ORIGINAL ARTICLE

The Costs and Benefits of Enhanced Depression Care to Employers

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Context: Although outreach and enhanced treatment interventions improve depression outcomes, uptake has been poor in part because purchasers lack information on their return on investment.

Objective: To estimate the costs and benefits of enhanced depression care for workers from the societal and employer-purchaser perspectives.

Design: Cost-effectiveness and cost-benefit analyses using state-transition Markov models. Simulated movements between health states were based on probabilities drawn from the clinical literature.

Participants: Hypothetical cohort of 40-year-old workers.

Intervention: Enhanced depression care consisting of a depression screen and care management for those depressed vs usual care.

Main Outcome Measures: Our base-case cost-effectiveness analysis was from the societal perspective; costs and quality-adjusted life-years were used to compute the incremental cost-effectiveness of the intervention relative to usual care. A secondary cost-benefit analysis from the employer's perspective tracked monetary costs and monetary benefits accruing to employers during a 5-year time horizon.

Results: From the societal perspective, screening and depression care management for workers result in an incremental cost-effectiveness ratio of $19 976 per quality-adjusted life-year relative to usual care. These results are consistent with recent primary care effectiveness trials and within the range for medical interventions usually covered by employer-sponsored insurance. From the employer's perspective, enhanced depression care yields a net cumulative benefit of $2895 after 5 years. In 1-way and probabilistic sensitivity analyses, these findings were robust to a variety of assumptions.

Conclusion: If these results can be replicated in effectiveness trials directly assessing effects on work outcomes, they suggest that enhanced treatment quality programs for depression are cost-beneficial to purchasers.

Arch Gen Psychiatry. 2006;63:1345-1353

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PREVIOUS RESEARCH HAS FOUND that depression is associated with enormous societal burdens.[1-3] Just the economic costs from depression are in the order of tens of billions of dollars each year in the United States, with the largest component deriving from lost work productivity.[4,5]

A growing body of evidence suggests that these economic burdens from depression, including those from impaired work performance, would respond to improvement in depressive symptomatology and currently available depression treatments.[6-16] Despite this, the economic burdens from depression persist because of the widespread underuse and poor-quality use of otherwise efficacious and tolerable depression treatments.[17-21]

Primary care effectiveness trials in the past decade have shown that a variety of interventions consisting of enhanced treatment quality can improve depression outcomes and, in some cases, work performance relative to usual care.[22-31] Economic analyses have also found that these primary care quality-improvement interventions are cost-efficient from a societal perspective, with cost-effectiveness ratios less than $50 000 per quality-adjusted life-year (QALY).[32-36]

Unfortunately, widespread uptake of these enhanced depression treatment programs has not occurred owing to various barriers.[37,38] One of these barriers occurs at the level of the purchasers, who cannot predict their return on investment from purchasing enhanced depression care programs.[39] Most earlier studies[22-31] have been conducted in primary care and not necessarily in working populations, and few have assessed the effect of enhanced depression care on lost productivity. Fur-

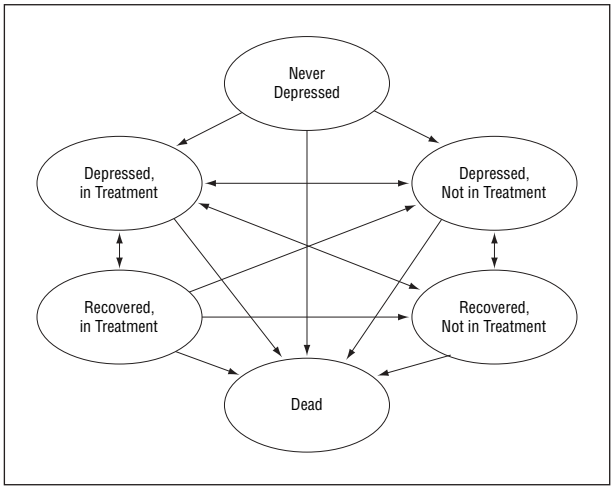

Figure. State-transition Markov model diagram for the usual care arm. For the intervention arm, additional states were created to represent those with and without care management.

thermore, we are not aware of published cost-effectiveness analyses conducted specifically from the perspective of the employer. Finally, results from short-term trials may not shed light on the economic effects of interventions in medium-term time frames of relevance to employers. Without such information, purchasers will have difficulty knowing their true costs and benefits and will continue to hesitate at investing in enhanced depression care.

The aims of the present study were 2-fold. First, we estimated the cost-effectiveness from the societal perspective of a program of enhanced depression care specifically for workers that involved outreach and improved treatment quality.[40] Second, we sought to follow a systems cost-effectiveness approach[41] and also to conduct a cost-benefit analysis from the more narrow perspective of the employer-purchaser, explicitly accounting for effects on relevant work outcomes over a 5-year time horizon. Both types of data—whether enhanced depression care is a good use of society's resources, as well as the employers' return on investment from interventions—are necessary first steps in informing purchasers of the true value of good-quality treatment.[42,43]

METHODS

MODEL

To evaluate the cost-effectiveness of a depression intervention relative to usual care in a cohort of 40-year-old employees (representing the median age of US workers[44]), we constructed a state-transition Markov model.[45] The depression intervention consisted of a one-time workplace-based depression screen for all employees and care management for those with positive results for depression. Care management was assumed to be similar to telephonic programs using masters-level clinicians that were developed by Simon and colleagues.[27,30] The generally lower intensity of this depression intervention and the greater feasibility of its implementation may make it more desirable to employers, who are sensitive to resource requirements when purchasing benefits.[46] However, we also assumed lower rates of treatment initiation and treatment adequacy resulting from this intervention vs more intensive ones.[47,48] Usual care depicted care-seeking and treatment patterns that would occur in the absence of depression screening or care management. Under both the intervention and usual care, treatment was defined in terms of visits to a primary care physician or a psychiatrist and pharmacotherapy with a selective serotonin reuptake inhibitor. Pharmacotherapies were used to define treatments because the care management trials used in this analysis (eg, the trial of Simon et al[27]) have reported initiation and adequacy rates for antidepressants but not for other modalities.

The model (**Figure**) was constructed using decision analysis software (Data TreeAge Pro; TreeAge, Williamstown, Mass) and included 6 disease states: never depressed; depressed, not in treatment; depressed, in treatment; recovered, in treatment; recovered, not in treatment, and dead. For the intervention arm, additional states were added for those with and without care management. An initial cohort of workers was distributed between states according to population-based estimates of the prevalence of depression, recovery from depression, and ongoing treatment. At the end of each 3-month cycle, subjects were allowed to move between alive states or to die according to probabilities drawn from the clinical literature.

TRANSITION PROBABILITIES

Transition probabilities are presented in **Table 1**. Age-, sex-, and race-specific mortality rates were assigned to each state according to 2002 US life tables.[77] All depression states were associated with a slightly increased mortality rate due to suicide.[51] The initial prevalence of depression, lifetime history of depression, and use of treatments in usual care were all obtained from the National Comorbidity Survey[49] and its recent replication.[21]

For workers assigned to intervention, we assumed that the sensitivity and specificity of a 1-time screen (on paper or Web-based for employees with Internet access) would be the same as in previous cost-effectiveness analyses of depression screening.[50] We also assumed that individuals with positive screen results who agree to care management would be given a full-length confirmatory depression assessment during the care manager's first call.[30] Probabilities of treatment initiation among untreated cases in response to care managers' outreach efforts were drawn from recent primary care effectiveness trials.[26]

Treatment was modeled as a mix of adequate and suboptimal treatment, to reflect the varying quality of treatment observed in typical practice.[21,27] Recent primary care effectiveness trial results were used to estimate the extent to which efforts by a care manager increase treatment initiation and the proportion of patients receiving adequate treatment relative to usual care.[27] Recovery rates and relapse rates while participants were receiving adequate, suboptimal, or no treatment were purposefully drawn whenever possible from trials that used randomization and intention-to-treat analyses.[52,53,78,79] Rates of treatment persistence in care management and usual care were obtained from recent primary care effectiveness trials, and greater treatment persistence under care management was assumed to continue for 18 months after care management ceased (a conservative assumption given that the benefits of care management on work outcomes were assumed to end immediately after care management ceased).[54]

COSTS

Costs are presented in Table 1. The cost of administering the screen was a weighted average of the costs of adding depression questions to existing paper-based health risk appraisals for the 70% of US companies that currently administer them and of implementing Web-based screens for the 30% of companies that do not.[80,81] For nondepressed patients with positive screen

Table 1. Parameter Estimates Governing the Markov Model

Parameter	Base-Case Estimate	Range	Source
Initial distributions across health states, %			
Initial depression prevalence	6.6	5.9 to 7.3	21
Initial prevalence of treatment among depressed	51.6	46 to 57	21
Initial prevalence of remitted depression	7.7	Not applicable	Calculated from model
Initial prevalence of treatment among remitted	5.7	4.1 to 7.3	49
Natural history of depression			
Depression incidence per 3 mo, %	0.08	0.025 to 0.378	21,50
Suicide rate for depressed per 3 mo	0.0009	0.000275 to 0.0055	51
Characteristics of depression screen, %			
Sensitivity	84	67 to 99	50
Specificity	85	80 to 95	50
3-mo Transition probabilities in usual care, %			
Initiating treatment among depressed	16.6	14.3 to 19.1	21
Receiving adequate care	18	12.6 to 23.4	27
3-mo Transition probabilities in care management, %			
Accepting care management	92	86.2 to 95	22,23,30
Initiating treatment among depressed	60	50 to 70	26
Receiving adequate care	30 to month 18, then 18	24 to 36	27
3-mo Probabilities of recovery from depression, %			
With no treatment	12.8	9 to 15	52
With suboptimal treatment	35	16 to 38	52
With adequate treatment	55	47 to 62	52
3-mo Probabilities of relapse if recovered, %			
Untreated or with suboptimal treatment	25	4.4 to 43	53
With adequate treatment	12	1.51 to 8.5	53
3-mo Probabilities of treatment persistence, %			
Depressed in usual care	88	85 to 91.4	54
Depressed in care management	94	91.2 to 96.3	54
Recovered	88	50 to 91.4	See text*
3-mo Probabilities of job turnover, %†			
Not depressed	10.89	7 to 13	26,55,56
Depressed in usual care	12.23	8 to 14	26,55,56
Depressed under care management	10.89	7 to 15	26,55,56
Direct treatment costs, $			
Hospitalization for depression	6889.88	4138 to 16 905	57-60
3-mo Physician visits	191.41	45 to 163	61-63
3-mo Pharmacotherapy‡	202.38	76 to 272	61,64,65
Lost productivity costs			
Absenteeism/presenteeism from depression per year, d†	40	20 to 60	66,67
Absenteeism/presenteeism recovered after remission, %†	73 for first year, then 100	0 to 100 for first year	See text§
Replacement costs, $‖	7771	1000 to 50 000	68-71
Long-term disability, $	0	0 to 317	See text§
Cost of time spent in treatment, $			
Societal perspective‖	92	28 to 183	See text§
Employer perspective‡	46	14 to 183	See text§
Intervention costs, $			
Screening	0.25	0.0 to 5	See text§
Confirmatory depression assessment	2	1 to 5	See text§
Care management	60	44 to 88	27
Utilities			
Never depressed‖	0.88	0.8 to 1.0	72
Recovered, not on treatment‖	0.88	0.86 to 0.88	73-75
Disutility of treatment in recovered‖	0.04	0 to 0.06	73-75
Depressed, not on treatment‖	0.63	0.3 to 0.65	73-75
Disutility of treatment in depressed‖	0	−0.22 to 0.06	73-75
Discount rate, %	3	0 to 5	40,76

*See "Transition Probabilities" subsection of the "Methods" section.
†Used in employer cost-benefit analysis only.
‡Total cost of suboptimal treatment assumed to be $50 less.
§See "Cost" subsection of the "Methods" section.
‖Used in societal cost-effectiveness only.

results (ie, those with false-positive results), we included the cost of a care manager's first call to conduct confirmatory depression assessments. Care management costs were drawn from a recent primary care effectiveness trial.[27]

Hospitalization costs were based on probabilities of hospitalization for treated and untreated patients in the clinical literature.[57-60] Prescription costs were based on average prescription costs in a managed care plan, as well as on Medicaid costs

and average wholesale prices; suboptimal pharmacotherapy was assumed to cost $50 less than adequate treatment.[61,64,65] Physician costs included 4 visits per cycle for the 30% of individuals receiving care from a psychiatrist and 2 visits per cycle for the remaining 70% receiving care from a primary care physician.[49,62] Visit costs were obtained from the 2004 Medicare physician fee schedule.[63] The costs of time in treatment included the hours spent in visits (ie, a half hour for primary care and 1 hour for psychiatrist visits) plus transit (ie, a half hour) multiplied by the average hourly wage. All costs were inflated using the medical care component of the consumer price index and are expressed in 2004 dollar values.[82] By convention, productivity losses were captured in our societal perspective analyses through quality-of-life adjustments and were omitted from dollar costs to avoid double counting.[40,76]

UTILITIES

Utilities were obtained from published studies, and those derived from standard gamble methods were used whenever available.[73-75,83] The utility for never being depressed was 0.88, consistent with data from the Beaver Dam Health Outcomes Study.[72] In the base case, a utility of 0.63 was assigned to both untreated and treated depression. In sensitivity analyses, the relationship between treated and untreated depression was varied to allow for the dual possibilities that treatment either improves quality of life or diminishes it owing to side effects. We assumed the same utility for having recovered from depression as that for having never been depressed (ie, 0.88) and assigned a disutility of 0.04 to having recovered but continuing to receive treatment for prophylaxis of relapse.

ANALYSES

Societal Perspective Analysis

Our base-case analysis was a cost-effectiveness analysis from the societal perspective. In this analysis, workers were assigned to usual care or intervention and followed up until death. Costs and quality-adjusted life expectancies were calculated for both cohorts and used to compute the incremental cost-effectiveness of the intervention relative to usual care. Costs and QALYs were both discounted at 3%.[40,76] To validate the model, model-derived projections of disease course and costs were compared with estimates published in the literature.[27,84,85]

Employer's Perspective Analysis

To conduct a secondary cost-benefit analysis solely from the employer's perspective, the employee cohort was maintained at a constant size by replacing those who left the company or died. Only monetary costs and monetary benefits accruing to current employees were tracked. This simulation was restricted to 5 years to be more relevant to employers' decision-making time frames. Costs of the intervention, depression treatments, and lost work time spent obtaining treatments (assumed to be 50% of all time spent in treatment) were estimated as described in the "Costs" subsection.

Productivity losses resulting from depression-related absenteeism and presenteeism (decreased productivity at work) were calculated as the product of the number of hours lost and the median hourly wage rates.[66,67] Upon recovery, productivity losses were assumed to decrease to zero over the course of a year.[5,9,10] A US Federal Reserve Board analysis[55] was used to derive the rate of turnover due to employer-to-employer movement, which was conservatively assumed to be identical for depressed and nondepressed workers. The rate of turnover due to movement into unemployment for depressed patients was obtained from a recent primary care effectiveness trial.[26] This study was also used to estimate the effect of the intervention vs usual care on reducing movement into unemployment during the first year; this benefit was conservatively assumed to end abruptly when care management ceased.[26] The resulting job separation rates used in this study are consistent with current data on job turnover from the Bureau of Labor Statistics.[56] Replacement costs associated with employee turnover were calculated as the sum of the costs of hiring and training a new employee.[68-71] In the base case, we assumed that employers did not offer long-term disability benefits, consistent with the fact that only 38% of employees have access to long-term disability insurance; in sensitivity analyses, long-term disability costs were included for employees becoming disabled owing to depression.[86,87]

SENSITIVITY ANALYSES

We conducted 1-way sensitivity analyses on all individual variables. Upper and lower bounds were estimated for parameters on the basis of 95% confidence intervals if available (minimum and maximum values across all confidence intervals if multiple existed); value ranges reported in the literature were also used, or expert opinion if no other source could be found. Sensitivity analyses on the discount rate were performed between 0% and 5%. We also conducted a probabilistic sensitivity analysis in which probability distributions were assigned to all variables using their base-case estimates and 95% confidence intervals (beta distributions for probabilities, log-normal distributions for costs and relative risks, and uniform distributions when the true functional form of the variable was not known). We performed 10 000 Monte Carlo simulations, selecting variable values on the basis of their distribution and calculating resulting costs and QALYs.

To examine whether results vary by workforce characteristics, we also recalculated employer costs and benefits as a function of occupation-specific wages[88] and occupation-specific multipliers[89] reflecting the influence that an employee's lost day of work has on the productivity of coworkers.

RESULTS

SOCIETAL PERSPECTIVE BASE-CASE ANALYSIS

From the societal perspective, performing a 1-time employer-based depression screen and providing telephonic depression care management resulted in 18.785 discounted QALYs at a cost of $3669 (**Table 2**). Usual care resulted in 18.783 QALYs and cost $3629. The incremental gain was 0.002 QALYs and incremental costs were $39.90. (These appear smaller than in previous studies[32-36] because only a small fraction of the intervention arm who were depressed received care management in our analysis, while entire intervention arms, all of whom were depressed, experienced care management in previous studies. We verified this in an analysis among exclusively depressed workers and found incremental gains [0.0192 QALYs] and costs [$564] that were comparable to those in previous studies.) The incremental cost-utility ratio of $19 976 was well within the range found in earlier analyses of primary care interventions.[32-36] When effectiveness was measured in life-years without adjusting for quality of life, care management increased life expectancy from 21.9337 to 21.9343 life-years at an incre-

Table 2. Cost-effectiveness of Intervention vs Usual Care From the Societal Perspective

Strategy	Cost, $		QALY		Incremental Cost-effectiveness Ratio, $ per QALY
	Total	Incremental	Total	Incremental	
Usual care	3629	. . .	18.783	. . .	. . .
Care management	3669	39.90	18.785	0.002	19 976

Abbreviations: QALY, quality-adjusted life-year; ellipses, not applicable.

mental cost of $64 847 per life-year. **Table 3** presents incremental costs broken down by components; all component costs were higher under the intervention vs usual care, except for psychiatric hospitalization costs.

EMPLOYER'S PERSPECTIVE BASE-CASE ANALYSIS

Table 4 presents results from the employer's perspective analysis by year, broken down by component costs and benefits. During the first year, the intervention cost employers $601 per 1000 employees vs usual care; this dollar amount results from enhanced depression care's increased direct treatment, intervention, and time-in-treatment costs. These costs are almost offset by increased productivity, reduced turnover, and lower psychiatric hospitalization costs. By the second year, the intervention has reduced the number of depressed employees relative to usual care, although a higher percentage of both depressed and recovered employees continue in treatment. As a result, workers given enhanced depression care continue to have higher treatment and time-in-treatment costs vs those in usual care. However, these costs are now more than exceeded by benefits of the intervention on absenteeism, presenteeism, and employee turnover, yielding a net savings to employers of $4631. In years 3 through 5, the intervention leads to modest net costs to employers relative to usual care. These net costs result in part from our conservative assumptions that the intervention's benefits on work outcomes end after care management ceases, while the increased use of treatments owing to care management persists. The intervention may also help companies retain people at risk of future episodes, who then have slightly higher costs than workers who would otherwise have replaced them. Over the course of 5 years, the intervention results in a cumulative savings to employers of $2895 per 1000 workers relative to usual care.

SENSITIVITY ANALYSES

Based on ranges shown in Table 1, the most influential parameter in our societal perspective analysis was treatment cost. The incremental cost-effectiveness ratio ranged from $7600 per QALY for treatment consisting exclusively of care from primary care physicians with generic drugs to $38 000 per QALY for care exclusively by psychiatrists (as occurs in some behavioral carve-outs that use psychiatrists as first-line providers) with brand name drugs. Results were equally sensitive to whether the changes in treatment costs were from pharmacotherapy or physician visits. The cost-effectiveness ratio was also sensitive to assumptions concerning the utility associated with depression (ranging from $9500 to $21 700 per QALY), disutility associated with depression treatments ($10 700-$23 500 per QALY), and suicide rate ($9500-$21 700 per QALY). Results of our probabilistic sensitivity analysis indicated that the incremental cost-effectiveness ratio for the intervention was between $9227 per QALY and $48 978 per QALY 95% of the time. It exceeded $50 000 per QALY for only 2.3% of the simulations.

Table 3. Average Lifetime Costs per Person Under Intervention vs Usual Care by Cost Component

Cost Component	Intervention	Usual Care	Difference*
Care manager	2.7	0.0	2.7
Time in treatment	629.9	621.5	8.4
SSRI pharmacotherapy	1101.1	1085.5	15.6
Physician visits	1302.8	1285.3	17.5
Psychiatric hospitalizations	632.1	636.5	–4.4
Total	**3668.6**	**3628.8**	**39.8**

Abbreviation: SSRI, selective serotonin reuptake inhibitor.
*Indicates incremental cost.

Our employer's perspective analysis results were also sensitive to the cost of treatment. Changing treatment to all generic pharmacotherapies delivered by primary care physicians increased intervention-related savings to $17 per employee. On the other hand, greater use of psychiatrists and/or branded drugs to the point that 3-month direct treatment costs exceed $442 per patient made the intervention more costly than usual care. The intervention also ceased to be cost-saving if screening costs exceeded $3.15 (more than 10 times our base-case estimate) or if employees spent more than 4 hours of work time per cycle being treated.

Employer characteristics also played a role in the net benefits of the intervention. Increasing worker replacement costs to $50 000 per employee (consistent with estimates of hiring costs equaling annual wages) increased net savings to $32 per employee. When hiring costs fell below $3570 per employee, the intervention was no longer cost-saving. Similarly, savings were sensitive to the magnitude of reduced productivity experienced by depressed employees and the degree to which it was recoverable. Treatment effectiveness—both in increasing recovery rates and in preventing relapse—was an important factor; for example, decreasing the 3-month recovery rate on suboptimal treatment to below 25% or in-

Table 4. Economic Consequences of the Intervention Relative to Usual Care From the Employer's Perspective*

Cost Component	Year 1	2	3	4	5	Cumulative Value
Costs, $						
Screening and care management	2725	. . .	. . .	. . .	. . .	2725
SSRI pharmacotherapy	7443	2055	501	136	46	10 181
Physician visits	8138	2336	593	161	54	11 282
Time-in-treatment costs	1967	565	143	39	13	2727
Total Employer Cost	**20 273**	**4956**	**1237**	**336**	**113**	**26 915**
Benefits: reductions in, $						
Absenteeism/presenteeism	–12 895	–8634	–975	230	313	–21 961
Employee turnover	–4919	–416	–52	10	15	–5362
Psychiatric hospitalizations	–1858	–537	–95	–5	8	–2487
Total Employer Benefit	**–19 672**	**–9587**	**–1122**	**235**	**336**	**–29 810**
Net costs and benefits	601	–4631	115	571	449	–2895

Abbreviation: SSRI, selective serotonin reuptake inhibitor.
*Results shown are per 1000 employees; future values are discounted at a rate of 3%. Negative values denote savings.

Table 5. Employer Net Benefits From the Intervention vs Usual Care According to Employees' Wages and Their Influence on the Productivity of Coworkers

Occupation	Hourly Wage + Nonwage Benefit, $	Wage Multiplier*	Net Benefit per 1000 Employees, $†
Civil engineer/ construction engineer	40.24	4.47	139 130
Paralegal	29.42	2.13	36 050
Legal secretary	27.58	1.61	20 000
Motor vehicle salesperson	28.98	1.54	20 180
Carpenter	26.73	1.48	15 740
Registered nurse	32.03	1.4	20 350
Welder	23.85	1.38	9900
Truck driver	22.04	1.28	5780
Retail cashier	11.70	1.27	–5930
Medical records clerk	19.61	1.23	2190
Retail salesperson	14.33	1.17	–4260
Maid	10.49	1.14	–8470
Waiter	9.59	1	–10 550

*The multiplier times the wage is equal to the value of 1 lost day of work. Occupation-specific wage multipliers reflect the influence that an employee's lost day of work has on the productivity of coworkers and were obtained from Nicholson et al.[89]

†A net benefit for each job category was calculated by running the model using the hourly wage and wage multiplier specific to that job category. Negative numbers indicate that the intervention is associated with a net cost to the employer.

creasing the relapse rate to 40% resulted in intervention costs exceeding benefits.

Finally, employer's net benefits, as a function of workers' wages and their influence on the productivity of coworkers, are presented in **Table 5**. As shown, enhanced depression care interventions have the most net benefit for employees with high incomes who have a greater influence on the productivity of their coworkers.

COMMENT

Our societal perspective analyses suggest that a program of enhanced depression care for workers, consisting of a 1-time workplace depression screen plus telephonic care management for depressed employees, yields gains in quality-adjusted life expectancy at a cost in the range seen for commonly accepted medical interventions covered by employer-sponsored insurance.[90] These results are consistent with previous cost-effectiveness analyses of primary care depression interventions (which have yielded cost-effectiveness ratios between $9478 and $39 128 per QALY),[32-36] providing some reassurance regarding the validity of the assumptions and modeling approach in this study of workers. These results suggest that, like primary care depression interventions, enhanced depression care for workers appears to be a good investment of society's resources.

However, to an employer deciding whether to add such an intervention to existing health benefits, what may be of additional importance are the economic costs and benefits of the intervention specifically from the purchaser's perspective.[42,43] These costs and benefits are likely to be important issues in contract negotiations between employers' benefits departments and health plans; some health plans and other groups have already begun to produce "calculators" to help estimate employers' benefits for purchasing enhanced care programs and other interventions.[91-93] Unfortunately, few formal cost-effectiveness analyses in health care have been published that explicitly include an analysis from the employer's perspective.[94]

Our employer's perspective analyses show results that may seem counterintuitive at first—namely, that a screening and care management intervention designed to *increase* the use and intensity of treatment for depression may actually *save* employers money. However, as our results suggest, the expected higher direct treatment costs are more than offset by savings from reduced absenteeism, presenteeism, and employee turnover costs. While the bulk of the savings did not occur immediately, they were fully realized well within our employer analyses' 5-year time horizon. This latter finding is especially relevant for companies with high worker mobility. It implies that potential savings can be accrued within realistic time frames even in the presence of employee turnover.

It is worth keeping in mind that the magnitude of benefits for enhanced depression care observed in our employer analyses underestimates the total benefits from the societal perspective. This is because analyses from just the employer's perspective miss important improvements beyond increased productivity and job retention, such as positive effects on nonlabor outcomes of workers (eg, diminished suffering, increased marital stability, and decreased needs for caregiver time) and employees' contributions outside the workplace.[32] Although alternative methods, such as those based on how much individuals would pay to avoid depression (ie, a "willingness to pay" approach[95]), can help account for any economic burdens in excess of labor outcomes in employer analyses, such approaches are difficult to implement.

The fact that our results were sensitive to estimates of treatment costs is important in light of recent and upcoming patent expirations on selective serotonin reuptake inhibitors. Increasing availability of generic antidepressants, growing use of primary care for mental health services, and greater application of brief or time-limited psychotherapies could all drive treatment costs lower in the future. Likewise, advances in Web-based, e-mail, and interactive voice-recognition technologies may help decrease the costs of depression screening programs.[96] Because our results were sensitive to employee replacement costs, it is also worth noting that a rough assumption used by many human resources personnel—that hiring costs approximate a worker's annual wages—is close to our upper bound (ie, $50 000 per employee) used in sensitivity analyses.[69-71]

Our findings, particularly from the employer's perspective, have several potential limitations. Effectiveness trials directly measuring the effects of enhanced depression care on pertinent work outcomes are starting to be performed.[31,97] However, to base our model inputs on trials that use randomization and intention-to-treat analyses, we indirectly estimated intervention consequences through their effects on depression and then linked these with known relationships between depression reduction and improved work outcomes.[9,10] Well-established methods for valuing productivity losses and turnover from the employer's perspective were also lacking. For example, our simple transformation of absenteeism and presenteeism to salary-equivalent human capital dollar values may overestimate costs to employers (eg, as might happen if unperformed work during an absence is simply made up when an employee returns).[98] However, we believe that true burdens on employers were underestimated because we did not take into account other costs, such as those for hiring temporary workers or paying coworkers overtime when an employee leaves, and the adverse influence of an employee's absence on coworkers' productivity.[89] Indeed, our occupation-specific sensitivity analyses taking into account the influence on coworkers' productivity show that such costs, not currently in our base-case estimates, can be very large.[89] Nevertheless, uncertainty in these and all model inputs remains a potential study limitation.

The generalizability of earlier primary care effectiveness trials to workers is unclear. One threat is that workers may have less severe depression. Interestingly, one primary care study found comparable numbers of baseline depression criteria in all participants vs the subgroup of workers[31,99]; depression severity also may not be related to whether one benefits from care management.[26,100] A second threat is that treatment initiation and adequacy may be lower in working vs primary care populations. Again, one primary care study found somewhat higher antidepressant initiation, duration, and counseling rates at 24 months in workers vs all participants.[31,99] A third threat would occur if workers participating in health risk appraisal screenings have a lower prevalence, severity, or impairment from depression than workers not participating. In a previous study, we found that workers initially participating in health risk appraisal screenings have levels of depression, work impairments, and associations between depression and work impairments comparable to those experienced by initial nonrespondents participating only after more intensive recruitment and financial incentives.[101] Despite such reassurances, empirical data from trials conducted specifically among workers remain imperative.

Results from the employer's perspective tend to disvalue interventions for traditionally disadvantaged groups that are not in the workforce (eg, the elderly and disabled). As seen in our occupation-specific sensitivity analyses, low-wage and more solitary workers are also undervalued. Both of these potential limitations can lead to suboptimal and even unethical resource allocation decisions relative to the societal perspective.[40] We tried to guard against this possibility by explicitly conducting a societal cost-effectiveness analysis together with our employer cost-benefit analysis; their joint results provide some reassurance that enhanced depression care for workers not only makes economic sense for employers but also is a good use of societal resources. Finally, there is an inherent danger in focusing on the return on investment to employers of enhanced depression care in that this may inadvertently hold the treatment of depression to a higher standard than treatment for other disorders.[32,102]

With these limitations in mind, results from this study suggest that enhanced depression care for workers is cost-beneficial from both the employer's and societal perspectives. If replicated in upcoming effectiveness trials that directly assess intervention effects on work outcomes, these findings suggest that it may be in society's and purchasers' interests to more widely disseminate successful programs of outreach and improved treatment quality for depression.[39]

Submitted for Publication: April 25, 2005; final revision received November 14, 2005; accepted March 15, 2006.
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Financial Disclosure: Dr Simon has received research grants from Organon and Eli Lilly and Company.
Funding/Support: This study was supported by grant R01 MH61941 from the National Institute of Mental Health (Dr Wang) and grant 048123 from the Robert Wood Johnson Foundation (Dr Wang).

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