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 $2,895 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.

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Previous research has found that depression is associated with enormous societal burdens.\(^1\) 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.\(^2\)\(^3\)

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.\(^4\)\(^5\)\(^6\)\(^7\)\(^8\)\(^9\)\(^10\)\(^11\)\(^12\)\(^13\)\(^14\)\(^15\)

Despite this, the economic burdens from depression persist because of the widespread underuse and poor-quality use of otherwise efficacious and tolerable depression treatments.\(^16\)\(^17\)\(^18\)\(^19\)\(^20\)

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.\(^21\)\(^22\)\(^23\)\(^24\)\(^25\)\(^26\)\(^27\)\(^28\)\(^29\)\(^30\)\(^31\) 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).\(^32\)\(^33\)\(^34\)\(^35\)

Unfortunately, widespread uptake of these enhanced depression treatment programs has not occurred owing to various barriers.\(^36\)\(^37\)\(^38\) 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\(^40\)\(^41\)\(^42\)\(^43\)\(^44\)\(^45\)\(^46\)\(^47\)\(^48\)\(^49\)\(^50\) 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-
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.46 Second, we sought to follow a systems cost-effectiveness approach41 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

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.31 The initial prevalence of depression, lifetime history of depression, and use of treatments in usual care were all obtained from the National Comorbidity Survey49 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.20

Treatment was modeled as a mix of adequate and suboptimal treatment, to reflect the varying quality of treatment observed in typical practice.32,33 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.22 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.32,33,78,79 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).34

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.50,51 For nondepressed patients with positive screen
In Table 1, we present parameter estimates governing the Markov model. These estimates include:

- **Initial distributions across health states, %**
  - Initial depression prevalence: 6.6
  - Initial prevalence of treatment among depressed: 51.6
  - Initial prevalence of remitted depression: 7.7
  - Initial prevalence of treatment among remitted: 5.7

- **Natural history of depression**
  - Depression incidence per 3 mo, %: 0.08
  - Suicide rate for depressed per 3 mo: 0.0009

- **Characteristics of depression screen, %**
  - Sensitivity: 84
  - Specificity: 85

- **3-mo Transition probabilities in usual care, %**
  - Initiating treatment among depressed: 16.6
  - Receiving adequate care: 18

- **3-mo Transition probabilities in care management, %**
  - Accepting care management: 92
  - Initiating treatment among depressed: 60

- **3-mo Probabilities of recovery from depression, %**
  - With no treatment: 12.8
  - With suboptimal treatment: 35
  - With adequate treatment: 55

- **3-mo Probabilities of relapse if recovered, %**
  - Untreated or with suboptimal treatment: 25
  - With adequate treatment: 12

- **3-mo Probabilities of treatment persistence, %**
  - Depressed in usual care: 88
  - Depressed in care management: 94

- **Lost productivity costs**
  - Absenteeism/presenteeism from depression per year, d: 40

- **Utilities**
  - Normal depression: 0.88
  - Disutility of treatment in normal depression: 0.04

Hospitalization costs were based on probabilities of hospitalization for treated and untreated patients in the clinical literature. 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.60,64 Visit costs were obtained from the 2004 Medicare physician fee schedule.60 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.73-75,80 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.73,78,85

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 3 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.59,10 A US Federal Reserve Board analysis70 was used to derive the rate of turnover due to employer-to-employer movement, which was conservatively assumed to be identical for depressed and non-depressed workers. The rate of turnover due to movement into unemployment for depressed patients was obtained from a recent primary care effectiveness trial.28 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.28 The resulting job separation rates used in this study are consistent with current data on job turnover from the Bureau of Labor Statistics.69 Replacement costs associated with employee turnover were calculated as the sum of the costs of hiring and training a new employee.66,71 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.40,87

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 3%. 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 wages82 and occupation-specific multipliers86 reflecting the influence that an employee’s lost day of work has on the productivity of coworkers.

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 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-
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 physici-

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

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Cost, $</th>
<th>QALY</th>
<th>Incremental Cost-effectiveness Ratio, $ per QALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual care</td>
<td>3629</td>
<td>18.738</td>
<td>0.002</td>
</tr>
<tr>
<td>Care management</td>
<td>3669</td>
<td>18.785</td>
<td>19.976</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Intervention</th>
<th>Usual Care</th>
<th>Difference*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care manager</td>
<td>2.7</td>
<td>0.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Time in treatment</td>
<td>629.9</td>
<td>621.5</td>
<td>8.4</td>
</tr>
<tr>
<td>SSRI pharmacotherapy</td>
<td>1101.1</td>
<td>1085.5</td>
<td>15.6</td>
</tr>
<tr>
<td>Physician visits</td>
<td>1302.8</td>
<td>1285.3</td>
<td>17.5</td>
</tr>
<tr>
<td>Psychiatric hospitalizations</td>
<td>632.1</td>
<td>636.5</td>
<td>-4.4</td>
</tr>
<tr>
<td>Total</td>
<td>3668.6</td>
<td>3628.8</td>
<td>39.8</td>
</tr>
</tbody>
</table>

Abbreviation: SSRI, selective serotonin reuptake inhibitor.

*Indicates incremental cost.

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

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

*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.42
†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.

The results shown are per 1000 employees; future values are discounted at a rate of 3%. Negative values denote savings.
It is worth keeping in mind that the magnitude of benefits for enhanced depression care observed in our employer analyses understimates 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. Although alternative methods, such as those based on how much individuals would pay to avoid depression (ie, a “willingness to pay” approach), 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. 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.

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. 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. 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). 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. 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. 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; depression severity also may not be related to whether one benefits from care management. 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. 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. Despite such reassurances, empirical data from trials conducted specifically among workers remain imperative.

Results from the employer’s perspective tend to dis-value 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. 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.

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.

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