ORIGINAL ARTICLE

Cost-effectiveness of Improving Primary Care Treatment of Late-Life Depression

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Context: Depression is a leading cause of functional impairment in elderly individuals and is associated with high medical costs, but there are large gaps in quality of treatment in primary care.

Objective: To determine the incremental cost-effectiveness of the Improving Mood Promoting Access to Collaborative Treatment (IMPACT) collaborative care management program for late-life depression.

Design: Randomized controlled trial with recruitment from July 1999 to August 2001.

Setting: Eighteen primary care clinics from 8 health care organizations in 5 states.

Participants: A total of 1801 patients 60 years or older with major depression (17%), dysthymic disorder (30%), or both (53%).

Intervention: Patients were randomly assigned to the IMPACT intervention (n=906) or to usual primary care (n=895). Intervention patients were provided access to a depression care manager supervised by a psychiatrist and primary care physician. Depression care managers offered education, support of antidepressant medications prescribed in primary care, and problem-solving treatment in primary care (a brief psychotherapy).

Main Outcome Measures: Total outpatient costs, depression-free days, and quality-adjusted life-years.

Results: Relative to usual care, intervention patients experienced 107 (95% confidence interval [CI], 86 to 128) more depression-free days over 24 months. Total outpatient costs were $295 (95% CI, –$525 to $1115) higher during this period. The incremental outpatient cost per depression-free day was $2.76 (95% CI, –$4.95 to $10.47) and incremental outpatient costs per quality-adjusted life-year ranged from $2519 (95% CI, –$4517 to $9554) to $5037 (95% CI, –$9034 to $19 108). Results of a bootstrap analysis suggested a 25% probability that the IMPACT intervention was "dominant" (ie, lower costs and greater effectiveness).

Conclusions: The IMPACT intervention is a high-value investment for older adults; it is associated with high clinical benefits at a low increment in health care costs.

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Group Information: A list of the Improving Mood Promoting Access to Collaborative Treatment (IMPACT) Investigators appears on page 1319.

MAJOR DEPRESSION AND dysthymia are common in older patients, particularly those with chronic medical illness.[1] Late-life depression is associated with an increased burden of physical symptoms[2] and functional impairment.[3] Depression also impairs one's ability to adhere to self-management regimens (diet, exercise, quitting smoking, taking medication regularly), potentially worsening the course of chronic medical illness.[4,5] Finally, late-life depression has been associated with significant increases in health care costs, even after adjusting for severity of comorbid medical illnesses.[6,7]

The treatment of older adults with depression in primary care is particularly challenging because of multiple competing priorities including medical comorbidities; decreasing physical function; adverse health behaviors, such as obesity and smoking[8,9]; and social stressors (such as the losses of friends and family). Several studies have tested interventions to improve outcomes of elderly patients with depression in primary care,[10,11] but, to our knowledge, the cost-effectiveness of improving care for late-life depression has not been examined.

The Improving Mood Promoting Access to Collaborative Treatment (IMPACT) trial enrolled 1801 elderly primary care patients with major depression and dysthymia and substantial medical comorbidity from 8 diverse health care organizations.[10,12,13] The tri-

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al's stepped collaborative care intervention markedly improved quality of care and outcomes of depression compared with usual care.[10,12,13] In this article, we report, to our knowledge, the first cost-effectiveness analysis of systematically improving depression care for older adults.

METHODS

The IMPACT trial was conducted in 18 primary care clinics affiliated with 8 diverse health care organizations in 7 distinct geographic areas across the United States. These clinics ranged from small practices with 3 physicians to large practices with 60 physicians. Detailed information on the methods and clinical outcomes of this trial has been provided elsewhere.[10,12,13] The institutional review boards from each participating organization and the study coordinating center approved the study procedures and all patients signed written informed consent.

Participants were either identified by systematic depression screening or referred by primary care physicians. Inclusion criteria included age 60 years or older, meeting current major depression and/or dysthymia criteria on the *Structured Clinical Interview for* DSM-IV *Axis I Disorders, Clinician Version*,[14] and plans to continue to use a participating primary care clinic over the next year. Exclusion criteria included current alcohol abuse, severe cognitive dysfunction, acute risk of suicide, and a history of bipolar disorder or psychosis. Recruitment of study patients was from July 1999 to August 2001. During this period, approximately 2% to 3% of the older population served by the participating clinics were enrolled in the IMPACT trial.[10,12] Patients who met the eligibility criteria and agreed to participate in the study were randomly assigned to either the IMPACT intervention or to usual care.

INTERVENTION

The IMPACT intervention was a 1-year, stepped collaborative care approach that included either a nurse or psychologist care manager working in the participant's primary care clinic to support the patient's regular primary care physician. The depression care manager completed an initial biopsychosocial history and provided education about antidepressant medication and psychotherapy approaches to treatment. All patients were encouraged to engage in behavioral activation and were offered a choice of treatment with an antidepressant medication or problem-solving treatment in primary care (PST-PC).[15-17] The PST-PC was a 6- to 8-session psychotherapy program designed for primary care patients[15-17] that has been found to be as effective as antidepressant medication for treating major depression.[16] The depression care manager received weekly supervision by a primary care physician with geriatric expertise and a psychiatrist to monitor progress of cases and to adjust treatment plans according to a stepped-care treatment algorithm.[12] This algorithm guided short-term and continuation therapy and relapse-prevention recommendations over the 12-month treatment period. The depression care manager followed up with patients in person or by telephone approximately every 2 weeks during short-term treatment and approximately monthly during the continuation phase. Depression care managers received training on pharmacotherapy and PST-PC during a 2-day workshop that included didactic training with a treatment manual[17] and role-plays and completed at least 5 videotaped training cases of PST-PC supervised by a psychologist.

USUAL CARE

Patients assigned to usual care had their physicians notified of their diagnoses and could receive all treatments routinely provided for depression (antidepressant medication and supportive counseling by their physician, as well as self- or physician referral to specialty mental health care).

OUTCOME MEASURES

Patients had a baseline interview prior to treatment assignment and were then interviewed blind to intervention status by a telephone survey team at the 3-, 6-, 12-, 18-, and 24-month follow-ups. Our primary health outcome was severity of depression measured by the 20-item Hopkins Symptom Checklist (HSCL-20).[18] Following the method developed by Lave and colleagues,[19] we used the HSCL-20 depression scores from baseline and follow-up assessments to estimate the number of depression-free days during the 24-month follow-up period. This method uses consecutive depression severity measures to estimate depression severity for each day during the interval by linear interpolation.[19,20] A score of 0.5 or less on the HSCL-20 was used to indicate remission and a fully depression-free day, and a score of 1.7 or more was used to indicate that the patient was "fully symptomatic."[20] Days with intermediate severity scores were assigned a value between depression-free and fully symptomatic by linear interpolation. Estimates for each follow-up interval were then summed to yield the total number of depression-free days during the 24-month follow-up period.

This article describes costs based on the payer's perspective. The intent was to capture in these 8 diverse organizations the costs of providing the actual services. In capitated systems, this was derived from cost-accounting data, and in fee-for-services systems, it was approximated by the actual revenue generated for the services provided (not the charges). Our primary cost outcome was total costs for outpatient care (mental health– and non–mental health–related costs, including pharmacy costs). Given that many health care organizations are not at risk for medication costs, we also evaluated total outpatient costs excluding medication costs. We did not have an a priori hypothesis regarding the effect of the intervention on inpatient costs but we describe these costs.

We estimated the incremental cost-effectiveness of the IMPACT intervention by comparing the 2-year difference in total outpatient costs in intervention and usual care control patients divided by the difference in depression-free days during this period.

In our analysis of outpatient costs, we defined mental health costs as the estimated costs of all antidepressant prescriptions, all outpatient specialty mental health care, and all intervention-specific costs. We estimated the costs of providing the IMPACT intervention based on detailed study records of all patient contacts (in person and telephone), mean salary and benefit costs of depression care managers plus 30% overhead costs, the cost of supervision and consultation from team psychiatrists and primary care experts at each site plus 30% overhead costs, and the cost of intervention materials.

We defined outpatient medical costs as the costs of all primary and specialty care visits, emergency department and urgent care clinic visits, nonantidepressant medications, laboratory tests, radiography, and costs for other medical care provided on an outpatient basis that was provided or paid by the participating health care organizations. Total outpatient costs were defined as the sum of costs for outpatient mental health and medical costs.

We defined total inpatient mental health costs as the sum of costs for all inpatient mental health and substance abuse treatment costs. Total inpatient medical costs were defined as the sum of costs for all inpatient medical/surgical admissions.

We also estimated incremental quality-adjusted life-years (QALYs) associated with the IMPACT intervention. Prior literature has suggested that full remission of depression increases quality of life by 0.2 to 0.4 on a scale of 0 (no quality) to 1 (full quality) relative to fully symptomatic depression.[21-26]

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Table 1. Subject Characteristics*

Sample Characteristics	All Subjects (N = 1801)	Usual Care Subjects (n = 895)	Intervention Subjects (n = 906)
Referred	50	50	50
Female	65	66	64
Age, y, mean (SD)	71.2 (7.5)	71.4 (7.6)	71 (7.4)
Married or living with partner	46	48	44
Ethnic minority	23	24	22
At least high school graduate	79	79	79
Medicare coverage	77	77	77
Prescription medication coverage	90	90	90
Depression status (SCID diagnosis)			
Major depression	17	16	18
Dysthymia	30	32	29
Major depression and dysthymia	53	52	54
≥2 Prior episodes of depression	71	71	71
HSCL-20 depression score (0-4), mean (SD)	1.7 (0.6)	1.7 (0.6)	1.7 (0.6)
Positive on cognitive impairment screen	35	36	35
Chronic disease count (of a list of 10), mean (SD)	3.2 (1.7)	3.2 (1.7)	3.2 (1.8)
Significant chronic pain	65	65	66
Health-related functional impairment score (0-10), mean (SD)	4.6 (2.6)	4.6 (2.6)	4.7 (2.6)
Overall quality of life score (0-10), mean (SD)	5.3 (2)	5.3 (1.9)	5.4 (2)

Abbreviations: HSCL-20, 20-item Hopkins Symptom Checklist; SCID, *Structured Clinical Interview for* DSM-IV *Axis I Disorders, Clinician Version*.

*Values are expressed as percentages unless otherwise indicated.

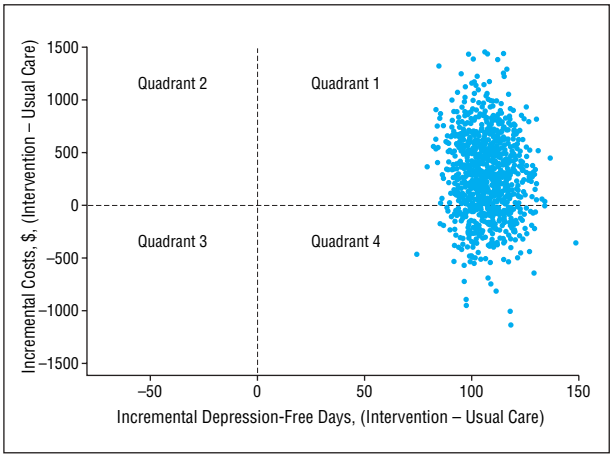

Figure 1. Bootstrap of incremental costs and health benefits of Improving Mood Promoting Access to Collaborative Treatment (IMPACT) intervention vs usual care.

To determine the incremental QALYs associated with the IMPACT intervention, we divided the 2-year difference in depression-free days between intervention and usual care patients by 365 days and multiplied by the 0.2 to 0.4 increase in QALYs associated with full remission of depression.[21-26] The resulting range of QALYs was then divided into the point estimate for incremental total primary care costs to estimate costs per QALY associated with the intervention vs usual care.

STATISTICAL ANALYSES

Table 1 describes the baseline demographic and clinical characteristics by intervention status. We conducted intent-to-treat analyses of our dependent variables (depression-free days and costs over 2 years). There were 5 baseline imputed data sets that had been previously imputed using a hot-deck imputation method.[27] All the statistics were first computed within each imputed data set and then were combined according to the formula suggested by Rubin.[28] Because all demographic and clinical characteristics were balanced between the 2 groups at baseline and there was no significant interaction between intervention status and recruitment method or intervention status and participating organization on depression-free days, we present the unadjusted means of depression-free days and health care costs in each cost category comparing intervention and usual care patients. Confidence intervals for the differences are also provided.

Missing cost data were imputed using SOLAS 3.2[29] with propensity score based on the Rubin method[28] to account for the finding that data in this study were not missing at random.[30] We imputed between 17% and 24% of health care costs that were not available owing to health care organizations not systematically collecting cost in some categories; patient disenrollment from the health care plan; and a small percentage of patients refusing to allow collection of automated health care use data in the second 12 months of the study. We imputed between 44% and 49% of pharmacy costs because several of our sites did not capture medication costs. In the imputation model, we used several groups of covariates including baseline demographics, prior health care use, self-reported health services used during the study period, medical comorbidities, depression variables, and medication use. Subjects were stratified into 5 groups according to the predicted values (propensity scores), and missing values were replaced by the observed values of subjects (donors) randomly selected within the same stratum. From each imputed baseline data set, we imputed 5 additional data sets, which resulted in 25 data sets in total. The imputation was carried out separately for intervention and usual care groups.

A total of 117 participants died before the 24-month follow-up. Half of them (n=61; 52%) were from the intervention group. We assigned "zero" costs and depression-free days to all observation periods after the time of death.

The variance of the incremental cost-effectiveness ratio (incremental cost per depression-free day) was approximated following the Taylor expansion and was combined by applying the Rubin rule.[28] The confidence interval for incremental cost per depression-free day was then constructed based on normal theory.

On the cost-effectiveness plane, the difference in cost (intervention – usual care) and the difference in depression-free days can result in 4 combinations (**Figure 1**). Dominance of an intervention is defined if the incremental cost-effectiveness ratio falls on the lower, right quadrant (quadrant 4), suggesting that the intervention is more effective and costs less than usual care. We estimated the probabilities of the incremental cost-effectiveness ratio falling on each of the 4 quadrants by means of bootstrapping procedures with 1000 replications. For example, the probability of dominance was estimated as the number of incremental cost-effectiveness ratios falling on the lower, right quadrant over the total 1000 incremental cost-effectiveness ratios derived from the bootstrap replications. This bootstrapping procedure and probability estimation were carried out for each of the 25 imputed data sets. The final probabilities reported were obtained by averaging over the 25 estimates.

RESULTS

The enrolled sample was clinically and sociodemographically diverse (Table 1). The mean (SD) age of partici-

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Table 2. Twenty-Four–Month Health Care Costs

	24-Month Health Care Costs, $		
	Intervention	Usual Care	Difference (95% CI)
Intervention costs			
Mean (95% CI)	591 (574 to 608)	0 (0 to 0)	591 (574 to 608)
Median	541	0	
Antidepressant medications			
Mean (95% CI)	905 (837 to 973)	489 (437 to 542)	416 (335 to 496)
Median	754	262	
Outpatient mental health services			
Mean (95% CI)	246 (196 to 297)	331 (266 to 397)	–85 (–167 to –2.8)
Median	0	0	
Total mental health services			
Mean (95% CI)	1742 (1648 to 1837)	821 (730 to 911)	921 (794 to 1049)
Median	1480	432	
Other medications			
Mean (95% CI)	2625 (2400 to 2850)	2751 (2558 to 2943)	–126 (–418 to 166)
Median	2058	2183	
Other outpatient services			
Mean (95% CI)	7011 (6577 to 7446)	7512 (6968 to 8055)	–501 (–1195 to 194)
Median	5403	5771	
Total outpatient services			
Mean (95% CI)	11 378 (10 830 to 11 926)	11 083 (10 454 to 11 711)	295 (–525 to 1115)
Median	9637	9346	
Inpatient mental health services			
Mean (95% CI)	23 (–0.9 to 46)	35 (–9.5 to 80)	–13 (–63 to 38)
Median	0	0	
Inpatient medical services			
Mean (95% CI)	4775 (3306 to 6244)	4366 (3490 to 5242)	409 (–1303 to 2120)
Median	0	0	
Grand total health care costs			
Mean (95% CI)	16 175 (14 522 to 17 829)	15 484 (14 307 to 16 661)	691 (–1333 to 2715)
Median	11 312	11 114	

Abbreviation: CI, confidence interval.

pants was 71.2 (7.5) years, 65% were women, and 23% of participants were from ethnic minority groups (12% African American, 8% Latino, 3% other ethnic minority). Approximately half of participants (53%) met diagnostic criteria for major depression and dysthymic disorder and 71% reported 2 or more prior depressive episodes. The mean (SD) HSCL-20 depression score[17] was 1.7 (0.6), indicating moderate to severe depression. One third (35%) showed some evidence of cognitive impairment. Participants reported a mean (SD) of 3.2 (1.7) of 10 comorbid medical conditions.

The mean number of depression-free days attributable to the intervention in the first 12 months was 52.6 (95% confidence interval [CI], 42.2 to 63.0) and in the second 12 months was 54.3 (95% CI, 42.4 to 66.2), resulting in 107 (95% CI, 86 to 128) additional depression-free days for intervention patients compared with those in usual care over 2 years.

Estimated health services costs during the 24-month intervention period are presented in **Table 2**. The average cost of the IMPACT intervention program was $591. Antidepressant prescription costs were $416 higher among intervention participants compared with usual care, but costs of specialty mental health care were approximately $85 lower in intervention patients. Total mental health costs (intervention program, specialty mental health, and antidepressants) were approximately $921 higher over the 2-year period. On the other hand, other medication costs were $126 lower and other outpatient costs were $501 lower in intervention patients, suggesting substantial cost-offset effects on non–mental health–related ambulatory care services. Our primary cost outcome, total outpatient services, was $295 (95% CI, –$525 to $1115) higher in intervention patients compared with usual care patients over the 2-year period. The incremental cost-effectiveness ratio based on this cost outcome was $2.76 per depression-free day (95% CI, –$4.95 to $10.47). When the analyses were rerun excluding all medication costs, the total outpatient costs were $5 (95% CI, –$702 to $712) higher in intervention compared with usual care patients and the incremental cost-effectiveness ratio showed a $0.05 cost per depression-free day (95% CI, –$6.57 to $6.67).

The majority of the 1801 patients (53%) met criteria for dysthymia and major depression, whereas 30% met criteria for dysthymia alone and 17% for major depression alone. The most favorable incremental cost-effectiveness ratio was seen in the patients with double depression, where there was a $6.52 (95% CI, –$15.85 to $4.61) cost savings per depression-free day associated with the intervention compared with a $3.47 (95% CI, –$5.83 to $12.78) incremental cost per depression-

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Table 3. Total Outpatient Costs and Depression-Free Days by Site

Site	Mean (95% CI)			
	Total Outpatient Cost, $		No. of Depression-Free Days	
	Usual Care	Incremental Intervention Effect (Intervention – Usual Care)	Usual Care	Incremental Intervention Effect (Intervention – Usual Care)
1	12 670 (9907 to 15 433)	–198 (–3603 to 3207)	277 (200 to 354)	147 (41 to 252)
2	13 301 (11 337 to 15 266)	–9 (–2585 to 2567)	206 (168 to 245)	128 (66 to 190)
3	9830 (8332 to 11 327)	944 (–963 to 2851)	362 (321 to 403)	120 (68 to 172)
4	10 802 (9134 to 12 469)	259 (–1982 to 2501)	185 (151 to 219)	143 (89 to 197)
5	11 315 (9358 to 13 272)	705 (–1883 to 3293)	257 (220 to 294)	72 (19 to 125)
6	9848 (8314 to 11 381)	689 (–1355 to 2733)	268 (232 to 304)	44 (–10 to 97)
7	12 178 (10 605 to 13 752)	–223 (–2255 to 1809)	295 (255 to 335)	106 (50 to 161)
8	10 214 (8861 to 11 568)	26 (–1863 to 1915)	261 (224 to 298)	122 (71 to 173)
All	11 083 (10 454 to 11 711)	295 (–525 to 1115)	265 (251 to 280)	107 (86 to 128)

Abbreviation: CI, confidence interval.

free day in those with dysthymia alone and a $49.91 (95% CI, –$15.16 to $114.98) incremental cost per depression-free day in the those with major depression alone.

The 107-day increase in depression-free days associated with the IMPACT intervention corresponds to an estimate of 0.059 (95% CI, 0.047 to 0.070) to 0.117 (95% CI, 0.094 to 0.140) QALYs. Combining the QALY estimates with the point estimate for incremental outpatient costs yields a cost per QALY range of $2519 (95% CI, –$4517 to $9554) to $5037 (95% CI, –$9034 to $19 108) associated with the IMPACT intervention.

Over 2 years, inpatient mental health costs were $13 (95% CI, –$63 to $38) lower in intervention compared with usual care patients. Inpatient medical costs were $409 higher (95% CI, –$1303 to $2120). Confidence intervals were progressively wider as we moved from ambulatory to inpatient costs. In a sensitivity analysis excluding patients in the top 5% of total inpatient costs to determine the effect of high-cost outliers, total inpatient cost differences narrowed to an increment of $77 (95% CI, –$414 to $567) in intervention compared with usual care patients.

The probability of a "dominant" intervention (the proportion of incremental cost-effectiveness ratios falling in quadrant 4 in Figure 1) was estimated in 1000 bootstrap replications to be 25%. In all these estimates, the intervention showed greater clinical effectiveness than usual care. A similar analysis that excluded costs of all medications showed that the probability that the IMPACT intervention compared with usual care was a dominant intervention was 49%.

As presented in **Table 3**, the intervention was associated with an increase in depression-free days in all 8 organizations and total ambulatory costs in the intervention group were lower than costs of usual care in 3 of 8 organizations. Outpatient medical costs (excluding mental health costs) were lower in intervention than in usual care participants in all 8 health care organizations (data not shown), suggesting a robust cost offset in this category.

Figure 2 shows the incremental total outpatient costs and number of depression-free days associated with IMPACT during each 6-month period over 2 years. In all 6-month periods, there is a robust increment in depression-free days associated with the intervention. In year 1, there was an increment of $383 (95% CI, –$104 to $870) in outpatient costs associated with the intervention, and in year 2 (during which no intervention services were available), there was a cost savings of $88 (95% CI, –$610 to $434) in total outpatient costs. When all medication costs were excluded, there was an increment of $180 (95% CI, –$234 to $595) associated with the intervention in year 1 and a cost savings of $175 (95% CI, –$636 to $285) in year 2.

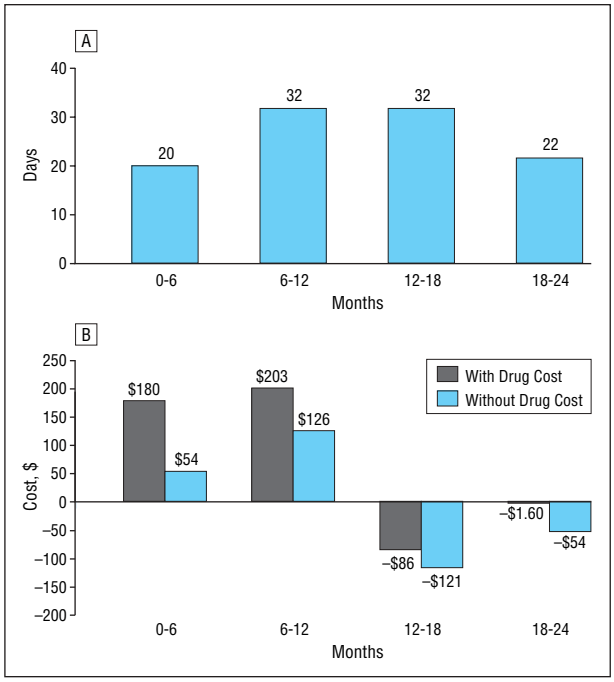

Figure 2. Incremental depression-free days by 6-month period (intervention vs usual care) (A) and incremental total outpatient costs by 6-month period (B).

COMMENT

The mean total outpatient cost of health care for study participants was approximately $15 000 over a 2-year pe-

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riod. In this context, the IMPACT intervention was associated with an increment of about $295 in total outpatient costs (an annualized rate of $148/y). In health care organizations that are not at risk for medication costs, our analyses suggest an increment of $5 in total outpatient costs. This incremental cost of $148/y is at the lower end of other successful primary care depression interventions, which have been shown to range from $130 to $800/y.[19,20,31-36] In contrast to these modest costs, IMPACT intervention participants experienced 107 more depression-free days than participants in care as usual over a 2-year period. The combination of low incremental costs and a very high benefit in depression-free days compared with usual care resulted in the lowest incremental outpatient cost per depression-free day that has been reported in primary care trials: approximately $2.76 (95% CI, –$4.95 to $10.47) per depression-free day. Seven prior trials have reported incremental outpatient costs per depression-free day that ranged from $10.30 to $35.20.[19,20,31-36]

In 3 of the 8 health care organizations, the IMPACT intervention was associated with lower ambulatory costs over the 2-year period. In all 8 health care organizations, the intervention was associated with a greater benefit in terms of depression-free days compared with usual care (ranging from 44 to 147 days over a 2-year period). These data suggest that in some organizations there may be cost offsets (ie, higher mental health costs in intervention patients are balanced by lower medical costs) associated with the IMPACT intervention. The fact that the patents for many antidepressants used in this trial subsequently ended or will end in the next few years should further decrease the IMPACT intervention costs to health care systems that do cover medication costs.

The range of incremental costs per QALY associated with the IMPACT intervention of $2519 to $5037 is lower than the costs per QALY range reported in prior depression trials (ie, $9051-$49 500)[36] and lower than many commonly used and accepted medical interventions, such as screening and treatment of hypertension ($8000-$44 000 per QALY),[37] statin use for primary prevention of cardiac events ($54 000 per QALY),[38] or coronary artery bypass surgery ($13 838 per QALY).[39] These data suggest that improving depression care in older adults is a high value compared with commonly used medical interventions.

The 2-year follow-up in this trial is relatively long compared with prior studies. Long-term outcomes should be considered in disease management studies because intervention costs are often front-loaded in the first year but benefits may continue to accrue over time. Although the IMPACT intervention shows continued benefit in terms of depression-free days in year 2 (a time during which intervention resources were no longer available), total outpatient costs in year 1 were $383 (95% CI, –$104 to $870) higher in the intervention compared with usual care but in year 2 outpatient costs were $88 lower (95% CI, –$610 to $434). These data suggest that health care organizations that implement IMPACT care can expect most of their costs for depression care to accrue in year 1, but the benefits to patients continue to accrue in year 2 with cost savings during the second year. Given the continued robust intervention vs control differences in depression at 24 months,[13] there is potential for continued benefit in year 3 and beyond. Two other primary care intervention trials that selected primary care patients with high rates of chronic depression (as found in IMPACT) also found continued improvement in depressive outcomes at 12[40] and 28 months,[41] respectively, with a suggestion of potential cost saving over the longer-term follow-ups reported in the latter trial.[41]

One of the most consistent cost offsets noted in our data was lower specialty mental health care costs in intervention vs usual care patients (seen in 6 of 8 organizations). This finding that providing mental health treatments in primary care is associated with less use of specialty mental health care has also been reported in other primary care–based depression trials.[20,31] Older trials that examined cost-offset effects prior to 1985 tended to find that mental health interventions were associated with fewer inpatient hospital days.[42] In this modern era, our data suggest almost no elderly patients with depression receive inpatient mental health care so cost savings are unlikely to occur in this cost category. Only approximately $30 of the $15 000 mean 2-year total health care costs in our study were inpatient mental health or substance abuse costs.

The medical/surgical inpatient costs described in the IMPACT trial demonstrate the lack of precision in such data. Although inpatient medical costs were approximately $409 (95% CI, –$1303 to $2120) higher in intervention compared with usual care patients, the 95% CIs of inpatient medical costs were extremely wide owing to very high cost outliers (as shown in our sensitivity analysis that excluded the patients in the top 5% of total inpatient costs). During the initial year in the study, inpatient medical costs were actually $112 (95% CI, –$977 to $753) lower than those in usual care, but during the second year, they were $521 (95% CI, –$935 to $1977) higher. The variability of inpatient cost differences between intervention and usual care across the 8 organizations (ranging from –$2658 [95% CI, –$4644 to –$672] to $3724 [95% CI, –$6269 to $13 717]) also suggests that this study is markedly underpowered to examine intervention vs control differences in inpatient medical costs. We did not observe an obvious pattern across health care organizations that explained these differences. For instance, 1 large health maintenance organization had 2 clinics participate in the study in 2 geographical regions. One of these clinics showed higher inpatient costs in intervention patients and the other higher costs in usual care patients.

A final point is that mean antidepressant costs over 2 years were significantly higher in both intervention ($905) and usual care ($489) patients than outpatient mental health care costs ($246 and $331, respectively). Older adults are significantly less likely than younger adults to use specialty mental health services.[43] In a national sample of adults with depression, 26% of people 30 to 64 years of age received psychotherapy vs only 6% of patients 65 years and older.[43] This may be because of greater stigma regarding psychotherapy among older adults, problems with paying for outpatient psychotherapy under Fee-For-Service Medicare, or mobility problems limiting the

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ability of older adults to travel to mental health appointments. Physicians may also be less likely to refer their older patients for psychotherapy.[44] The IMPACT trial suggests that, when offered as part of a primary care–based program of care, older adults effectively use psychosocial interventions such as behavioral activation and PST-PC.

Limitations of this article include the relatively narrow focus on outcomes of depression and medical costs from the payer's perspective and some variation in the sources of cost data across the 8 different health care systems. Future analyses will focus on other potential benefits such as improved productivity and decreased need of informal care. Another limitation is the relatively high rate of missing cost data, particularly for medications, mostly because not all participating health care organizations consistently track all categories of health services we examined. A final limitation is that the HSCL-20–based depression-free day measure has not been independently validated against other measures of QALYs (eg, standard gamble or time trade-off).

In conclusion, the IMPACT care model is a "high-value" intervention, compared with other medical interventions, that produced substantial and robust improvements in health over 2 years at a modest cost of approximately $148 per person per year. Assuming that 2% of eligible older adults would use this health care benefit in any given year, the incremental cost of the added benefit translates into $0.25 per member per month if this program was offered to a population of insured older adults. Most of these program costs, such as care manager visits in the primary care physician's office, are already covered by existing health care (eg, Medicare) benefits. For this low cost, we observed health benefits well beyond reduced depression, such as improved quality of life,[10,13] improved physical functioning,[45] higher patient satisfaction with care,[10] decreased burden from pain in the 1001 IMPACT patients with depression and comorbid osteoarthritis,[46] increased adherence to exercise regimens, and improved physical functioning in the approximately 400 patients with type 2 diabetes mellitus.[47] Based on its clinical effectiveness, the President's New Freedom Commission on Mental Health recently recommended that collaborative care models such as IMPACT "should be widely implemented in primary health care settings and reimbursed by public and private institutions."[48]

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REFERENCES

1. Katon W. Clinical and health services relationships between major depression, depressive symptoms and general medical illness. *Biol Psychiatry*. 2003;54:216-226.
2. Sheehan B, Bass C, Briggs R, Jacoby R. Somatization among older primary care attenders. *Psychol Med*. 2003;33:867-877.
3. Bruce M. Depression and disability in late life: directions for future research. *Am J Geriatr Psychiatry*. 2001;9:102-112.
4. DiMatteo M, Lepper H, Croghan T. Depression is a risk factor for noncompli-

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ance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med*. 2000;160:2101-2107.
5. Ciechanowski P, Katon W, Russo J. Depression and diabetes: impact of depressive symptoms on adherence, function and costs. *Arch Intern Med*. 2000;160: 3278-3285.
6. Katon W, Lin EH, Russo J, Unützer J. Increased medical costs of a population-based sample of depressed elderly patients. *Arch Gen Psychiatry*. 2003;60: 897-903.
7. Unützer J, Patrick D, Simon G, Grembowski D, Walker E, Rutter C, Katon W. Depressive symptoms and the cost of health services in HMO patients aged 65 years and older. *JAMA*. 1997;277:1618-1623.
8. Klinkman M. Competing demands in psychosocial care: a model for the identification and treatment of depressive disorders in primary care. *Gen Hosp Psychiatry*. 1997;19:98-111.
9. Katon W. The many faces of depression. *J Gen Intern Med*. 2004;19:893-895.
10. Unützer J, Katon W, Callahan CM, Williams JW Jr, Hunkeler E, Harpole L, Hoffing M, Della Penna RD, Noel PH, Lin EH, Arean PA, Hegel MT, Tang L, Belin TR, Oishi S, Langston C; IMPACT Investigators. Improving mood-promoting access to collaborative treatment: collaborative care management of late-life depression in the primary care setting. a randomized controlled trial. *JAMA*. 2002; 288:2836-2845.
11. Bruce ML, Ten Have TR, Reynolds CF III, Katz II, Schulberg HC, Mulsant BH, Brown GK, McAvay GJ, Pearson JL, Alexopoulos GS. Reducing suicidal ideation and depressive symptoms in depressed older primary care patients: a randomized controlled trial. *JAMA*. 2004;291:1081-1091.
12. Unützer J, Katon W, Williams JW Jr, Callahan CM, Harpole L, Hunkeler EM, Hoffing M, Arean P, Hegel MT, Schoenbaum M, Oishi SM, Langston CA. Improving primary care for depression in late life: the design of a multicenter randomized trial. *Med Care*. 2001;39:785-799.
13. Hunkeler E, Katon W, Tang L, Callahan C, Williams JW, Harpole L, Hoffing M, Unutzer J Jr. Long-term benefits of a one year collaborative care program for late-life depression: complexities of co-occurring conditions. Paper presented at: National Institutes of Health; June 24, 2004; Washington, DC.
14. First MB, Spitzer RL, Gibbon M, Williams JBW. *Structured Clinical Interview for* DSM-IV *Axis I Disorders (SCID), Clinician Version*. Washington, DC: American Psychiatric Press; 1996.
15. Hegel M, Imming J, Cyr-Provost M, Hitchcock Noël P, Areán P, Unützer J. Role of behavioral health professionals in a collaborative stepped care treatment model for depression in primary care: Project IMPACT. *Fam Syst Health*. 2002;20:265-277.
16. Mynors-Wallis L. Randomized controlled trial comparing problem-solving treatment with amitriptyline and placebo for major depression in primary care. *BMJ*. 1995;310:441-445.
17. Hegel M, Areán P. *Problem-Solving Treatment for Primary Care (PST-PC): A Treatment Manual for Depression Project IMPACT*. Hanover, NH: Dartmouth Medical School; 2003.
18. Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L. The Hopkins Symptom Checklist (HSCL): a measure of primary symptom dimensions. *Mod Probl Pharmacopsychiatry*. 1974;7:79-110.
19. Lave JR, Frank RG, Schulberg HC, Kamlet MS. Cost-effectiveness of treatments for major depression in primary care practice. *Arch Gen Psychiatry*. 1998;55: 645-651.
20. Simon GE, Katon WJ, VonKorff M, Unutzer J, Lin EH, Walker EA, Bush T, Rutter C, Ludman E. Cost-effectiveness of a collaborative care program for primary care patients with persistent depression. *Am J Psychiatry*. 2001;158:1638-1644.
21. Wells KB, Sherbourne CD. 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.
22. Unützer J, Patrick DL, Diehr P, Simon G, Grembowski D, Katon W. Quality adjusted life years in older adults with depressive symptoms and chronic medical disorders. *Int Psychogeriatr*. 2000;12:15-33.
23. Revicki DA, 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.
24. Kaplan R. Health-related quality of life in mental health services evaluation. In: Miller N, Magruder K, eds. *Cost-Effectiveness of Psychotherapy: A Guide for Practitioners, Researchers, and Policy-Makers*. New York, NY: Oxford University Press; 1999:213-228.
25. Fryback DG, Dasbach EJ, Klein R, Klein BE, Dorn N, Peterson K, Martin PA. The Beaver Dam Health Outcomes Study: initial catalog of health-state quality factors. *Med Decis Making*. 1993;13:89-102.
26. Pyne JM, Patterson TL, Kaplan RM, Ho S, Gillin JC, Golshan S, Grant I. Preliminary longitudinal assessment of quality of life in patients with major depression. *Psychopharmacol Bull*. 1997;33:23-29.
27. Tang L, Belin T, Song S. A comparison of inputation methods for missing data in a multi-center randomized clinical trial: the impact study. Paper presented at: Joint Statistical Meeting, American Statistical Association; August 11, 2002; New York, NY.
28. Rubin D. *Multiple Imputation for Non-response in Surveys*. New York, NY: John Wiley & Sons, 1987.
29. O'Callahan F. Multiple imputation using SOLAS for missing data analysis. *Magazine Students Stat*. 2001;0:3-7.
30. Tang L, Son J, Belin T, Unützer J. A comparison of imputation models in a longitudinal randomized clinical trial. *Stat Med*. 2005;24:2111-2128.
31. Von Korff M, Katon W, Bush T, Lin EH, Simon GE, Saunders K, Ludman E, Walker E, Unützer J. Treatment costs, cost offset, and cost-effectiveness of collaborative management of depression. *Psychosom Med*. 1998;60:143-149.
32. Simon GE, Manning WG, Katzelnick DJ, Pearson SD, Henk HJ, Helstad CS. Cost-effectiveness of systematic depression treatment for high utilizers of general medical care. *Arch Gen Psychiatry*. 2001;58:181-187.
33. Simon GE, Von Korff M, Ludman EJ, Katon WJ, Rutter C, Unützer J, Lin EH, Bush T, Walker E. Cost-effectiveness of a program to prevent depression relapse in primary care. *Med Care*. 2002;40:941-950.
34. Schoenbaum M, Unützer J, Sherbourne C, Duan N, Rubenstein LV, Miranda J, Meredith LS, Carney MF, Wells K. Cost-effectiveness of practice-initiated quality improvement for depression: result of a randomized controlled trial. *JAMA*. 2001; 286:1325-1330.
35. Liu C, Hedrick S, Chaney E, Heagerty P, Felker B, Hasenberg N, Fihn S, Katon W. Cost-effectiveness of collaborative care for depression in a primary care veteran population. *Psychiatr Serv*. 2003;54:698-704.
36. Neumeyer-Gromen A, Lampert T, Stark K, Kallischnigg G. Disease management programs for depression: a systematic review and meta-analysis of randomized controlled trials. *Med Care*. 2004;42:1211-1221.
37. Littenberg B, Garber A, Sox H. Screening for hypertension. *Ann Intern Med*. 1990; 112:192-202.
38. Prosser LA, Stinnett AA, Goldman PA, Williams LW, Hunink MG, Goldman L, Weinstein MC. Cost-effectiveness of cholesterol lowering therapies according to patient characteristics. *Ann Intern Med*. 2000;132:769-779.
39. Yock C, Boothroyd D, Owens D, Garber A, Hlaky M. Cost-effectiveness of bypass surgery versus statins in patients with multilevel coronary artery disease. *Am J Med*. 2003;115:382-389.
40. Katzelnick DJ, Simon GE, Pearson SD, Manning WG, Helstad CP, Henk HJ, Cole SM, Lin EH, Taylor LH, Kobak KA. Randomized trial of a depression management program in high utilizers of medical care. *Arch Fam Med*. 2000;9:345-351.
41. Katon W, Russo J, Von Korff M, Lin E, Simon G, Bush T, Ludman E, Walker E. Long-term effects of a collaborative care intervention in persistently depressed primary care patients. *J Gen Intern Med*. 2002;17:741-748.
42. Mumford E, Schlesinger H, Glass G, Patrick Z, Cuerdon T. A new look at evidence about reduced cost of medical utilization following mental health treatment. *Am J Psychiatry*. 1984;141:1145-1158.
43. Klap R, Unroe K, Unützer J. Caring for mental illness in the United States: a focus on older adults. *Am J Geriatr Psychiatry*. 2003;11:517-524.
44. Unützer J, Katon W, Sullivan M, Miranda J. Treating depressed older adults in primary care: narrowing the gap between efficacy and effectiveness. *Milbank Q*. 1999;77:225-256.
45. Callahan C, Kroenke K, Counsell S, Hendrie HC, Perkins AJ, Katon W, Hitchcock Noel P, Harpole L, Hunkeler EM, Unützer J; IMPACT Investigators. Improved functional status with effective treatment of late-life depression. *J Am Geriatr Soc*. 2005;53:367-373.
46. Lin EH, Katon W, Von Korff M, Tang L, Williams JW Jr, Kroenke K, Hunkeler E, Harpole L, Hegel M, Arean P, Hoffing M, Della Penna R, Langston C, Unützer J; IMPACT Investigators. Effect of improving depression care on pain and function among older adults with arthritis: a randomized controlled trial. *JAMA*. 2003; 290:2428-2429.
47. Williams JW Jr, Katon W, Lin EH, Noel PH, Worchel J, Cornell J, Harpole L, Fultz BA, Hunkeler E, Mika VS, Unützer J; IMPACT Investigators. Effectiveness of depression care management on diabetes-related outcomes in older patients. *Ann Intern Med*. 2004;140:1015-1024.
48. The President's New Freedom Commission on Mental Health. Achieving the promise: transforming mental health care in America: final report. 2003. Available at: www.mentalhealthcommission.gov. Accessed September 27, 2005. Department of Health and Human Services publication SMA-03-3832.

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