estimates in systematic reviews.[76]

Conclusion

This systematic review and meta-analysis found that robust evidence is available and demonstrates the effectiveness of collaborative care models in the treatment of depressive disorders. These interventions are applicable in most primary care settings and for most populations to improve a range of depression outcomes. Organizational changes at the healthcare-system level are necessary for the successful implementation of these models so that a coordinated team, consisting of primary care providers, case managers, and mental health specialists, can be utilized to improve quality of depression care. Few variables that substantially moderated the effectiveness of this type of intervention were found, suggesting that although collaborative care models are composed of several moving parts working simultaneously, it remains difficult to identify and estimate the individual contributions of specific components to overall effectiveness. Collaborative care models also provide a supportive network that encourages patients with depression to take an active role in their own care, thus constituting a vital resource of social support as these patients seek to initiate and maintain treatment for depression.

Points of view are those of the authors and do not necessarily reflect those of the CDC.

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