

Cost-effectiveness of Systematic Depression Treatment for High Utilizers of General Medical Care

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Background: Expanding access to high-quality depression treatment will depend on the balance of incremental benefits and costs. We examine the incremental cost-effectiveness of an organized depression management program for high utilizers of medical care.

Methods: Computerized records at 3 health maintenance organizations were used to identify adult patients with outpatient medical visit rates above the 85th percentile for 2 consecutive years. A 2-step screening process identified patients with current depressive disorders, who were not in active treatment. Eligible patients were randomly assigned to continued usual care (n=189) or to an organized depression management program (n=218). The program included patient education, antidepressant pharmacotherapy initiated in primary care (when appropriate), systematic telephone monitoring of adherence and outcomes, and psychiatric consultation as needed. Clinical outcomes (assessed using the Hamilton Depression Rating Scale on 4 occasions throughout 12 months) were converted to measures of "depression-free days."

Health services utilization and costs were estimated using health plan-standardized claims.

Results: The intervention program led to an adjusted increase of 47.7 depression-free days throughout 12 months (95% confidence interval [CI], 28.2-67.8 days). Estimated cost increases were \$1008 per year (95% CI, \$534-\$1383) for outpatient health services, \$1974 per year for total health services costs (95% CI, \$848-\$3171), and \$2475 for health services plus time-in-treatment costs (95% CI, \$880-\$4138). Including total health services and time-in-treatment costs, estimated incremental cost per depression-free day was \$51.84 (95% CI, \$17.37-\$108.47).

Conclusions: Among high utilizers of medical care, systematic identification and treatment of depression produce significant and sustained improvements in clinical outcomes as well as significant increases in health services costs.

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DESPITE the prevalence^{1,2} and effect^{3,4} of depression in primary care, current management often falls short of recommended standards.⁵⁻⁸ Several randomized trials during the last decade demonstrate that organized treatment programs significantly improve the quality and outcomes of primary care depression treatment. Schulberg et al⁹ demonstrated that depression screening followed by guideline-based pharmacotherapy or psychotherapy significantly improved outcomes compared with usual care. Katon et al¹⁰⁻¹² have described 3 models of collaborative care (shared management by primary care physicians and consulting psychiatrists or psychologists) that significantly improved both quality of depression treatment and clinical outcomes. Mynors-Wallis et al¹³ have demonstrated the effective-

ness of brief, structured psychotherapy provided in primary care. We have recently described the effectiveness of a population-based depression screening and treatment program for high utilizers of medical care.¹⁴

Willingness to implement proven depression treatment programs will depend on the balance of additional benefits and additional costs. Cost-effectiveness analyses of 2 of the interventions described earlier in the introduction show modest increases in outpatient treatment costs.^{15,16} Neither of these studies examined the effect of improved depression treatment on overall health services utilization. The consistent association between depression and increased use of medical services¹⁷⁻²¹ suggests that improved depression treatment could reduce general medical expenditures, partially or fully offsetting costs of depression treatment. To our knowledge to

PARTICIPANTS AND METHODS

STUDY SETTING

The study was conducted within selected primary care clinics at Dean Health Plan of Wisconsin, Dean; Harvard Pilgrim Health Care of Massachusetts (HPHC), Boston; and Group Health Cooperative of Washington (GHC), Seattle. Participating physicians in Dean worked in group-model clinics serving suburban and rural patients, while GHC and HPHC clinics were staff-model facilities serving urban and suburban areas. Participating physicians were primarily family practitioners at GHC, internists at HPHC, and a mixture at Dean. At all 3 sites, outpatient specialty mental health care was provided by employed or affiliated clinicians. Self-referral for mental health was allowed for most Dean members and for all GHC and HPHC members. Typical coverage limits for specialty mental health visits were: at Dean, a yearly limit of \$1800 with no visit copayments; at GHC, 20 psychotherapy visits per year covered with copayments of \$10 to \$20; and at HPHC, 20 psychotherapy visits per year covered with copayments of \$5 for the first 8 visits and \$35 thereafter. Both GHC and HPHC covered psychiatric visits for medication management at parity with medical visits (ie, no annual limit, copayments equal to those for medical visits).

SCREENING AND RECRUITMENT OF PARTICIPANTS

Methods and results of the 2-stage screening process are described in an earlier publication.²² At all 3 sites, administrative databases were used to identify members in participating clinics between the ages of 23 and 63 years with continuous coverage during the past 2 years. Visitation data at each site were used to select those whose number of outpatient medical visits exceeded the 85th percentile for each of the last 2 years (either 7 or 8 visits per year). We excluded those patients receiving active depression treatment during the last 90 days (ie, specialty mental health visits or use of antidepressant medication at a therapeutic dose for at least 1 month) and those for whom the depression treatment program would be clearly inappropriate (ie, diagnosis of a bipolar or psychotic disorder during the prior 2 years, diagnosis of substance abuse during the prior 120 days, or diagnosis of a near-terminal medical condition such as metastatic malignancy). Eligible members (n=7203) were contacted for telephone screening that included the depression module of the Structured Clinical Interview for DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*).²³ Those meeting DSM-IV criteria for current major depression, as well as those reporting a recent (ie, prior 2 years) major depression now in partial remission (n=1475) were eligible for a second telephone assessment approximately 2 weeks later. This assessment included a telephone administration of the 17-item Hamilton Depression Rating Scale (HDRS)²⁴ and screening for current substance use. Those reporting any current illicit drug use and those reporting potentially harmful levels of alcohol use (more than 8 drinks per week for women or 12 drinks per

week for men) were excluded. Participants with HDRS scores of 15 or more were invited to participate in the randomized trial. Of 1295 patients completing the second-stage screening, 410 (32%) were eligible, and 407 consented to enroll in the randomized trial.

TREATMENT ASSIGNMENT

Prior to patient screening, physicians were randomly assigned (using computer-generated random numbers) to the intervention or usual care group. As each patient was screened for participation, this treatment assignment was concealed from interviewers (using sealed envelopes) until after the point of enrollment in the randomized trial.

Patients in the practices of usual care physicians were informed that telephone screening suggested depression, and they were advised that care was available in the primary care clinic. Patients in the practices of intervention group physicians were invited to participate in the depression management program (DMP) described below. All analyses were based on the assignment of the responsible primary care physician at the time of randomization (ie, intent to treat).

DEPRESSION MANAGEMENT PROGRAM

The DMP was a primary care-based intervention including education and telephone care management for all patients, antidepressant pharmacotherapy for most, and psychiatric consultation for those failing to respond to algorithm-based primary care treatment.

Prior to patient enrollment, all physicians in the intervention group completed a 2-hour training session focused on initial assessment of depression and initiation of antidepressant treatment.

Immediately after enrollment, each patient in the intervention group was invited to schedule an evaluation visit with his or her primary care physician. This structured visit (lasting approximately 30 minutes) included confirmation of the diagnosis of depression as well as assessment of prior treatment history, important complicating factors (psychotic symptoms, history of mania), and contraindications to antidepressant treatment. If appropriate, the physician initiated antidepressant treatment. Physicians also asked patients to schedule specific positive activities (eg, physical exercise or social activities) at least 2 times per week.

The protocol for antidepressant pharmacotherapy called for the use of sertraline as the first-line antidepressant, with an initial dose of 50 mg/d. Depending on response and adverse effects, dose could be increased to 100 mg/d after 4 weeks, with further increases to a maximum of 200 mg/d. Nortriptyline was the second-line medication, with an initial dose of 25 mg every night and a maximum dose of 100 mg/d. Follow-up visits with the primary care physician were scheduled at approximately 1 week, 3 weeks, 6 weeks, and 10 weeks after initiation of treatment, with later visits recommended every 10 weeks.

Prior to the initial visit, patients in the intervention program were mailed written and videotaped educational materials discussing the nature of depression, the relationship between depression and medical illness, and the

effectiveness of depression treatment. Patients initiating antidepressant treatment were also enrolled in the Rhythms education program (Pfizer Pharmaceuticals, New York, NY) which included periodic mailings during a 3-month period.

Treatment coordinators monitored all patients in the intervention program, including those who were initially declining treatment. Scheduled phone contacts for monitoring of treatment response, treatment adherence, and medication adverse effects occurred at approximately 2 weeks and 10 weeks, with additional calls at 18 weeks, 30 weeks, and 42 weeks, depending on clinical need. Coordinators also monitored records of visits made and prescriptions refilled. Treating physicians received written feedback reports following each telephone monitoring call, as well as notification of any apparent treatment dropout.

At each site, one or more psychiatric consultants were available to provide as-needed consultation—either telephone consultation with treating physicians or consultation visits with intervention patients. Primary care physicians were advised to seek consultation for any patient with persistent depression after 18 weeks.

USUAL CARE CONTROL GROUP

For patients assigned to the “usual care” group, no additional services were provided to either physicians or patients. Physicians received no information regarding patients’ participation. Patients could, however, receive any services normally available (eg, antidepressant medication, referral to specialty mental health care).

CLINICAL ASSESSMENTS

All participants in the intervention and usual care groups were contacted for blinded telephone assessments (including the HDRS) at 6 weeks, 3 months, 6 months, and 12 months after enrollment. Analyses of clinical effectiveness used the “depression-free days” measure described by Lave et al.¹⁶ This method uses data at each assessment to estimate depression-free days during an interval between 2 assessments. Each day in the interval is assigned a value between 1 (“depression free,” or an HDRS score ≤ 7) and 0 (“fully symptomatic,” or an HDRS score ≥ 22) using a linear interpolation of clinical ratings at the beginning and end of the interval. The number of depression-free days for the 12-month period equals the sum for each interval.

ESTIMATION OF HEALTH SERVICES COSTS

Health plan administrative data systems were used to extract data on all services either provided by or paid for by the health plans during the 12 months prior to and the 12 months after randomization. For these analyses, outpatient visits included all contacts with medical or ancillary providers (excluding radiology, pathology, and laboratory). Specialty mental health visits were defined according to provider specialty rather than visit content. All units of service were assigned standard codes (ie, *Current Procedural*

Terminology, Fourth Revision [CPT-4] codes and *International Classification of Diseases, Ninth Revision [ICD-9]* codes for visits and procedures, *National Drug Codes* for prescribed drugs, and diagnosis-related groups for hospitalizations). Standard codes were then translated into unit prices using Medicare’s Prospective Payment System diagnosis-related groups for inpatient stays; Medicare’s 1996 fee schedule²⁵ for inpatient physician services, outpatient visits, and procedures; and Red Book average wholesale prices (First Data Bank, San Bruno, Calif) for prescribed drugs. Costs of the depression screening program and costs of monitoring by the treatment coordinator were estimated using actual input costs (labor and overhead). Screening cost per DMP patient was calculated as total screening costs for patients of DMP physicians divided by the number of patients randomized.

ESTIMATION OF TIME-IN-TREATMENT COSTS

Follow-up assessments included detailed questions regarding time required for outpatient visits (including travel and waiting time). Time “lost” for each day of inpatient treatment was estimated at 16 hours. These time estimates were multiplied by the actual number of outpatient visits and hospital days during follow-up (based on claims data). Time costs were estimated using predicted wage rates based on age, sex, education, and baseline physical and mental health status, site, and treatment group.

DATA ANALYSIS

Clinical effectiveness (depression-free days) was modeled using ordinary least squares regression. Hospital admissions were compared using a negative binomial regression model with a log link. Outpatient visit and estimated cost measures were compared using Blough et al’s formulation²⁶ of the traditional 2-part model (ie, one equation estimating the probability of any cost and a gamma regression with log link estimating the level of cost). This method avoids potential difficulties introduced by transformation and retransformation.²⁷ We estimated a similar 2-part model for time-in-treatment costs; total social costs are the sum of health services costs and time-in-treatment costs. Standard errors and confidence intervals for utilization, cost, effectiveness, and cost-effectiveness were estimated by bootstrapping (with 1000 replications).^{28,29} All models include adjustment for age, sex, study site, baseline measures of depression severity and health status, and for clustering of patients within physicians. Models for utilization measures included indicator variables for any use in the prior year and adjustment for the logarithm of prior use. Tests for dominance of usual care (ie, positive incremental costs with negative incremental benefits) or dominance of the intervention (ie, negative incremental costs with positive incremental benefits) were also evaluated using the bootstrap method with 1000 replications. An α error level of .05 (2-sided) was used for all tests of statistical significance. Analyses were conducted using version 5.0 of the STATA software package (Stata Corp, College Station, Tex).

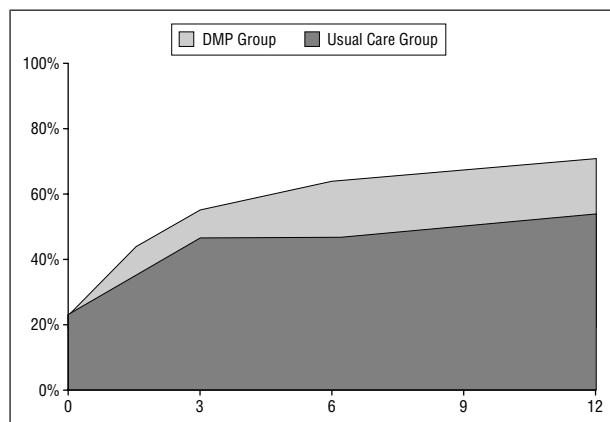
Table 1. Baseline Comparisons of Patients Assigned to DMP and Usual Care Groups*

	DMP (n = 218)	Usual Care (n = 189)
Age	45.6 (8.6)	45.4 (9.6)
Female patients, %	77	78
Baseline HDRS score	19.1 (3.4)	19.2 (3.4)
Outpatient costs for prior year†	2911 (2871)	2673 (2209)
Total cost for prior year‡	4331 (6257)	4826 (7501)

*Data are given as mean (SD) except where noted. DMP indicates depression management program, HDRS, Hamilton Depression Rating Score. For the overall test for DMP vs usual care difference, $F_{5,372} = 1.08$; $P = .37$.

†Values indicate estimated costs for all outpatient health services and exclude inpatient care, skilled nursing care, and home health care.

‡Values indicate estimated costs for all health services (inpatient, outpatient, skilled nursing, and home health).



Proportion of days "depression free" calculated according to the method of Lave et al.¹⁶ For each group, the area under the curve reflects the total number of depression-free days during 12 months.

date, that possibility has not been examined in experimental studies.

This article examines incremental cost and cost-effectiveness of a population-based program to identify and treat depression among high utilizers of general medical care. As reported previously,¹⁴ this program resulted in increased probability of initiating depression treatment, increased intensity of depression treatment, and significant improvements in both clinical and functional outcomes.

RESULTS

STUDY SAMPLE

Patients assigned to the DMP (n=218) and those assigned to usual care (n=189) did not differ significantly on baseline measures (**Table 1**). Utilization and estimated cost results are based on the 374 patients (92% of those randomized) enrolled in respective health plans throughout the 12-month follow-up period. Treatment effectiveness and cost-effectiveness results are based on the 369 patients (91% of those randomized) enrolled for 12 months who completed all 4 blinded follow-up assessments. Neither follow-up participation nor disen-

Table 2. Service Utilization by DMP and Usual Care Patients During 12 Months After Randomization*

	DMP (n = 205)	Usual Care (n = 169)	Adjusted Difference	95% CI for Difference
Specialty MH visits/y†	1.7 (4.5)	1.2 (3.4)		
Other outpatient visits/y‡	18.4 (14.8)	16.7 (12.8)		
Total outpatient visits/y	20.1 (15.7)	18.0 (13.8)	+3.20	+0.70-+5.80
MH hospital admissions/y	0.02 (0.23)	0		
Other admissions/y§	0.23 (0.63)	0.18 (0.47)		
Total admissions/y	0.26 (0.66)	0.18 (0.47)	+0.08	-0.02-+0.20

*Data are given as mean (SD) except where noted. DMP indicates depression management program; CI, confidence interval; and MH, mental health. Standard deviations do not account for clustering of patients within physicians.

†Indicates outpatient visits to specialty mental health providers.

‡Indicates all outpatient visits except those to specialty mental health providers.

§Indicates all hospital admissions except those to mental health facilities.

rollment was related to clinical or demographic characteristics assessed at baseline.

TREATMENT EFFECTIVENESS

Effects of the DMP on treatment received and patient outcomes have been reported in an earlier publication.¹⁴ During the first 6 months of treatment, DMP patients were significantly more likely either to receive any antidepressant treatment (82% vs 32%, $P < .001$) or to fill at least 3 antidepressant prescriptions (69% vs 18%, $P < .001$). As shown in the **Figure**, the proportion of depression free days increased in both groups over time, but this proportion was greater in the DMP group at every follow-up assessment. The total number of depression-free days (ie, the area under the curves shown in the **Figure**) was 229.3 days in the DMP group compared with 181.9 days among patients receiving usual care. The adjusted difference was 47.4 days (95% confidence interval, 26.6-68.2).

HEALTH SERVICES UTILIZATION AND ESTIMATED COSTS

As presented in **Table 2**, DMP patients made approximately 2 additional outpatient visits during the follow-up period (adjusted difference, 3.2 visits). While hospitalizations during the follow-up period were slightly more frequent in the DMP group, this difference was not statistically significant ($P = .14$). For both hospitalizations and outpatient visits, specialty mental health care accounted for less than 10% of utilization in both groups.

Estimated outpatient costs were \$675 higher in the DMP group, with antidepressant prescriptions accounting for \$412 of this difference (**Table 3**). Direct intervention program costs (ie, screening and monitoring by the treatment coordinator) were approximately \$135 per patient. Estimated inpatient costs were \$839 higher in

the DMP group, but confidence limits for inpatient costs were considerably wider than those for outpatient costs.

INCREMENTAL COST AND COST-EFFECTIVENESS

As presented in **Table 4**, estimates of incremental cost clearly exceeded zero for all 3 categories examined (outpatient health services, total health services, and health services plus time in treatment). After adjustment, outpatient services and inpatient services each contributed approximately \$1000 to incremental costs, while time costs contributed approximately \$500. Incremental cost-effectiveness ratios for the comparison of DMP with usual care are given in the third column of Table 4. Outpatient services and inpatient services each contributed approximately \$20 per additional depression-free day. In a bootstrap analysis, dominance of DMP over usual care (ie, greater effectiveness and lower cost) was seen in only 1 of 1000 cases, and dominance of usual care over DMP was never observed.

COMMENT

In a population of high utilizers of general medical care, an organized DMP produced significant and sustained gains in time free of depression, as well as significant increases in estimated health services costs and time in treatment costs. These findings place this DMP in the same category as most proven medical treatments: achieving better health requires investment of additional resources. Decision makers must choose among competing uses of health resources based on expected value (the cost per gain in health outcomes).

Interpretation of these data should consider several limitations. First, our results might not generalize to other populations (eg, elderly adults, uninsured people, those who are not high utilizers of medical services) or to dissimilar health care systems. Second, we do not consider broader perspectives such as costs to the employer (eg, lost work productivity) or the larger society (eg, educational attainment, marital stability). Third, our notification of usual care patients regarding diagnoses of depression, while necessary for ethical reasons, may have led some patients to seek depression treatment, and reduced differences between groups in clinical effectiveness and cost. Fourth, actual implementation of this program might produce less dramatic effects on treatment received, leading to smaller effects on both utilization and outcomes. Finally, our cost estimates are based on standard prices and might not reflect true costs of providing services. For example, drug prices for large institutional purchasers may be 10%-20% lower than average wholesale prices, and expected future costs of generic alternatives may be lower still. Consequently, our results may overstate pharmacy costs (the largest single component of incremental cost).

We identify 2 limitations in the scope of our analyses that might lead to less favorable cost-effectiveness estimates. First, a 12-month period may underestimate long-term effectiveness (which continued to increase throughout 12 months) and overestimate long-term

Table 3. Unadjusted Cost Components for DMP and Usual Care Groups*

	DMP (n = 205)	Usual Care (n = 169)
Screening†	83 (0)	0
Treatment coordinator‡	52 (49-55)	0
Intervention program costs	135 (132-138)	0
Specialty MH outpatient visits	123 (79-166)	86 (43-129)
Antidepressant prescriptions	599 (492-706)	187 (97-277)
Other prescriptions§	1072 (833-1311)	952 (764-1140)
Other outpatient services	1596 (1358-1835)	1490 (1248-1732)
Total outpatient services	3390 (2945-3835)	2715 (2324-3106)
Specialty MH inpatient	87 (-33-206)	0
Other inpatient services¶	1946 (1093-2800)	1194 (604-1784)
Total inpatient services	2033 (1166-2900)	1194 (604-1784)
Long-term care#	125 (-123-373)	0
Total health services costs	5549 (4313-6784)	3909 (3123-4695)
Time in treatment costs	1636 (1356-1916)	1337 (1174-1499)

*Data are given (in dollars) as mean (95% confidence interval). DMP indicates depression management program; MH, mental health.

†Costs include total screening costs divided by number of patients enrolled in randomized trial.

‡Costs include costs of supervision by study psychiatrist.

§Costs include costs of all prescriptions except those for antidepressant drugs.

||Costs include costs of all outpatient health services except those listed above.

¶Costs include costs of all inpatient services except those provided at mental health facilities.

#Costs include costs of skilled nursing facility care and home health care.

Table 4. Incremental Cost of Depression Screening and Treatment*

	Incremental Cost	Cost per Additional Depression-free Day
Outpatient health services	1008 (534-1383)	21.12 (10.53-37.61)
Plus inpatient health services	1974 (848-3171)	41.34 (16.04-81.03)
Plus time in treatment costs	2475 (880-4138)	51.84 (17.37-108.47)

*Data are given (in dollars) as mean (95% confidence interval). All values include screening and monitoring costs. Differences between Table 3 and Table 4 reflect adjustment for age, sex, study site, baseline depression severity, and costs for the 12 months prior to randomization (n = 202 for the depression management program group; n = 167 for the usual care group).

cost (which might decline during maintenance treatment).³⁰ Second, we do not include the effects of treatment not captured by HDRS scores, such as the observed improvements in social function and general health perception.¹⁴

While the incremental cost of this program may seem greater than for other primary care interventions, most of this apparent difference probably reflects differences in methods. Lave et al¹⁶ reported incremental health services costs of approximately \$740 for guideline-based pharmacotherapy and \$840 for interpersonal psychotherapy (compared with usual primary care). VonKorff et al¹⁵ reported incremental costs of \$260 to \$490 for a collaborative care treatment program among patients with major depression. Both of these

reports included only outpatient health services costs. Neither report considered costs of identifying eligible patients or monitoring participation in the treatment program. If our analysis is restricted to comparable categories (ie, excluding screening costs, treatment coordinator costs, and inpatient costs), incremental costs were approximately \$550.

Our estimates of time in treatment costs (\$1636 for DMP patients, \$1337 for usual care) are much higher than those reported by Lave et al (\$122 for usual care, \$214 for pharmacotherapy, \$366 for psychotherapy). Some of this difference reflects our high-utilizing population: an average of 18 medical visits throughout 12 months, compared with 7 in the Lave et al study. In addition, our patients' reports of time per visit were 3 times as great as those from national survey data used by Lave et al. Finally, we monetized time in treatment using sample-specific wage rates in 1995 dollars rather than national norms for 1989. Using our methods, the value of patients' time spent on a typical primary care visit (including travel and waiting time) exceeds the Medicare fee schedule price. We suspect that decision makers give much less weight to time costs born by patients than to smaller components of treatment costs born directly by insurers.

Our data are not consistent with the hypothesis that improved depression treatment reduces overall health care expenditures during a 12-month period. Instead, we estimate an increase of \$1974, and a complete cost-offset effect (ie, lower costs in the DMP group) occurred in only 22 of 1000 replications. The increase in outpatient costs was relatively precise and occurred in areas targeted by the intervention program (antidepressant prescriptions and follow-up visits). We did not observe offsetting decreases in other components of outpatient utilization. The increase in estimated inpatient costs was less precise and was not clearly linked to any component of the intervention program; this finding requires replication. We should point out that DMP patients made 3 additional outpatient visits (compared with usual care) while the protocol called for up to 8 medication monitoring visits. This suggests that effective depression treatment for high utilizers can integrate with ongoing medical care, requiring only a small increase in visit rates.

Comparing the value of improved depression treatment with other health care programs requires a common measure such as cost per quality-adjusted life-year (QALY). Unfortunately, no method for translating depressive symptom measures into health utility or QALYs is well established. Our review of available literature³¹ suggests that the transition from fully symptomatic depression (ie, an HDRS score of 22 or higher) to remission (ie, an HDRS score of 7 or lower) is associated with an improvement in health utility of approximately 0.35.³²⁻³⁵ This is slightly more conservative than the estimate of 0.41 used by Lave et al.¹⁶ Applying this measure, the additional 47 depression-free days among DMP patients would equal approximately 0.05 QALYs. Our cost-effectiveness estimates presented in Table 4 would translate to ratios of approximately \$22 000 per QALY for outpatient services, \$43 100 per QALY for total health services, and \$49 500 per QALY for health

services plus time in treatment. Even before discounting for inflation, our estimated cost-effectiveness ratio is similar to those for other generally accepted medical interventions^{36,37} (such as use of tissue plasminogen activator for myocardial reperfusion³⁸ and pharmacotherapy for hypercholesterolemia among patients at moderate risk for heart disease³⁹).

We should also highlight that our cost-effectiveness estimate is based on a true experiment rather than the more commonly used decision-analytic model. Modeling studies typically depend on optimistic assumptions (eg, increased use of general medical services among depressed patients is completely owing to depression and completely reversible through treatment) and that treatment effects transfer perfectly from efficacy studies to actual practice. For this reason, our estimated cost-effectiveness of depression treatment may be conservative (ie, less favorable cost per QALY ratios) compared with model-based estimates in psychiatry and general medicine.

The argument for more equitable funding of mental health treatment is often framed in terms of cost savings or cost-offset—that improved depression treatment will reduce overall health care expenditures. Our analyses limited to health sector costs do not find evidence for such a cost-offset effect. As we⁴⁰ and others⁴¹ have argued, however, cost savings should not be the primary justification for providing effective mental health care. Claims focused on cost savings ignore the true purposes of treatment—reduction in morbidity and improvement in quality of life. Cost-effectiveness analyses explicitly consider the value created when money is invested in health services. We find that implementation of a systematic depression treatment program for high utilizers of medical services leads to an increase of approximately \$40 000 in health services costs per QALY gained—a cost-effectiveness ratio commensurate with other generally accepted medical interventions.

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REFERENCES

1. Spitzer R, Williams JBW, Kroenke K, Linzer M, deGruy FV, Hahn SR, Brody D, Johnson JG. Utility of a new procedure for diagnosing mental disorders in primary care: the PRIME-MD 1000 study. *JAMA*. 1994;272:1749-1756.
2. Ustun T, Sartorius N. *Mental Illness in General Health Care*. New York, NY: John Wiley & Sons; 1995.
3. Ormel J, VonKorff M, Ustun TB, Pini S, Korten A, Oldehinkel T. Common mental disorders and disability across cultures. *JAMA*. 1994;272:1741-1748.
4. Wells K, Stewart A, Hays R, Burnam M, Rogers W, Daniels M, Berry S, Greenfield S, Ware J. The functioning and well-being of depressed patients: results from the Medical Outcome Study. *JAMA*. 1989;262:914-919.
5. Simon G, VonKorff M, Wagner EH, Barlow W. Patterns of antidepressant use in community practice. *Gen Hosp Psychiatry*. 1993;15:399-408.
6. Katzelnick D, Kobak K, Jefferson J, Greist JHH. Prescribing patterns of antidepressant medications for depression in an HMO. *Formulary*. 1996;31:374-388.
7. Katz S, Kessler R, Lin E, Wells K. Medication management of depression in the United States and Canada. *J Gen Intern Med*. 1998;13:77-85.

8. Wells K, Katon W, Rogers B, Camp P. Use of minor tranquilizers and antidepressant medications by depressed outpatients: results from the Medical Outcomes Study. *Am J Psychiatry*. 1994;151:694-700.
9. Schulberg H, Block MR, Madonia MJ, Scott C, Rodriguez E, Imber S, Perel J, Lave J, Houck P, Coulehan JL. Treating major depression in primary care practice: eight-month clinical outcomes. *Arch Gen Psychiatry*. 1996;53:913-919.
10. Katon W, VonKorff M, Lin E, Walker E, Simon G, Bush T, Robinson P, Russo J. Collaborative management to achieve treatment guidelines: impact on depression in primary care. *JAMA*. 1995;273:1026-1031.
11. Katon W, Robinson P, VonKorff M, Lin E, Bush T, Ludman E, Simon G, Walker E. A multifaceted intervention to improve treatment of depression in primary care. *Arch Gen Psychiatry*. 1996;53:924-932.
12. Katon W, VonKorff M, Lin E, Simon G, Walker G, Unutzer J, Bush T, Russo J, Ludman E. Stepped collaborative care for primary care patients with persistent symptoms of depression. *Arch Gen Psychiatry*. 1999;56:1109-1115.
13. Mynors-Wallis L, Gath DH, Lloyd-Thomas AR, Tomlinson D. Randomised controlled trial comparing problem solving treatment with amitriptyline and placebo for major depression in primary care. *BMJ*. 1995;310:441-445.
14. Katzelnick D, Simon G, Pearson S, Manning W, Helstad C, Henk H, Cole S, Lin E, Taylor L, Kobak K. Randomized trial of a depression management program in high utilizers of medical care. *Arch Fam Med*. 2000;9:345-351.
15. VonKorff M, Katon W, Bush T, Lin E, Simon G, Saunders K, Ludman E, Walker E, Unutzer J. Treatment costs, cost offset, and cost-effectiveness of collaborative management of depression. *Psychosom Med*. 1998;60:143-149.
16. Lave J, Frank R, Schulberg H, Kamlet M. Cost-effectiveness of treatments for major depression in primary care practice. *Arch Gen Psychiatry*. 1998;55:645-651.
17. Simon G, Ormel J, VonKorff M, Barlow W. Health care costs associated with depressive and anxiety disorders in primary care. *Am J Psychiatry*. 1995;152:352-357.
18. Simon G, VonKorff M, Barlow W. Health care costs of primary care patients with recognized depression. *Arch Gen Psychiatry*. 1995;52:850-856.
19. Unutzer J, Patrick DL, Simon G, Grembowski D, Walker E, Rutter C, Katon W. Depressive symptoms and the cost of health services in HMO patients aged 65 and older: a 4-year prospective study. *JAMA*. 1997;277:1618-1623.
20. Henk H, Katzelnick DJ, Kobak KA, Greist JH, Jefferson JW. Medical costs attributed to depression among patients with a history of high medical expenses in a health maintenance organization. *Arch Gen Psychiatry*. 1996;53:899-904.
21. Manning W, Wells KB. The effects of psychological distress and psychological well-being on use of medical services. *Med Care*. 1992;30:541-553.
22. Pearson S, Katzelnick D, Simon G, Manning W, Helstad C, Henk H. Depression among high utilizers of medical care. *J Gen Intern Med*. 1999;14:461-468.
23. First M, Spitzer R, Gibbon M, Williams J. *Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I), Clinician Version*. Washington, DC: American Psychiatric Press; 1997.
24. Hamilton MA. A rating scale for depression. *J Neurol Neurosurg Psychiatry*. 1960;23:56-62.
25. Health Care Financing Administration. *Physician Fee Schedule for Calendar Year 1996*. Vol 60. Washington, DC: Federal Register; 1995.
26. Blough D, Madden C, Hornbrook M. Modeling risk using generalized linear models. *J Health Econ*. 1999;18:151-173.
27. Manning W. The logged dependent variable, heteroscedasticity, and the retransformation problem. *J Health Econ*. 1998;17:283-295.
28. Manning W, Fryback D, Weinstein M. Reflecting uncertainty in cost-effectiveness analyses. In: Gold M, Siegel J, Russell L, Weinstein M, eds. *Cost-Effectiveness in Health and Medicine*. New York, NY: Oxford University Press; 1996.
29. Efron B, Tibshirani R. *An Introduction to the Bootstrap*. New York, NY: Chapman & Hall; 1993.
30. Meltzer D. Accounting for future costs in medical cost-effectiveness analysis. *J Health Econ*. 1997;16:33-64.
31. Revicki D, Wood M. Patient-assigned health state utilities for depression-related outcomes: differences by depression severity and antidepressant medications. *J Affect Disord*. 1998;48:25-36.
32. Kaplan R. Using general measures of health-related quality of life to assess mental health outcomes. In: Miller N, Magruder K, eds. *Cost-Effectiveness of Psychotherapy: A Guide for Practitioners, Researchers, and Policy-Makers*. New York, NY: Oxford University Press; 1999.
33. Fryback D, Dasbach E, Klein R, Klein B, Dorn N, Peterson K, Martin P. The Beaver Dam health outcomes study: initial catalog of health state quality factors. *Med Decis Making*. 1993;13:89-102.
34. Pyne J, Patterson T, Kaplan R, Ho S, Gillin J, Golshan S, Grant I. Preliminary longitudinal assessment of quality of life in patient with major depression. *Psychopharmacol Bull*. 1997;33:23-29.
35. Wells K, Sherbourne C. Functioning and utility for current health of patients with depression or chronic medical conditions in managed, primary care practices. *Arch Gen Psychiatry*. 1999;56:897-904.
36. Gold M, Siegel J, Russell L, Weinstein M. *Cost-Effectiveness in Health and Medicine*. New York, NY: Oxford University Press; 1996.
37. Tengs T, Adams M, Pliskin J, Safran D, Siegel J, Weinstein M, Graham J. Five-hundred life-saving interventions and their cost-effectiveness. *Risk Anal*. 1995;15:369-390.
38. Mark D, Hlatky M, Califf R, Naylor C, Lee K, Armstrong P, Garbush G, White H, Simoons M, Nelson C, Clapp-Channing N, Knight J, Harrell F, Simes J, Topol E. Cost effectiveness of thrombolytic therapy with tissue plasminogen activator as compared with streptokinase for acute myocardial infarction. *N Engl J Med*. 1995;332:1418-1424.
39. Goldman L, Weinstein M, Goldman P, Williams L. Cost-effectiveness of HMG-CoA reductase inhibition for primary and secondary prevention of coronary heart disease. *JAMA*. 1991;265:1145-1151.
40. Simon G, Katzelnick D. Depression, use of medical services, and cost-offset effects. *J Psychosom Res*. 1997;42:333-344.
41. Frank R, McGuire T, Normand S, Goldman H. The value of mental health care at the system level: the case of treating depression. *Health Aff (Millwood)*. 1999;18:71-88.