A Community Study of Depression Treatment and Employment Earnings

Mingliang Zhang, Ph.D.
Kathryn M. Rost, Ph.D.
John C. Fortney, Ph.D.
G. Richard Smith, M.D.

Objective: **Although treatment for major depression has been shown to reduce the costs of lost earnings resulting from lost work days, research has not demonstrated whether the reduction fully offsets the costs of treatment for the disorder.** ***Methods:*** **A statewide cohort of community residents with recent major depression, dysthymia, or substantial depressive symptoms was recruited and interviewed at baseline and at six-month and 12-month follow-ups. The cost of lost earnings was measured by lost work days multiplied by subjects' wage rates. Cost of treatment for depression was approximated using charges abstracted from provider and insurance records. Net economic cost, defined as the sum of changes in lost earnings and depression treatment costs, was examined in multiple regression analyses.** ***Results:*** **After the analyses controlled for sociodemographic characteristics, baseline severity of depression, and comorbidity, no statistically significant effect of depression treatment on net economic cost was found. This finding suggests that the cost of depression treatment was fully offset by savings from reduction in lost work days. Results from sensitivity analyses in multiple alternative scenarios support the same conclusion.** ***Conclusions:*** **The finding of a full offset of depression treatment cost is conservative because other benefits, such as reduced pain and suffering and increased productivity while at work, were not included in the analyses. Employers who bear the cost from lost work days should encourage their employees with depressive disorders to seek treatment, even if it means paying for the entire treatment cost. Self-employed individuals with depression also will benefit even if they pay for the treatment costs themselves. (*Psychiatric Services* 50:1209–1213, 1999)**

Depression is a common mental disorder in the general U.S. population, with an estimated one-year prevalence of 10.3 percent for unipolar major depression and dysthymia among community residents ages 15 to 54 years (1). An additional 11 percent of community residents who do not meet the strict criteria for either major depression or dysthymia are estimated to have substantial depressive symptoms (2). The costs of treatment for depressive disorders are estimated to range between $12.4 billion (3) and $19.2 billion (4) per year in 1990 dollars.

However, most of the total cost of depression to society is not treatment cost. Estimates of indirect costs due to mortality and morbidity alone range from $11.2 billion (4) to $31.3 billion (3) in 1990 dollars. These estimates do not include other categories of cost such as the costs of lost leisure time (5) and the pain and suffering endured by individuals with depression and their families (6).

Research demonstrates that appropriate treatment for depression improves functional outcomes, thereby reducing the cost of morbidity associated with the disorder (7–9). However, whether such reductions in morbidity cost are large enough to compensate for the cost of treatment is not known. In other words, do the savings from treating depression outweigh the cost of treatment? We sought to fill this knowledge gap by examining the relationship between cost of treatment for depression and changes in lost employment earnings due to lost work days in a community-based sample of individuals with depressive disorders.

Methods

Data collection

Data collection, which is described in detail elsewhere (10), is outlined briefly here. In a stratified sample design that oversampled rural subjects, 11,078 individuals were randomly selected from 15,721 households in Ar-

Dr. Zhang*, who previously was with the Department of Veterans Affairs in Little Rock, Arkansas, and the University of Arkansas for Medical Sciences, is now affiliated with Merck and Company, Inc., in Whitehouse Station, New Jersey.* ***Dr. Rost, Dr. Fortney,*** *and* ***Dr. Smith*** *are with the Centers for Mental Healthcare Research of the department of psychiatry at the University of Arkansas for Medical Sciences in Little Rock.* ***Dr. Fortney*** *and* ***Dr. Smith*** *are also with the Center for Mental Healthcare and Outcomes Research, Health Services Research and Development, of the Department of Veterans Affairs in Little Rock. Address correspondence to* ***Dr. Rost*** *at the Department of Psychiatry, University of Arkansas for Medical Sciences, 5800 West Tenth Street, Suite 605, Little Rock, Arkansas 72204 (e-mail, rostkathrynm@exchange.uams.edu).*

kansas to complete an eight-item telephone screen for current depression (11). A total of 998 of the individuals (9 percent) screened positive for depressive disorder or substantial depressive symptoms.

We excluded 364 of the 998 individuals from the study for various reasons: 14 respondents had suicidal ideation and were referred to treatment; 288 respondents manifested a postbereavement depression; 54 respondents were subsequently diagnosed with lifetime mania; and eight respondents denied all depressive symptoms in a baseline home interview following the screening. Of the remaining 634 individuals, 470 (74 percent) agreed to participate in the study.

We examined differences between participants and nonparticipants in the longitudinal study. Only age and rural or urban residence were found to differ significantly, although not substantially, between the participant and nonparticipant groups. Participants were a mean±SD of 46.3±15.8 years old, compared with 55.1±18.7 years for the nonparticipants ($t=5.3$, $df=253$, $p<.01$). A larger proportion of participants than nonparticipants resided in urban areas (26 percent, compared with 17 percent for nonparticipants; $\chi^2=5.4$, $df=1$, $p<.01$). Gender, race, marital status, insurance coverage, baseline severity of depressive symptoms, physical and psychiatric comorbidities, previous health care utilization self-reported at baseline, and lost work days were not found to differ significantly.

Because participants and nonparticipants did not differ in utilization, severity and comorbidity, and lost work days, the effect of nonresponse bias in estimating costs of treatment and changes in lost earnings was expected to be minimal. To make the sample subjects more representative of the adults with depression identified in the telephone survey and to adjust for the stratified sampling design, we weighted the sample by age, gender, education, and regional distribution.

The subjects were reinterviewed by telephone six months and 12 months after the baseline interview. At these follow-up interviews, they were asked to provide consent for release of information from all health care providers and third-party payers. Both health care providers and third-party payers were contacted to obtain all essential medical records and billing and reimbursement records. These records were also used to identify additional health care providers seen but not initially identified by the subject. Medical and billing records from these additional providers were then obtained. Utilization and expenditure data were abstracted from the billing and insurance records following a detailed protocol. This process has been used in several successful projects to collect utilization and expenditure data in a community population (12,13).

Of the 470 subjects participating in the study, 446, or 94.9 percent, completed both the six-month and the 12-month follow-up interviews. We were not able to obtain complete medical and insurance records for 11 of these subjects, and they were excluded from the analyses in this paper. Therefore, the final sample consisted of 435 subjects.

Dependent variable

The dependent variable in this study was net economic costs, defined as the sum of changes in lost employment earnings and the costs of depression treatment during the 12-month period.

Changes in lost earnings. Subjects were asked about their number of lost work days for the four weeks before the baseline interview and the six-month and 12-month follow-up interviews. Estimates for the two interim periods between interviews were linearly extrapolated. Changes in lost work days in the first and second six-month periods were summed to derive the annual change in lost work days. A negative value indicates that the total number of lost work days decreased during the 12 months after baseline.

To calculate the changes in lost earnings due to changes in lost work days, the number of lost work days was multiplied by eight (hours) and then by the subject's hourly wage rate. Wage rates for 25 subjects were missing. For 19 of the 25 subjects, the average wage rate for the persons with the subject's age, sex, and occupation listed in the Statistical Abstract of the United States (14) was used. For the remaining six subjects, whose occupation codes were also missing, we substituted the national average rates, according to their age and gender. Because average earnings in Arkansas were 77.3 percent of the national average in 1993 ($19,008 versus $24,575 annually) (14), we weighted the national wage rates by 77.3 percent for these 25 subjects. Although there are other categories of economic benefits that result from treatment, we limited our analyses to the changes in lost earnings.

Cost of treatment for depression. The total economic cost of depression treatment to society should include the health care costs of providing the treatment services as well as costs incurred by the patient in obtaining the services. Costs incurred by patients include costs of time (travel time, waiting time, and treatment time) and costs of transportation. In our base-case scenario—a set of assumptions about costs and lost earnings from which we calculated the value of the dependent variable used in the regression analyses—we included only health care costs as cost of treatment because we did not have data on patient time and transportation costs. However, we performed a sensitivity analysis—an analysis of an alternative scenario in which the assumptions deviate from those in the base-case scenario—in which an estimated cost of patient time was included.

Health care costs of depression treatment were approximated using charges abstracted from billing and insurance records. When depression treatment was provided in a visit during which the patient received care for physical problems, we allocated 50 percent of the charges for the visit to the cost of depression treatment, in our base-case scenario. The remainder of the charges was allocated to care for physical problems. We used a similar procedure to allocate charges when the visit addressed multiple psychiatric problems including depression. We performed sensitivity analyses in alternative scenarios by

varying this percentage allocation. All health care costs were converted into 1994 fourth-quarter values using the medical component of the Consumer Price Index (14).

Control variables

Control variables include physical comorbidity, psychiatric comorbidity, severity of depression, and sociodemographic characateristics. Physical comorbidity was measured by the number of 11 chronic physical conditions reported by a subject at baseline. They included arthritis, asthma, cancer, diabetes, epilepsy, heart disease, chronic lung disease, gastrointestinal disorders, hypertension, renal failure, and stroke.

Psychiatric comorbidity, identified at baseline by the Quick Diagnostic Interview Schedule (QDIS) (15), included lifetime and one-year anxiety disorder, panic disorder, obsessive-compulsive disorder, alcohol dependence or abuse, drug dependence or abuse, schizophrenia or schizophreniform disorder, and posttraumatic stress disorder. Severity of depression was measured by the acuity of *DSM-III-R* depressive symptoms, standardized to a 0-to-100 scale.

Sociodemographic variables included age, gender, education, marital status, minority status, and income. Income was expressed as the ratio of family income to poverty-level income according to family size.

Analytical model

We estimated a multiple linear regression model in the base-case scenario to examine the net economic cost for subjects who received depression treatment, compared with that for subjects who did not receive depression treatment. The dependent variable was net economic costs as defined above in the base-case scenario. The explanatory variable of major interest was a dummy variable indicating whether a subject received depression treatment during the 12-month study period. Control variables included baseline physical and psychiatric comorbidities, baseline severity of depression, and sociodemographic characteristics, as described above.

A direct application of the model specified above could have resulted in a biased estimate of the treatment effect on net economic cost, because in an observational design subjects self-select into the treatment condition as opposed to random assignment in a randomized controlled trial. In a controlled trial, differences in subjects' characteristics (observed or unobserved) between the treatment and control groups are balanced by the random assignment (16). However, in an observational study, individuals who seek treatment may be more severely ill in ways that the study's instruments do not measure, compared with those who do not seek treatment. Such unmeasured differences in severity may result in a biased estimate of the treatment effect. To correct for this potential selection bias, we used instrumental variables, a widely used econometric method, in sensitivity analyses to examine the robustness of our results.

Table 1

Characteristics of 435 subjects who screened positive for depressive disorder or depressive symptoms at baseline of a one-year study of net economic cost of depression treatment

Characteristic	Value
Receiving treatment for depression (%)	39.3
Mean age (years)	45.6
Female (%)	67.1
Mean level of education (on 1-to-9 scale)	5.0
Married (%)	51.3
Mean ratio of household income to poverty-level income	2.8
White (%)	80.7
Employed (%)	48.5
Mean depression severity score (on a 0-to-100 scale)	49.3
Mean number of comorbid psychiatric conditions (range of 0 to 7)	1.4
Mean number of comorbid physical conditions (range of 0 to 11)	2.4

Results

Base-case scenario

Characteristics of the 435 study subjects are presented in Table 1. A total of 171 subjects received treatment for depression during the 12-month period. The results of the regression analysis for the base-case scenario are presented in Table 2. The estimated effect of depression treatment on net economic cost was –$448 (p=.4). The negative sign of the estimate indicates that the net economic cost was lower for those receiving depression treatment, compared with those who did not receive depression treatment.

An alternative explanation is that there were potential economic savings from depression treatment. However, the result was not statistically significant at conventional levels. Therefore, we concluded that depression treatment had no statistically significant effect on net economic cost. In other words, treatment for depression paid for itself in terms of savings from the reductions in lost earnings.

Sensitivity analyses

We performed sensitivity analyses in several alternative scenarios to examine the robustness of the result in the base-case scenario. In the base-case scenario, we did not take into account the potential selection bias. We performed a sensitivity analysis using instrumental variables to correct for selection bias (scenario A). In applying this method, we first estimated the probability of seeking treatment for depression using a nested logit model (17). In this model, we used actual travel distances to mental health providers and primary care providers as predictors for choice of treatment for depression. Theoretically, travel time represents an appropriate instrumental variable because it affects the decision to seek treatment but does not affect outcomes directly. A geographic information system was used to code the geographic location of study subjects as well as all general medical providers (N=3,419) and mental health specialists (N=1,034)

Table 2

Coefficients resulting from regression analysis of the effect of treatment of depression on net economic cost for characteristics in the base-case scenario[1]

Characteristic	Coefficient
Receiving treatment for depression (=1)	–448.2
Mean age (years)	42.4**
Female (=1)	1149.7**
Mean level of education (on 1-to-9 scale)	320.9*
Married (=1)	–859.9
Mean ratio of household income to poverty-level income	–13.3
White (=1)	–230.3
Mean depression severity score (on a 0-to-100 scale)	15.0
Mean number of comorbid psychiatric conditions (range of 0 to 7)	–45.6
Mean number of comorbid physical conditions (range of 0 to 11)	–74.7

[1] Intercept=–3571.4
*p<.05
**p<.01

practicing in Arkansas and to calculate the travel times from each study subject to each provider. A three-level nested logit model was specified to estimate the sequential impact of travel times on choice of provider, choice of provider sector, and the decision to seek treatment.

Travel time was found to be a significant predictor of choice of provider in both the general medical and the specialty sectors (p<.001). The expected maximum utility of provider choice—a function of travel times to providers in each sector—was found to be a significant predictor of sector choice (p<.05) and, in turn, of the decision to seek depression treatment.

The predicated probability of seeking depression treatment from this nested logit model was then used in the regression analysis to estimate net economic cost, replacing the dummy variable indicating depression treatment in the base-case scenario. In this sensitivity analysis, the results indicated that the effect of depression treatment on net economic cost was –$1,118 (p=.7). Thus the estimated effect was magnified, from –$448 to –$1,118. However, the standard error of the estimate increased as well, due to the application of instrumental variables, resulting in a nonsignificant parameter estimate. Thus we can conclude again that depression treatment had no statistically significant effect on net economic cost and that depression treatment paid for itself.

In the base-case scenario, if the visit was also for physical or other problems, we allocated 50 percent of the charges as costs of treatment for depression. This allocation was arbitrary. We therefore performed a sensitivity analysis by allocating 100 percent of the charges as costs of treatment for depression for those visits (scenario B). The same regression analysis used in the base-case scenario was used in scenario B. The estimated treatment effect on net economic costs was –$420 (p=.4). We also performed a regression analysis using 0 percent as the allocation of depression treatment costs (scenario C). In this scenario, the estimated effect of depression treatment on net economic costs was –$476 (p=.3). In both of these scenarios, the results were essentially the same as that of the base-case scenario.

From the societal perspective as well as the patient's perspective, the time consumed in receiving treatment—including travel time, waiting time, and time seeing the provider—should be considered part of the cost of treatment. We performed an analysis including an estimated time cost as part of the treatment cost (scenario D).

Specifically, for outpatient visits that were exclusively for depression we assumed the total time consumed was three hours for each visit. For outpatient visits that were partly for depression, we assumed that one and a half hours was spent for treatment of depression. For inpatient admissions, we assumed eight hours a day for each hospital stay. Then the total number of hours was prorated by the ratio of depression charges to the total charge for the stay. The cost of patient time was estimated by the number of hours multiplied by a subject's wage rate. The estimated effect of depression treatment on net economic cost in this scenario was –$399 (p=.4). Again, the cost of depression treatment was offset by the savings in reduced lost earnings, or depression treatment paid for itself.

Recent research on cost of illness suggests that the human capital approach used to calculate indirect costs or lost earnings in our study may overestimate actual costs (18,19). In some occupations, for example, the economic cost of absenteeism from work due to illness may be reduced by one of several ways. First, the ill employee may make up the lost production when he or she returns to work from sick leave. Second, coworkers may help make up the lost production by sharing the ill employee's responsibilities. Third, when the economy is not at full employment, the employer may be able to find a replacement worker at little additional cost.

Based on these arguments, we analyzed another scenario in which we assumed the value of lost earnings was half of that in the base-case scenario (scenario E). The estimated effect of depression treatment on net economic costs in this scenario was $17 (p=.9). Even in this conservative scenario, depression treatment still paid for itself.

Discussion and conclusions

Because treatment cost is only a small part of the total cost of depression (3), the economic value of depression treatment must be evaluated by examining the changes in potential savings in morbidity costs, such as lost earnings. Our analyses indicate that depression treatment, at the minimum, pays for itself in terms of savings in lost earnings. Our sensitivity analyses in the alternative scenarios had similar results.

These findings suggest that self-insured employers can fully recover what they expend for depression treatment. This conclusion is conser-

vative because we did not take into account increased productivity while at work—for example, reduced tardiness—associated with recovery from depression. We also did not take into account other economic benefits of depression treatment such as increased household production and reduced pain and suffering.

Other studies have supported increased cost-sharing for mental health services because demand for mental health services is more responsive to cost-sharing than demand for physical health services (20). Our findings, in contrast, suggest that there may be limited wisdom in imposing more restrictive constraints on mental health insurance policies than on physical health insurance policies. Such constraints may reduce the likelihood that depressed individuals seek professional help for mental health services.

Federal and state governments may also recover what they expend for treating depression among individuals who are publicly insured if such treatment increases employment earnings, and hence tax revenues, or decreases transfer payments. However, a definitive demonstration of such savings requires a study with a larger population of publicly insured employees than existed in the subject pool we recruited.

If high-quality treatment for depression, such as treatment that is concordant with the guidelines of the Agency for Health Care Policy and Research, results in a greater improvement in patient outcomes, we expect a greater economic return on such treatment as a result of further reductions in lost work days and further gains in increased productivity. Future studies should be designed to examine the relationship between quality of treatment and economic benefits.

Although our conclusions are strengthened by a prospective design with high follow-up rates in a community sample, several factors limit the generalizability of our findings. First, because subjects were recruited by telephone, we could not screen any of the approximately 11 percent of the state's residents who did not have a household telephone. Second, because few subjects were covered by capitated insurance plans, we do not know whether these findings generalize to regions where capitation dominates. Third, only changes in lost work days were included as economic benefits; other important benefits were not included in our analyses, as mentioned previously. In addition, data on lost work days in this study were based on subjects' self-report and were not verified by researchers. Future studies may be designed to address these issues.

In summary, this study is a first step in quantifying the economic benefits of providing treatment for depression. The results from this study indicate that, through reduction in lost work days alone, depression treatment pays for itself. Therefore, policies should be designed to increase access to professional help for individuals with mental health problems such as depression. ♦

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