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

Gregory E. Simon, MD, MPH; Willard G. Manning, PhD; David J. Katzelnick, MD; Steven D. Pearson, MD; Henry J. Henk, MS; Cindy P. Helstad, PhD

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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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. 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). 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) 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. 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 \( \leq 7 \)) and 0 (“fully symptomatic,” or an HDRS score \( \geq 22 \)) 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 schedule for inpatient physician services, outpatient visits, and procedures; and Red Book average wholesale prices (First Data Bank, San Bruno, Cali) 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 formulation 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. 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). 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 \( \alpha \) 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).
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, 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 disenrollment 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. During the first 6 months of treatment, DMP patients were significantly more likely 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 $300. 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 cost (which might decline during maintenance treatment). 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.

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 al reported incremental health services costs of approximately $740 for guideline-based pharmacotherapy and $840 for interpersonal psychotherapy (compared with usual primary care). VonKorff et al reported incremental costs of $260 to $490 for a collaborative care treatment program among patients with major depression. Both of these

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Table 4. Incremental Cost of Depression Screening and Treatment*

<table>
<thead>
<tr>
<th>Description</th>
<th>DMP (n = 205)</th>
<th>Usual Care (n = 169)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatient health services</td>
<td>1008 (534-1383)</td>
<td>21.12 (10.53-37.61)</td>
</tr>
<tr>
<td>Plus inpatient health services</td>
<td>1974 (848-3171)</td>
<td>41.34 (16.04-81.03)</td>
</tr>
<tr>
<td>Plus time in treatment costs</td>
<td>2475 (880-4138)</td>
<td>51.84 (17.37-108.47)</td>
</tr>
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* 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).
that the transition from fully symptomatic depression (ie, total health services, and $49500 per QALY for health QALYs. Our cost-effectiveness estimates presented in applicable symptom measures into health utility or QALYs is well established. Our review of available literature 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. This is slightly more conservative than the estimate of 0.41 used by Lave et al. Applying this measure, the additional 47 depression-free patient 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 literature 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. This is slightly more conservative than the estimate of 0.41 used by Lave et al. 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 $22000 per QALY for outpatient services, $43100 per QALY for total health services, and $49500 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 (such as use of tissue plasminogen activator for myocardial reperfusion and pharmacotherapy for hypercholesterolemia among patients at moderate risk for heart disease).

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 we and others 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 $40000 in health services costs per QALY gained—a cost-effectiveness ratio commensurate with other generally accepted medical interventions.

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Corresponding author and reprints: Gregory E. Simon, MD, MPH, Center for Health Studies, 1730 Minor Ave, Suite 1600, Seattle, WA 98101-1448 (e-mail: simon_g@ghc.org).

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