Annals of Internal Medicine | ARTICLE

Depression Decision Support in Primary Care

A Cluster Randomized Trial

Steven K. Dobscha, MD; Kathryn Corson, PhD; David H. Hickam, MD, MPH; Nancy A. Perrin, PhD; Dale F. Kraemer, PhD; and Martha S. Gerrity, MD, PhD

Background: Intensive collaborative interventions improve depression outcomes, but the benefit of less intensive interventions is not clear.

Objective: To determine whether decision support improves outcomes for patients with depression.

Design: Clinician-level, cluster randomized, controlled trial.

Setting: 5 primary care clinics of 1 Veterans Affairs medical center.

Participants: 41 primary care clinicians, and 375 patients with depression (Patient Health Questionnaire [PHQ-9] depression scores of 10 to 25 or Hopkins Symptom Checklist-20 [SCL-20] scores $\geq$ 1.0).

Measurements: The primary outcome was change in depression score (SCL-20) at 6 and 12 months. Secondary outcomes were health-related quality-of-life (36-item Short Form for Veterans [SF-36V] score), patient satisfaction, antidepressant use, and health care utilization.

Intervention: Clinicians received depression education and were randomly assigned to depression decision support or usual care. The depression decision support team, which consisted of a psychiatrist and nurse, provided 1 early patient educational contact and depression monitoring with feedback to clinicians over 12 months.

Results: Although SCL-20 depression scores improved in both groups, the intervention had no effect compared with usual care. The difference in slopes comparing intervention and control over 12 months was 0.20 (95% CI, −0.37 to 0.78; $P = 0.49$), which was neither clinically nor statistically significant. Changes in SF-36V scores also did not differ between groups. At 12 months, intervention patients reported greater satisfaction ($P = 0.002$) and were more likely to have had at least 1 mental health specialty appointment (41.1% vs. 27.2%; $P = 0.025$), to have received any antidepressant (79.3% vs. 69.3%; $P = 0.041$), and to have received antidepressants for 90 days or more (76.2% vs. 61.6%; $P = 0.008$).

Limitations: Usual care clinicians received depression education and had on-site mental health support, which may have mitigated intervention effectiveness.

Conclusions: Decision support improved processes of care but not depression outcomes. More intensive care management or specialty treatment may be needed to improve depression outcomes.

Ann Intern Med. 2006;145:477-487. www.annals.org

For author affiliations, see end of text.

Depression is a common problem worldwide. According to projections from the World Health Organization (WHO), depression will be the second leading cause of disability in the developed world by 2020 (1). One in 10 primary care patients meets criteria for major depression (2), yet underrecognition and undertreatment are common (3, 4). Untreated depression is associated with increased deaths, adverse medical outcomes, deficits in function and well-being, and increased use of health services (3, 5–9).

Multifaceted, collaborative interventions have been shown to improve depression-related outcomes in primary care (10–22). These interventions include decision support for clinicians, self-management support for patients, clinical information systems modifications, and care management. Care management typically consists of patient education and activation, symptom and treatment adherence monitoring, and self-management reinforcement (23).

Most collaborative depression interventions have relied on intensive involvement of care managers and specialists, usually shifting responsibility and workload toward mental health or research teams. Clinical systems may not be capable of sustaining this level of intensity. We therefore developed a multifaceted depression decision support intervention, which was designed to optimize primary care clinicians' abilities to treat depression without adding substantial new resources. We aimed to determine the effect of depression decision support on clinical outcomes and processes of care among patients with depression in a Veterans Affairs (VA) primary care setting.

METHODS

Design Overview

Our clinician-level, cluster randomized, controlled trial studied depression decision support versus usual care. We randomly assigned clinicians to either group and nested patients within clinician group assignment. We recruited participants between July 2002 and October 2003

See also:

Print

Editors' Notes 478
Editorial comment. 544
Summary for Patients. I-10

Web-Only

CME quiz
Conversion of figures and tables into slides

Context

Most successful disease management interventions for depression care have required intensive involvement of care managers or mental health specialists.

Contribution

The authors randomly assigned 41 primary care physicians from 5 clinics to receive either depression decision support or usual care. Depression decision support was provided by a team that included a psychiatrist and a nurse care manager and involved an initial telephone contact, patient education, monthly record review, and sending a progress report to primary care physicians every 3 months. Depression severity improved equally in both groups over 12 months, despite evidence that intervention clinicians delivered more depression-related services.

Implications

Decision support improved processes of depression care but not outcomes.

—The Editors

from 5 primary care clinics of a VA medical center and followed patients for 12 months. The local institutional review board approved the study, and all patients and clinicians gave written informed consent.

Setting

Approximately 25 000 veterans were treated during the study period in the 5 primary care clinics (3 urban and 2 rural clinics). Mental health clinicians are available on site in all clinics to provide consultation and brief treatment. A separate, more traditional mental health clinic serves approximately 8000 patients with chronic mental illnesses.

Participants

Full- and part-time staff physicians, fellows, physician assistants, and nurse practitioners were eligible to participate, and 41 (95%) of 43 eligible clinicians agreed to participate. To decrease variability in baseline depression-related knowledge and skills, we invited all clinicians to participate in the MacArthur Foundation depression education program (24–27) before randomization. In two 4-hour sessions, the program addresses communication skills and knowledge related to recognizing and managing depression.

All patients of participating clinicians were eligible for the study. Research assistants reviewed medical records of patients with upcoming primary care appointments (within 4 to 6 weeks). They excluded patients who had received treatment from mental health specialists within the previous 6 months; who had received a diagnosis of psychotic disorder, dementia, or bipolar disorder; or who were considered to be terminally ill. They mailed study introduction letters to nonexcluded patients. The letters informed the patients that the research team would call them within 2 weeks unless they declined screening by notifying the study office.

Telephone screening measures included the Patient Health Questionnaire (PHQ-9) (28) and the Short Blessed Test screening for dementia (29). We invited patients with PHQ-9 scores of 10 to 25 (moderate to severe depression) (30) to attend in-person enrollment interviews. We referred patients with PHQ-9 scores greater than 25 (very severe depression) or active dangerous ideation for urgent care, and we excluded them from participation. Enrollment interviews were scheduled within 2 weeks of primary care visits and usually took place the same day. The primary inclusion criterion was a repeated PHQ-9 score of 10 to 25 or a Hopkins Symptom Checklist-20 (SCL-20) (31) score of 1.0 or greater at the enrollment interview.

Of the 5434 patients who were mailed study introduction letters, 3500 (64%) were reached by telephone and were offered screening (**Figure 1**), and 3103 (89%) of those patients completed telephone screening. Of these patients, 560 (18%) had PHQ-9 scores between 10 and 25 and were eligible for in-person enrollment interviews. Of the 402 patients who completed the enrollment interviews, 375 had repeated PHQ-9 scores between 10 and 25 or SCL-20 scores of 1.0 or greater and were enrolled in the study.

Randomization

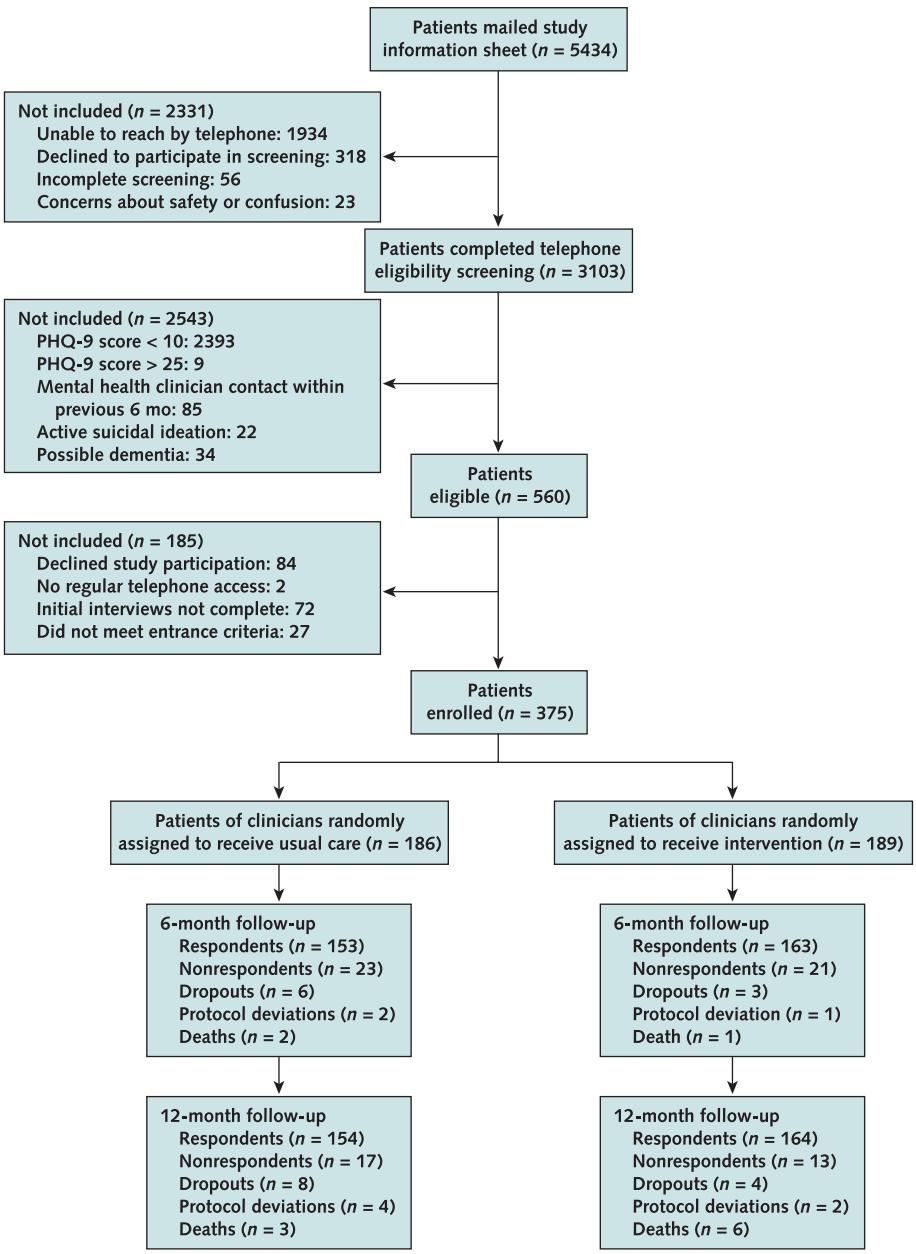
After clinicians participated in the MacArthur Foundation depression education program, we randomly assigned clinicians to receive depression decision support or to usual care. Patients were nested within clinician assignment group. A stratified technique used a random-number generator to produce equivalent distributions across clinician type (physician vs. physician's assistant or nurse practitioner) and clinic site. Clinicians in one clinic with substantial variation in caseload size were ranked by caseload and underwent block randomization.

Intervention

The depression decision support team consisted of 1 psychiatrist who was assigned up to 4 hours per week and 1 nurse care manager who was assigned up to 8 hours per week. Within 1 to 2 weeks after enrollment, the depression decision support care manager attempted to call each intervention patient to provide education, explore barriers, emphasize adherence to treatment, and encourage communication with clinicians about depression (**Table 1**). Supplemental educational materials were mailed to all intervention patients. During the telephone call, patients were invited to attend a 2-hour group depression education program led by the care manager or a depression education class offered by the mental health team in 1 of the urban clinics. Aside from this single early telephone contact, only rare additional contact between the depression decision support care manager and patients was expected.

The depression decision support team met weekly and

Figure 1. **Study flow chart.**



PHQ-9 = Patient Health Questionnaire.

reviewed PHQ-9 scores (collected by the research team at baseline and at 1, 3, 6, 9, and 12 months) and medication and appointment data from the medical records. The team reviewed each intervention patient record at least monthly. Using a database, the depression decision support care manager compiled symptom severity and adherence data, posttraumatic stress disorder and alcohol screening results (obtained from routine clinic screening), and treatment recommendations into a treatment progress report. The report was mailed to each intervention clinician for all of their enrolled patients quarterly. If primary care clinicians did not respond to initial PHQ-9 scores greater than 15 or when patients' depression did not adequately improve (PHQ-9 score >10 at 3 months or PHQ-9 score >5 at 6, 9, or 12 months), the depression decision support team reviewed records again and then contacted clinicians or their nurses to discuss treatment strategies or to offer consultation. When the depression decision support team and primary care clinician agreed that psychiatric consultation might be helpful, the psychiatrist arranged a visit. When ongoing mental health specialty care was indicated, the depression decision support team facilitated a referral.

Table 1. **Summary of Depression Decision Support Intervention and Usual Care Components**

Care Component	Usual Care	Intervention	Timing of Care Component
Initial intensive depression education program for clinicians	X	X	Before randomization
On-site mental health consultation team available	X	X	Ongoing
Primary care clinician notified that patient with depression entering study	X	X	Patient study entry = 0
Serial depression severity measurements available in chart	X	X	Baseline and 1, 3, 6, 9, and 12 months
Care manager makes telephone call to patient; patient encouraged to attend depression education class		X	1–3 weeks after study entry
Review of patient progress by depression decision support team		X	Monthly or more often
Feedback or suggestions to primary care clinician or nurse		X	3, 6, 9, or 12 months or more often
Psychiatrist consultation actively offered or suggested		X	As indicated by protocol
Facilitated referral to other mental health services when indicated		X	As indicated by protocol

Usual Care

Clinicians received notifications when their patients enrolled in the study and were provided baseline PHQ-9 scores (**Table 1**). Usual care clinicians had access to all initial and follow-up PHQ-9 scores (available in the medical record), but usual care clinicians did not receive notifications, reminders, or recommendations about scores from the depression decision support team. Usual care clinicians and their patients also had access to mental health services, including on-site mental health teams.

Outcomes and Measurements

Blinded research assistants collected baseline patient data in person and PHQ-9 scores (at 1, 3, 6, 9, and 12 months) and outcome data (at 6 and 12 months) by telephone. When patients could not be reached by telephone, research assistants mailed questionnaires to them. Baseline measures included demographic information, Medical Outcomes Study 36-item Short Form for Veterans (SF-36V) scores for health-related quality of life (32), SCL-20 score for depression severity (31), Alcohol Use Disorders Identification Test score (33, 34), PHQ scores for anxiety and panic disorders (35), Posttraumatic Stress Disorder Checklist score (36), Medical Outcomes Study pain effects score (37), and the dysthymia stem from the WHO Composite International Diagnostic Interview (38). The PHQ-9 from the enrollment interview was used to diagnose major depression (DSM-IV [*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition] criteria method) (28). We measured general medical comorbid conditions by using RxRisk-V, a version of the Chronic Disease Score derived from VA pharmacy data (39). Clinician baseline measures addressed confidence in caring for patients with depression (40), job satisfaction (41), burnout (42), and satisfaction with mental health services.

The primary study outcome was mean depression severity score (SCL-20) at 6 and 12 months. Additional outcomes included SF-36V and PHQ-9 scores, 4 items addressing satisfaction with care (43–46), antidepressant prescription durations and dosages, and health care utilization. We rated satisfaction from poor to excellent by using 5-point Likert scales. For patients who were not taking antidepressants at study entry, we determined the numbers of initial depression assessments and follow-up contacts between patients and primary care clinicians that resulted in depression-related clinical actions. Two research assistants reviewed medical charts to rate depression-related actions, which included monitoring and adjusting antidepressant treatments, making mental health referrals, or overtly documenting watchful waiting (47). An investigator arbitrated coding discrepancies. We obtained antidepressant and VA health care utilization data from the Veterans Integrated Service Network 20 (VISN 20) Data Warehouse (48), which contains reliable local and national VA data.

Statistical Analysis

On the basis of previous collaborative trials (10–12), we hypothesized a mean difference in change of SCL-20 score of 0.35 (SD, 0.5). For a cluster randomization model with one level of nesting and a 2-tailed α level of 0.05, 20 clinicians per group and 7 patients per clinician (280 patients total) would provide 80% power to detect a treatment effect size of 0.33 or greater (determined by using PASS 2002, NCSS, Kaysville, Utah).

We used *t*-tests and chi-square statistics to assess the relationships of baseline variables with SCL-20 scores at 6 or 12 months. Because we randomly assigned by clinician and nested patients within clinician assignment, we used multilevel modeling with HLM 6.0 (Scientific Software International, Lincolnwood, Illinois) for the analyses. For the outcomes, SCL-20 scores, SF-36V physical health component and mental health component scores, and time (baseline, 6 months, or 12 months) formed the first level of the model. The slope associated with the linear trend across time reflects the change in outcome from baseline to 12 months. We nested outcome scores across time within patients at the second level of the model, which included the patient-level covariates. The clinician formed the third level of the model, which included the independent variable of interest (intervention vs. usual care). We used the independent variable of intervention as a predictor of the

slope across time, which was our primary test of the effectiveness of the intervention. Therefore, if the intervention variable is a statistically significant predictor of slope across time, then the intervention and usual care groups differ in the degree of change over time. We also used 3-level models for PHQ-9 scores (baseline and 1, 3, 6, 9, and 12 months), in which we fitted both linear and quadratic models to the data. We used 2-level continuous and logistic models for satisfaction, process-of-care, and utilization variables at 12 months, with patients at the first level of the model and clinician and the independent variable of intervention versus usual care as the second level of the model. Full maximum likelihood estimation was used for all models.

Hierarchical linear modeling incorporates all patients with at least 1 time point in the first level of the model (49), and thus, we did not exclude patients from the analyses because of missing dependent variables at follow-up. We excluded patients with missing covariate data from the analyses if those covariates were included in the model ($n = 13$ [3%]). After enrollment, 11% of enrollees deviated from group assignment or study protocol, and 5 clinicians (1 intervention clinician and 4 usual care clinicians) left the VA. All results are based on intention-to-treat analyses.

Unadjusted means and proportions are presented to describe the baseline characteristics. We reported adjusted means and proportions and corresponding P values for all other models and derived them from the multilevel models using the method described by Raudenbush and Bryk (49).

Role of the Funding Source

Our study was funded by the VA Health Services Research and Development Service (Project Mental Health Initiative [MHI 20-020]). The funding source had no role in the recruitment of participants; study intervention; collection, analysis, or interpretation of the data; or preparation or review of the manuscript.

RESULTS

We collected follow-up data on 84% of enrollees at 3 months, 84% at 6 months, and 85% at 12 months. Seventy-six percent of enrollees completed both the 6- and 12-month follow-ups. Therefore, 76% of enrollees completed all 3 time points, 18% completed 2 time points, and 7% completed only 1 time point (baseline). Missingness did not vary by intervention group or baseline depression scores. Approximately two thirds of follow-up surveys were administered by telephone, and the remainder were completed by mail.

Baseline characteristics did not statistically significantly differ between the intervention and usual care clinicians (**Table 2**) and patients (**Table 3**). The patient sample is representative of local and national VA populations (51). Comorbid psychiatric and medical conditions were prevalent. The SF-36V scores were in the 10th percentile of functioning range according to national norms (52).

Clinical Outcomes

We tested dysthymia, pain, anxiety, and posttraumatic stress disorder for possible correlations with the main outcome because these variables have been identified as important predictors of depression (6, 53–55). We confirmed these relationships in bivariate analyses: Baseline dysthymia, pain effects, anxiety, and posttraumatic stress disorder diagnosis were statistically significantly correlated with SCL-20 scores. We therefore included these variables in analyses as patient-level covariates.

In the linear models, both intervention and usual care groups showed significant improvement in SCL-20 scores overall (slope, −0.382 [95% CI, −0.488 to −0.276]; $P < 0.001$) (**Figure 2**). On average, SCL-20 scores decreased by 0.382 at each time period, controlling for the covariates, for a total decrease in SCL-20 scores of 0.764 from baseline to 12 months (mean baseline SCL-20 score, 1.9). However, the slope of the change in SCL-20 depression scores over 12 months did not differ between the groups

Table 2. **Baseline Characteristics of Participating Clinicians**

Characteristic	Usual Care ($n = 21$)	Intervention ($n = 20$)
Mean (SD) age, *y**	45.1 (8.6)	45.1 (6.6)
Women, *n (%)*	10 (48)	11 (55)
Nurse practitioners or physicians' assistants, *n (%)*	7 (33)	6 (30)
Physicians, *n (%)*	14 (67)	14 (70)
Mean (SD) time since training, *y*	14.6 (8.8)	15.4 (8.5)
Mean (SD) number of patients in panel, *n*	483 (244)	493 (223)
Mean (SD) proportion of patient panel with antidepressant prescription, %	24.5 (6.2)	25.2 (5.7)
Mean (SD) confidence in providing depression care score (4 items)†	2.6 (0.59)	2.6 (0.59)
Mean (SD) burnout score (2 items)†	3.5 (1.2)	3.8 (1.0)
Mean (SD) job satisfaction score (5 items)†	3.9 (1.2)	4.2 (0.90)
Mean (SD) satisfaction with mental health services score (2 items)†	3.2 (0.71)	3.0 (0.60)

* $P \geq 0.389$ for all comparisons.
† Measured by using Likert scales: confidence, 1–4; burnout, 1–6 (reverse scoring—higher scores represent less burnout); job satisfaction, 1–6; and satisfaction with mental health services, 0–4. Greater scores represent higher satisfaction.

Table 3. **Baseline Characteristics of Patients***

Characteristic	Usual Care (*n* = 186)	Intervention (*n* = 189)
Mean (SD) age, *y*†	56.3 (11.2)	57.3 (10.9)
Women/men, *n/n*	13/173	13/176
Race or ethnicity, *n (%)*		
White	84 (45.2)	93 (49.2)
Not white	8 (4.3)	2 (1.1)
Not recorded	94 (50.5)	94 (49.7)
Married, %	49	53
Mean (SD) education, *y*	13.5 (2.4)	13.4 (2.6)
Worked during past 12 months, %	35	38
Mean (SD) baseline SCL-20 score	1.9 (0.50)	1.9 (0.57)
Mean (SD) baseline PHQ-9 score‡	14.1 (5.0)	13.6 (4.4)
Meets PHQ-9 major depression diagnosis criteria, %§	51	47
Dysthymia, %	48	46
Moderate or greater pain effects, %‖	71	65
Active alcohol use disorder, %¶	15	19
Panic disorder, %	16	13
Other anxiety disorder, %	29	21
Active posttraumatic stress disorder, %**	44	35
Mean (SD) medical comorbid condition categories (RxRisk-V††), *n*	4.1 (2.6)	4.0 (2.7)
Taking an antidepressant at study entry, %	43	39
Took antidepressant in the year before study entry, %	58	48
Mean (SD) SF-36V subscale and component score		
Physical functioning	44.1 (26.2)	44.2 (27.6)
Role physical	36.3 (27.7)	39.4 (27.5)
Bodily pain	33.8 (21.2)	35.0 (20.7)
General health	37.5 (20.3)	37.9 (17.9)
Vitality	24.7 (17.4)	23.8 (15.5)
Social functioning	37.9 (21.1)	37.9 (22.4)
Role emotional	43.7 (22.8)	48.6 (23.0)
Mental health	46.0 (15.4)	45.8 (15.9)
Physical component score	32.9 (10.2)	33.1 (10.6)
Mental component score	32.8 (8.0)	33.2 (8.2)

* PHQ-9 = Patient Health Questionnaire; SCL-20 = Hopkins Symptom Checklist-20; SF-36V = 36-item Short Form for Veterans.
† $P \geq 0.073$ for all comparisons.
‡ A PHQ-9 score between 10 and 15 indicates moderate depression severity (50).
§ ≥5 symptoms occurring more than half the days in past 2 weeks (suicide ideation counts regardless of frequency); ≥1 depressed mood or anhedonia item must be endorsed (28).
‖ ≥3, on average, of the 6 Medical Outcomes Study pain effects items.
¶ Alcohol Use Disorder Identification Test (AUDIT-C) score ≥ 5 (34).
** Posttraumatic Stress Disorder Checklist score ≥ 50 (36).
†† Version of the Chronic Disease Score derived from Veterans Affairs pharmacy data (39).

(difference, 0.020 [CI, −0.037 to 0.780]; $P = 0.49$). Similarly, overall mental health component scores improved over time in both groups (slope, 1.105 [CI, 0.420 to 1.791]; $P = 0.003$), and physical health component scores decreased in both groups (slope, −1.100 [CI, −1.645 to −0.553]; $P < 0.001$). On average, mental health component scores improved by 1.105 and physical health component scores decreased by 1.100 at each time period, controlling for covariates, for a total increase in the mental health component score of 2.21 (baseline mean score, 33.0) and a total decrease in the physical health component score of 2.20 (baseline mean score, 33.0) over 12 months. However, the difference in slopes of the mental and physical health component scores over time did not differ between the intervention group (difference, −0.008 [CI, −0.916 to 0.900]; $P = 0.98$) and the usual care group (difference, 0.636 [CI, −1.401 to 0.128]; $P = 0.111$).

The PHQ-9 scores also improved from baseline (**Figure 3**). In the quadratic multilevel model, the intervention group had greater initial improvement from baseline than the usual care group (difference in slopes, 0.248 [CI, 0.032 to 0.465]; $P = 0.019$). The 2 groups did not significantly differ in the degree to which initial improvement in PHQ-9 scores reversed over time (difference in slopes, 0.080 [CI, −0.027 to 0.187]; $P = 0.062$).

Process of Care

Intervention patients reported greater satisfaction with care than usual care patients at 12 months (adjusted means, 3.58 vs. 3.16; $P = 0.002$). Over 12 months, intervention patients were more likely to receive antidepressants than usual care patients (79.3% vs. 69.3%; $P = 0.041$) and were more likely to receive them for 90 days or more (76.2% vs. 61.6%; $P = 0.008$) but not for 180 days or more (63.1% vs. 52.3%; $P = 0.065$) (**Table 4**). Intervention patients were also more likely to receive more than 1 antidepressant at therapeutic dosages (2) (23.9% vs. 13.6%; $P = 0.028$).

Table 4 includes process-of-care variables for patients who were not taking antidepressants at baseline. Intervention patients in this subgroup were more likely to be assessed for depression by their clinicians over 12 months (93.5% vs. 77.4%; $P = 0.003$). Within this same subgroup, intervention clinicians were also more likely to perform 1 or more follow-up depression-related clinical actions per patient than usual care clinicians (84.8% vs. 53.6%; $P < 0.001$).

Utilization

Compared with those in the usual care group, patients in the intervention group were more likely to attend at least 1 mental health specialty appointment (41.1% vs. 27.2%; $P = 0.025$) (Table 4). Utilization of primary care visits, psychiatric or medical–surgical inpatient services, or emergency care did not statistically significantly differ between the groups.

Intervention Implementation

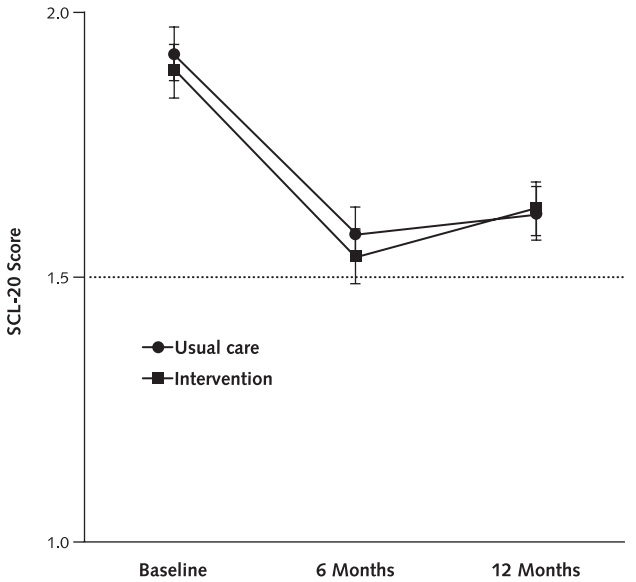
We reviewed logs and medical charts for the 172 (91%) intervention patients who received care from their assigned clinician for the entire 12 months. The depression decision support care manager conducted educational telephone calls that lasted an average of 16.6 minutes (SD, 5.5) with 155 (90%) patients. For 118 (76%) of these patients, this telephone call was the only contact with the depression decision support team. The psychiatrist met with 13% of patients and called 2 patients who declined in-person psychiatric consultation. Eight percent of patients attended a depression group education session. The depression decision support team communicated with primary care clinicians or their nurses an average of 2.2 times (SD, 1.7 [range, 0 to 8]) per patient, primarily via e-mail. Per independent ratings of the care manager and the psychiatrist and ratings of depression decision support logs by an investigator, approximately half of clinicians performed clinical actions in response to recommendations from the depression decision support team most of the time. Including training time, the depression decision support team spent 3.5 hours (SD, 2.3) per patient, of which approximately 0.5 hour involved direct patient contact.

DISCUSSION

The depression decision support intervention had a positive effect on the rates of clinicians recognizing and treating depression and on patient satisfaction but did not generate sustained improvements in depression severity or health-related quality of life compared with usual care. While PHQ-9 scores in the intervention group initially improved, this effect diminished over time. The findings suggest that the intervention influenced clinician behaviors and that differences in clinician behaviors may have been perceived by patients, as evidenced by improvements in satisfaction scores.

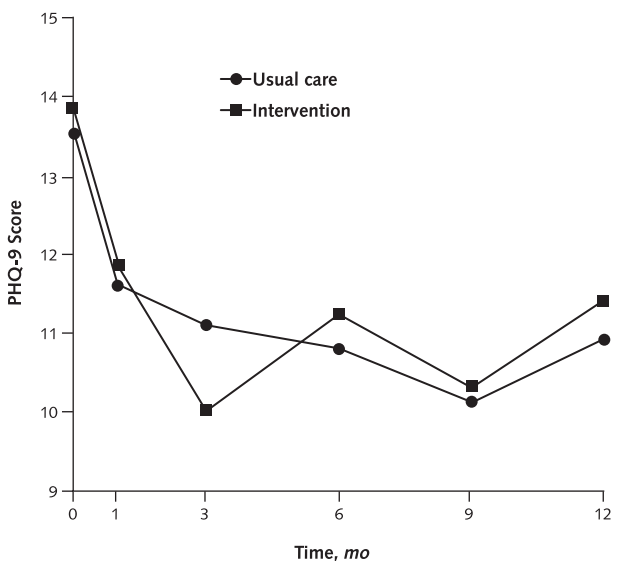
The high prevalence of comorbid conditions in the sample may have influenced our results. According to SF-36V scores, these patients had very low levels of function at baseline. Two thirds of patients reported substantial pain, most patients had several chronic medical conditions, and

Figure 2. **Unadjusted mean Hopkins Symptom Checklist-20 (*SCL-20*) depression severity scores over time.**



Mean ± SE scores for the intervention group were 1.89 ± 0.05 at baseline, 1.54 ± 0.05 at 6 months, and 1.63 ± 0.06 at 12 months. Mean ± SE scores for the usual care group were 1.92 ± 0.05 at baseline, 1.58 ± 0.06 at 6 months, and 1.62 ± 0.06 at 12 months.

Figure 3. **Unadjusted mean Patient Health Questionnaire-9 (*PHQ-9*) depression scores over time.**



$P = 0.019$ for initial improvement from baseline (quadratic model), comparing intervention and usual care groups.

Table 4. **Adjusted Proportions for Process-of-Care Variables**

Characteristic	Usual Care, %	Intervention, %	*P* Value
Received any antidepressant during study period			
Overall sample (n = 375)	69.3	79.3	0.041
Patients not taking antidepressants at baseline (n = 223)*	50.6	68.0	0.015
Received ≥90 d of therapy with an antidepressant			
Overall sample (n = 375)	61.6	76.2	0.008
Patients not taking antidepressants at baseline (n = 223)*	42.1	63.7	0.004
Received ≥180 d of therapy with an antidepressant			
Overall sample (n = 375)	52.3	63.1	0.065
Patients not taking antidepressants at baseline (n = 223)*	31.8	47.3	0.033
Received ≥90 d of therapy with a minimally therapeutic dosage of antidepressant†			
Overall sample (n = 375)	58.4	72.1	0.019
Patients not taking antidepressants at baseline (n = 223)*	37.4	59.5	0.002
Received >1 type of antidepressant at a minimally therapeutic dosage			
Overall sample (n = 375)	13.6	23.9	0.028
Attended >3 (median) primary care appointments			
Overall sample (n = 375)	49.1	39.2	0.106
Attended ≥1 appointment with mental health specialist			
Overall sample (n = 375)	27.2	41.1	0.025
Attended ≥3 appointments with mental health specialist			
Overall sample (n = 375)	16.5	22.4	0.25
Assessed for depression by their clinicians			
Patients not taking antidepressants at baseline (n = 223)*	77.4	93.5	0.003
Primary care clinician performed ≥1 follow-up depression-related action			
Patients not taking antidepressants at baseline (n = 223)*	53.6	84.8	0.000
Had ≥1 follow-up depression-related contact with staff			
Patients not taking antidepressants at baseline (n = 223)*	28.6	37.6	0.208
Attended visit with substance use disorder clinician			
Overall sample (n = 375)	2.3	3.7	0.35

* 107 usual care patients and 116 intervention patients were not taking antidepressants at study entry (P = 0.45).
† Reference 2.

40% of patients had active posttraumatic stress disorder. Moreover, dysthymia, pain effects, anxiety, and posttraumatic stress disorder were associated with worse depression outcomes. Previous reports suggest that although patients with substantial medical and psychiatric comorbid conditions often respond to depression treatment, they tend to respond to a lesser degree than patients without those conditions (53–61). Finally, 41% of patients were taking antidepressants at baseline, suggesting that some patients may have been refractory to antidepressant treatment.

We designed our study to help define the most essential elements of collaborative care (**Table 1**). While our data suggest that the intervention was implemented as intended, the intervention was not robust enough to influence clinical outcomes over time. Recent reviews of collaborative depression studies (17, 19, 23) suggest a possible association among the intensity and frequency of care management, specialty treatment, and response to depression treatment. In contrast to interventions involving more intensive contact between intervention team members and patients (10, 14), our intervention included only 1 early direct contact between the depression decision support team and each patient. In addition, all clinicians received baseline depression education and had access to on-site mental health consultation. These factors may have contributed to the limited effectiveness of depression decision support compared with usual care. We note that our PHQ-9 data echo Hedrick and colleagues' (62) findings of an early intervention effect that dissipated over time. Hedrick and colleagues' study was also performed in a VA setting with a usual care condition that included on-site mental health support.

Several other limitations are worth noting. Sampling bias might have been present because of whom we were able to reach by telephone (for example, patients who were not employed may have been overrepresented). On the

other hand, we avoided referral bias by using a screening method that required patients to opt out of being contacted. Thus, we did not select patients who were especially motivated for treatment. Together, these biases may have resulted in a sample that was more difficult to treat. Another potential limitation is that the research team collected the data used by the care manager for outcomes monitoring. However, this had several advantages. First, we could limit attention bias toward intervention patients. In most collaborative interventions, care managers monitor outcomes in conjunction with providing patient support and problem solving. Our design allowed us to study the specific effects of monitoring treatment outcomes and providing decision support. Second, symptom outcome measures can be administered by using automated systems (63) that decrease personnel time. If the intervention had been more successful, depression decision support might have been implemented into routine practice by using such a system.

Finally, primary care clinicians are under increasing pressure to address several competing issues (64). Local VA primary care panel sizes increased by 62% over the course of our study, while the average number of patient visits per year decreased by 40% (from 3.2 to 1.9 visits per year). Trends are similar in practices across the country. Despite a recent report showing that extending time between VA primary care visits did not negatively affect several performance indicators (65), decreasing clinician–patient contact may have important consequences for depression and other clinical outcomes. A previous VA intervention that emphasized electronic notifications (as opposed to clinician–patient contact) did not improve depression outcomes (66). Recent changes in primary care practice may, therefore, necessitate an approach that increases personal contact between patients and care managers or other individuals who are trained to deliver key elements of depression care over time.

In conclusion, while our results suggest that depression decision support can improve the process of care, the approach is insufficient to improve outcomes in a patient population with high rates of comorbid conditions, compared with usual care that includes on-site mental health support. Our study helps to define the boundaries of effective collaborative care for VA primary care settings and specifically indicates that more intensive and direct care management activities (for example, patient activation, self-management, and problem solving) or mental health specialty treatment over time may be critical elements of effective collaborative care for patients with complex illnesses.

From Portland Veterans Affairs Medical Center, Oregon Health & Science University, and Oregon State University, Portland, Oregon.

Disclaimer: The views expressed herein are those of the authors and do not necessarily reflect those of the U.S. Department of Veterans Affairs.

Acknowledgments: The authors thank Ginger Hanson, MS, for assistance with statistical analysis; Megan Crutchfield, BS, and Marsha W. Perkett, BA, for assistance with chart review; and the Portland Veterans Affairs Medical Center's primary care clinicians and staff whose participation made this study possible.

Grant Support: By the VA Health Services Research & Development Service (Project Mental Health Initiative [MHI 20-020]).

Potential Financial Conflicts of Interest: None disclosed.

Requests for Single Reprints: Steven K. Dobscha, MD, Portland Veterans Affairs Medical Center, PO Box 1034 (P3MHDC), Portland, OR 97207; e-mail, steven.dobscha@va.gov.

Current author addresses and author contributions are available at www.annals.org.

References

1. **Murray CJ, Lopez AD.** Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. Lancet. 1997;349:1498-504. [PMID: 9167458]

2. **Whooley MA, Simon GE.** Managing depression in medical outpatients. N Engl J Med. 2000;343:1942-50. [PMID: 11136266]

3. **Simon GE, Von Korff M.** Recognition, management, and outcomes of depression in primary care. Arch Fam Med. 1995;4:99-105. [PMID: 7842160]

4. **Ormel J, Koeter MW, van den Brink W, van de Willige G.** Recognition, management, and course of anxiety and depression in general practice. Arch Gen Psychiatry. 1991;48:700-6. [PMID: 1883252]

5. **Bruce ML, Leaf PJ, Rozal GP, Florio L, Hoff RA.** Psychiatric status and 9-year mortality data in the New Haven Epidemiologic Catchment Area Study. Am J Psychiatry. 1994;151:716-21. [PMID: 8166313]

6. **Wells KB, Stewart A, Hays RD, Burnam MA, Rogers W, Daniels M, et al.** The functioning and well-being of depressed patients. Results from the Medical Outcomes Study. JAMA. 1989;262:914-9. [PMID: 2754791]

7. **Broadhead WE, Blazer DG, George LK, Tse CK.** Depression, disability days, and days lost from work in a prospective epidemiologic survey. JAMA. 1990;264:2524-8. [PMID: 2146410]

8. **Unützer J, Patrick DL, Simon G, Grembowski D, Walker E, Rutter C, et al.** Depressive symptoms and the cost of health services in HMO patients aged 65 years and older. A 4-year prospective study. JAMA. 1997;277:1618-23. [PMID: 9168292]

9. **Simon G, Ormel J, VonKorff M, Barlow W.** Health care costs associated with depressive and anxiety disorders in primary care. Am J Psychiatry. 1995;152:352-7. [PMID: 7864259]

10. **Katon W, Von Korff M, Lin E, Walker E, Simon GE, Bush T, et al.** Collaborative management to achieve treatment guidelines. Impact on depression in primary care. JAMA. 1995;273:1026-31. [PMID: 7897786]

11. **Katon W, Robinson P, Von Korff M, Lin E, Bush T, Ludman E, et al.** A multifaceted intervention to improve treatment of depression in primary care. Arch Gen Psychiatry. 1996;53:924-32. [PMID: 8857869]

12. **Katon W, Von Korff M, Lin E, Simon G, Walker E, Unützer J, et al.** Stepped collaborative care for primary care patients with persistent symptoms of depression: a randomized trial. Arch Gen Psychiatry. 1999;56:1109-15. [PMID: 10591288]

13. **Katzelnick DJ, Simon GE, Pearson SD, Manning WG, Helstad CP, Henk HJ, et al.** Randomized trial of a depression management program in high utilizers of medical care. Arch Fam Med. 2000;9:345-51. [PMID: 10776363]

14. **Unützer J, Katon W, Callahan CM, Williams JW Jr, Hunkeler E, Harpole L, et al.** Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. JAMA. 2002;288:2836-45. [PMID: 12472325]

15. **Hunkeler EM, Meresman JF, Hargreaves WA, Fireman B, Berman WH, Kirsch AJ, et al.** Efficacy of nurse telehealth care and peer support in augmenting treatment of depression in primary care. Arch Fam Med. 2000;9:700-8. [PMID: 10927707]

16. **Simon GE, VonKorff M, Rutter C, Wagner E.** Randomised trial of monitoring, feedback, and management of care by telephone to improve treatment of depression in primary care. BMJ. 2000;320:550-4. [PMID: 10688563]
17. **Von Korff M, Goldberg D.** Improving outcomes in depression [Editorial]. BMJ. 2001;323:948-9. [PMID: 11679372]
18. **Dietrich AJ.** The telephone as a new weapon in the battle against depression [Editorial]. Eff Clin Pract. 2000;3:191-3. [PMID: 11183436]
19. **Gilbody S, Whitty P, Grimshaw J, Thomas R.** Educational and organizational interventions to improve the management of depression in primary care: a systematic review. JAMA. 2003;289:3145-51. [PMID: 12813120]
20. **Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A.** Improving chronic illness care: translating evidence into action. Health Aff (Millwood). 2001;20:64-78. [PMID: 11816692]
21. **Bodenheimer T, Wagner EH, Grumbach K.** Improving primary care for patients with chronic illness: the chronic care model, Part 2. JAMA. 2002;288:1909-14. [PMID: 12377092]
22. **Bodenheimer T, Wagner EH, Grumbach K.** Improving primary care for patients with chronic illness. JAMA. 2002;288:1775-9. [PMID: 12365965]
23. **Gerrity MS, Williams WJ, Dobscha SK, Deveau J, Holsinger T, Gaynes BN, et al.** Improving depression care: systematic review of multifaceted interventions in primary care settings [Abstract]. J Gen Intern Med. 2004;19(Suppl 1):166.
24. **Cole S, Raju M, Barrett J, Gerrity M, Dietrich A.** The MacArthur Foundation Depression Education Program for Primary Care Physicians: background and rationale. Gen Hosp Psychiatry. 2000;22:299-358. [PMID: 11203035]
25. Depression in Primary Care: Detection and Diagnosis, Volume 1. Clinical Practice Guideline Number 5. AHCPR publication no. 93-0550. Rockville, MD: Agency for Health Care Policy and Research; 1993.
26. Depression in Primary Care: Treatment of Major Depression, Volume 2. Clinical Practice Guideline Number 5. AHCPR publication no. 93-0551. Rockville, MD: Agency for Health Care Policy and Research; 1993.
27. **Gerrity MS, Cole SA, Dietrich AJ, Barrett JE.** Improving the recognition and management of depression: is there a role for physician education? J Fam Pract. 1999;48:949-57. [PMID: 10628575]
28. **Spitzer RL, Kroenke K, Williams JB.** Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA. 1999;282:1737-44. [PMID: 10568646]
29. **Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H.** Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. Am J Psychiatry. 1983;140:734-9. [PMID: 6846631]
30. **Kroenke K, Spitzer RL, Williams JB.** The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16:606-13. [PMID: 11556941]
31. **Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L.** The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. Behav Sci. 1974;19:1-15. [PMID: 4808738]
32. **Kazis LE, Miller DR, Clark JA, Skinner KM, Lee A, Ren XS, et al.** Improving the response choices on the veterans SF-36 health survey role functioning scales: results from the Veterans Health Study. J Ambul Care Manage. 2004;27:263-80. [PMID: 15287216]
33. **Babor TF, de la Fuente J, Saundres J, Grant M.** The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care. Geneva: World Health Organization; 1989.
34. **Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA.** The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. Arch Intern Med. 1998;158:1789-95. [PMID: 9738608]
35. **Spitzer RL, Williams JB, Kroenke K, Hornyak R, McMurray J.** Validity and utility of the PRIME-MD patient health questionnaire in assessment of 3000 obstetric-gynecologic patients: the PRIME-MD Patient Health Questionnaire Obstetrics-Gynecology Study. Am J Obstet Gynecol. 2000;183:759-69. [PMID: 10992206]
36. **Blanchard EB, Jones-Alexander J, Buckley TC, Forneris CA.** Psychometric properties of the PTSD Checklist (PCL). Behav Res Ther. 1996;34:669-73. [PMID: 8870294]
37. Psychometric properties of the MOS core measures. In: Hays RD, Sherbourne CD, Mazel R. User's Manual for the Medical Outcomes Study (MOS) Core Measures of Health-Related Quality of Life. Document no. MR-162-RC. Santa Monica, CA: RAND; 1995:23-44.
38. **World Health Organization.** Composite International Diagnostic Interview (CIDI). Core Version 2.1. Geneva: World Health Organization; 1997.
39. **Sloan KL, Sales AE, Liu CF, Fishman P, Nichol P, Suzuki NT, et al.** Construction and characteristics of the RxRisk-V: a VA-adapted pharmacy-based case-mix instrument. Med Care. 2003;41:761-74. [PMID: 12773842]
40. **Gerrity MS, Williams JW, Dietrich AJ, Olson AL.** Identifying physicians likely to benefit from depression education: a challenge for health care organizations. Med Care. 2001;39:856-66. [PMID: 11468504]
41. **Linzer M, Konrad TR, Douglas J, McMurray JE, Pathman DE, Williams ES, et al.** Managed care, time pressure, and physician job satisfaction: results from the physician worklife study. J Gen Intern Med. 2000;15:441-50. [PMID: 10940129]
42. **Saint S, Zemencuk JK, Hayward RA, Golin CE, Konrad TR, Linzer M, et al.** What effect does increasing inpatient time have on outpatient-oriented internist satisfaction? J Gen Intern Med. 2003;18:725-9. [PMID: 12950481]
43. **Kroenke K, West SL, Swindle R, Gilsenan A, Eckert GJ, Dolor R, et al.** Similar effectiveness of paroxetine, fluoxetine, and sertraline in primary care: a randomized trial. JAMA. 2001;286:2947-55. [PMID: 11743835]
44. **Wells KB, Sherbourne C, Schoenbaum M, Duan N, Meredith L, Unützer J, et al.** Impact of disseminating quality improvement programs for depression in managed primary care: a randomized controlled trial. JAMA. 2000;283:212-20. [PMID: 10634337]
45. **Rubenstein LV, Jackson-Triche M, Unützer J, Miranda J, Minnium K, Pearson ML, et al.** Evidence-based care for depression in managed primary care practices. Health Aff (Millwood). 1999;18:89-105. [PMID: 10495595]
46. **American Board of Internal Medicine.** Final Report on the Patient Satisfaction Questionnaire Project. Vol 2-E-1. Philadelphia: American Board of Internal Medicine; 1989.
47. **Dobscha SK, Gerrity MS, Corson K, Bahr A, Cuilwik NM.** Measuring adherence to depression treatment guidelines in a VA primary care clinic. Gen Hosp Psychiatry. 2003;25:230-7. [PMID: 12850654]
48. Overview VISN 20 Data Warehouse. Veterans Integrated Service Network 20. Accessed at www.visn20.med.va.gov/DataManagement/Documents/DW_Intro.htm at 6 April 2006.
49. **Raudenbush SW, Bryk AS.** Hierarchical Linear Models: Applications and Data Analysis Methods. 2nd ed. Thousand Oaks, CA: Sage; 2001.
50. **Kroenke K, Spitzer RL.** The PHQ-9: a new depression diagnostic and severity measure. Psychiatr Ann. 2002;32:509-15.
51. **Richardson C, Waldrop J.** Veterans: 2000. Census 2000 Brief. Washington, DC: U.S. Census Bureau; May 2003. Accessed at www.census.gov/prod/2003pubs/c2kbr-22.pdf on 1 August 2006.
52. **Kazis LE.** The Veterans SF-36 Health Status Questionnaire: development and application in the Veterans Health Administration. Monitor. 2000;5:1-2, 13-4.
53. **Bair MJ, Robinson RL, Katon W, Kroenke K.** Depression and pain comorbidity: a literature review. Arch Intern Med. 2003;163:2433-45. [PMID: 14609780]
54. **Walker EA, Katon WJ, Russo J, Von Korff M, Lin E, Simon G, et al.** Predictors of outcome in a primary care depression trial. J Gen Intern Med. 2000;15:859-67. [PMID: 11119182]
55. **Holtzheimer PE 3rd, Russo J, Zatzick D, Bundy C, Roy-Byrne PP.** The impact of comorbid posttraumatic stress disorder on short-term clinical outcome in hospitalized patients with depression. Am J Psychiatry. 2005;162:970-6. [PMID: 15863800]
56. **Koike AK, Unützer J, Wells KB.** Improving the care for depression in patients with comorbid medical illness. Am J Psychiatry. 2002;159:1738-45. [PMID: 12359681]
57. **Harpole LH, Williams JW Jr, Olsen MK, Stechuchak KM, Oddone E, Callahan CM, et al.** Improving depression outcomes in older adults with comorbid medical illness. Gen Hosp Psychiatry. 2005;27:4-12. [PMID: 15694213]
58. **Iosifescu DV, Nierenberg AA, Alpert JE, Papakostas GI, Perlis RH, Sonawalla S, et al.** Comorbid medical illness and relapse of major depressive disorder in the continuation phase of treatment. Psychosomatics. 2004;45:419-25. [PMID: 15345787]
59. **Simon GE, Von Korff M, Lin E.** Clinical and functional outcomes of depression treatment in patients with and without chronic medical illness. Psychol Med. 2005;35:271-9. [PMID: 15841684]
60. **Hasin DS, Tsai WY, Endicott J, Mueller TI, Coryell W, Keller M.** Five-year course of major depression: effects of comorbid alcoholism. J Affect Disord. 1996;41:63-70. [PMID: 8938207]

61. **Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, et al.** Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. Results from the National Comorbidity Survey. Arch Gen Psychiatry. 1994;51:8-19. [PMID: 8279933]
62. **Hedrick SC, Chaney EF, Felker B, Liu CF, Hasenberg N, Heagerty P, et al.** Effectiveness of collaborative care depression treatment in Veterans' Affairs primary care. J Gen Intern Med. 2003;18:9-16. [PMID: 12534758]
63. **Kobak KA, Taylor LH, Dottl SL, Greist JH, Jefferson JW, Burroughs D, et al.** A computer-administered telephone interview to identify mental disorders. JAMA. 1997;278:905-10. [PMID: 9302242]
64. **Rost K, Nutting P, Smith J, Coyne JC, Cooper-Patrick L, Rubenstein L.** The role of competing demands in the treatment provided primary care patients with major depression. Arch Fam Med. 2000;9:150-4. [PMID: 10693732]
65. **Schectman G, Barnas G, Laud P, Cantwell L, Horton M, Zarling EJ.** Prolonging the return visit interval in primary care. Am J Med. 2005;118:393-9. [PMID: 15808137]
66. **Rollman BL, Hanusa BH, Lowe HJ, Gilbert T, Kapoor WN, Schulberg HC.** A randomized trial using computerized decision support to improve treatment of major depression in primary care. J Gen Intern Med. 2002;17:493-503. [PMID: 12133139]

Current Author Addresses: Dr. Dobscha: Portland Veterans Affairs Medical Center, PO Box 1034 (P3MHDC), Portland, OR 97207.
Drs. Corson, Hickam, and Gerrity: Portland Veterans Affairs Medical Center, 3710 SW U.S. Veterans Hospital Road, Portland, OR 97239.
Dr. Perrin: Oregon Health & Science University, 3455 SW U.S. Veterans Hospital Road, Portland, OR 97239.
Dr. Kraemer: Oregon State University, 840 SW Gaines, MC GH212, Portland, OR 97239-2985.

Author Contributions: Conception and design: S.K. Dobscha, D.H. Hickam, D.F. Kraemer, M.S. Gerrity.
Analysis and interpretation of the data: S.K. Dobscha, K. Corson, D.H. Hickam, N.A. Perrin, D.F. Kraemer, M.S. Gerrity.
Drafting of the article: S.K. Dobscha, K. Corson, D.H. Hickam, D.F. Kraemer, M.S. Gerrity.
Critical revision of the article for important intellectual content: S.K. Dobscha, K. Corson, D.H. Hickam, N.A. Perrin, D.F. Kraemer, M.S. Gerrity.
Final approval of the article: S.K. Dobscha, K. Corson, D.H. Hickam, N.A. Perrin, D.F. Kraemer, M.S. Gerrity.
Provision of study materials or patients: S.K. Dobscha.
Statistical expertise: K. Corson, N.A. Perrin, D.F. Kraemer.
Obtaining of funding: S.K. Dobscha, D.H. Hickam, M.S. Gerrity.
Administrative, technical, or logistic support: K. Corson.
Collection and assembly of data: S.K. Dobscha, K. Corson.