Cost of Lost Productive Work Time Among US Workers With Depression

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Context Evidence consistently indicates that depression has adversely affected work productivity. Estimates of the cost impact in lost labor time in the US workforce, however, are scarce and dated.

Objective To estimate the impact of depression on labor costs (ie, work absence and reduced performance while at work) in the US workforce.

Design, Setting, and Participants All employed individuals who participated in the American Productivity Audit (conducted August 1, 2001–July 31, 2002) between May 20 and July 11, 2002, were eligible for the Depressive Disorders Study. Those who responded affirmatively to 2 depression-screening questions (n=692), as well as a 1:4 stratified random sample of those responding in the negative (n=435), were recruited for and completed a supplemental interview using the Primary Care Evaluation of Mental Disorders Mood Module for depression, the Somatic Symptom Inventory, and a medical and treatment history for depression. Excess lost productive time (LPT) costs from depression were derived as the difference in LPT among individuals with depression minus the expected LPT in the absence of depression projected to the US workforce.

Main Outcome Measure Estimated LPT and associated labor costs (work absence and reduced performance while at work) due to depression.

Results Workers with depression reported significantly more total health-related LPT than those without depression (mean, 5.6 h/wk vs an expected 1.5 h/wk, respectively). Eighty-one percent of the LPT costs are explained by reduced performance while at work. Major depression accounts for 48% of the LPT among those with depression, again with a majority of the cost explained by reduced performance while at work. Self-reported use of antidepressants in the previous 12 months among those with depression was low (<30%) and the mean reported treatment effectiveness was only moderate. Extrapolation of these survey results and self-reported annual incomes to the population of US workers suggests that US workers with depression employed in the previous week cost employers an estimated $44 billion per year in LPT, an excess of $31 billion per year compared with peers without depression. This estimate does not include labor costs associated with short- and long-term disability.

Conclusions A majority of the LPT costs that employers face from employee depression is invisible and explained by reduced performance while at work. Use of treatments for depression appears to be relatively low. The combined LPT burden among those with depression and the low level of treatment suggests that there may be cost-effective opportunities for improving depression-related outcomes in the US workforce.

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HEALTH CONDITIONS THAT affect ability to work are costly to employers (unpublished data; an electronic manuscript, *Lost Productive Work Time Costs From Health Conditions in the US: Results From the American Productivity Audit*, is available from W.F.S. on request). Evidence consistently indicates that common conditions including migraine,[1-8] low back pain,[9,10] diabetes,[11,12] allergic rhinitis,[5,13-18] gastroesophageal reflux,[19-21] and depression[5,10,22-25] dominate health-related lost labor time costs. Among these, depression is among the most costly because it is highly prevalent and comorbid with other conditions. Furthermore, although workers with depression are usually present at work, their performance can be substantially reduced.

Model-based estimates indicate that depression costs US employers $24 billion annually in lost productive work time.[23] However, some notable limitations challenge the relevance of this and other estimates. Using a human capital approach, this model makes important assumptions regarding the prevalence of depression in the workforce, the duration of depressive episodes, their imputed impact on productive time at work, and the cost to employers. Furthermore, although stated in 1990 terms, the cost estimate is based on data collected in the early to mid-1980s. The management and treatment of depression has changed substantially since the 1980s; use of pharmaceutical care and, more generally, access to care have increased[26] and may have influenced disability status and how work time is lost.

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The American Productivity Audit was initiated to more directly understand the relation between health and lost productive time (LPT) in the US workforce (W.F.S., unpublished data). We describe the results of a supplemental study to the productivity audit that focused on depression in the US workforce.

METHODS

The productivity audit was completed using the Work and Health Interview (Ricci et al[27] and unpublished data; 2 electronic manuscripts, *The Work and Health Interview* and *Validation of the Work and Health Phone Interview*, are available from W.F.S. on request). A supplemental study, the Depressive Disorders Study, was conducted in a random sample of audit participants to more accurately estimate the LPT costs due to depression.

Work and Health Interview

The Work and Health Interview, a computer-assisted telephone interview, captures data on work absence, reduced performance while at work, and health-related causes. The recall period is 2 weeks. The interview comprises 8 modules. The first 3 capture detailed data on employment status, occupation and usual work time, and the presence of 22 different health conditions. The health assessment includes 1 of 2 depression screening questions (ie, "In the past 2 weeks, did you feel sad, blue, or down in the dumps?") that were used to identify random samples of individuals with and without probable depression for the Depressive Disorders Study. A module for missed days of work captured missed workdays and the related cause. A module for job visualization asked about activities performed at work and about job demand and control.[28] The module for LPT on days at work asked about missed hours and reduced performance on workdays and the related cause. The demographics module gathered additional information, including annual salary.

Health-related LPT, described in detail elsewhere (Ricci et al[27] and unpublished data, available from W.F.S. on request), was defined as the sum of hours per week absent from work for a health-related reason ("absenteeism") and the hour-equivalents per week of health-related reduced performance on workdays ("presenteeism"). Absenteeism was calculated as the sum of missed workdays (ie, multiplied by average number of hours worked per day) and reduced work hours on workdays (ie, late start, early departure, or missed time during the workday) during the recall period. Presenteeism was defined as reduced work performance during the recall period. It was quantified by responses to 6 questions on specific work behaviors.

For 5 of the 6 questions, respondents were asked how often on average during the recall period they lost concentration, repeated a job, worked more slowly than usual, felt fatigued at work, and did nothing at work on days when they were at work not feeling well. Responses were "all of the time," "most of the time," "half of the time," "some of the time," and "none of the time." A sixth question asked respondents about the average amount of time it took them to start working after arriving at work on days not feeling well during the recall period. The aggregate measure of reduced performance was then derived in 4 steps: (1) convert the categorical response options for 5 of the 6 questions into percentages as follows: all of the time (100%), most of the time (75%), half of the time (50%), some of the time (25%), and none of the time (0%); (2) average the responses to the 5 categorical behavior questions to yield the average percentage of lost productive work time and multiply this percentage by the number of hours worked per day to yield its hour equivalent; (3) add the hours of lost productive work time to the reported average amount of time it took to start working after arriving at work; and (4) divide by the number of weeks per recall period for the hours per week of LPT on days at work.

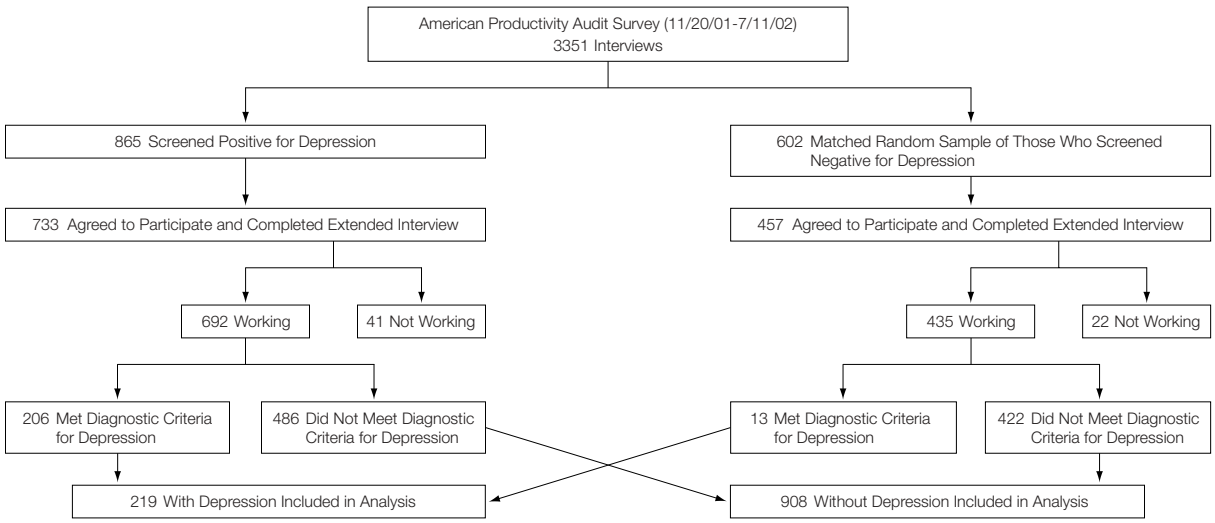
American Productivity Audit

The productivity audit, the parent survey for the Depressive Disorders Study, is a national survey of the US population, with 30 523 interviews completed between August 1, 2001, and July 31, 2002 (W.F.S., unpublished data). The Depressive Disorders Study and all related estimates are based on the subsample of 3351 productivity audit interviews completed between May 20 and July 11, 2002, and the 1190 individuals selected from this subsample to complete the supplemental interview.

Audit households were selected as a random sample of residences within the continental United States with a telephone and at least 1 permanent adult (ie, aged 18-65 years) resident. Residents who reported affirmatively to the Current Population Survey (CPS)[29] question on employment status (ie, "Last week, did you do any work for either pay or profit?"), and a 10% random sample of those who responded in the negative, were invited to participate. Up to 2 eligible members were interviewed per household. Oral informed consent was obtained from each participant before initiating the interview. Audit participation was 66.2%.

A 2-step weighting method accounted for selective participation. One weight was applied to individuals as the inverse of the number of phone numbers available for incoming calls to account for the unequal probability of selecting households. Second, a population weighting adjustment accounted for selection bias due to incomplete coverage of the US population and ensured that estimates of certain sample demographic subgroups' totals conformed to known values. The CPS was used as the external reference database because it provides high-quality data on a nationally representative sample of the US workforce. A raking method was used for population weighting adjustment, benchmarking to 4 variables common to both the productivity audit and the CPS. Raking uses an iterative proportional fitting procedure to ensure that the weights assigned to individual respondents lead to marginal distributions on auxiliary variables that are equivalent to the CPS.[30] Wesvar version 4 statistical software (Westat, Rock-

Figure. Identification and Selection of the Analytic Sample for the Depression Disorders Study



ville, Md), was used to perform the raking adjustments.

The Depressive Disorders Study

The FIGURE describes participant identification and selection for the Depressive Disorders Study. Between May 20 and July 11, 2002, 3351 audit participants were asked 2 questions: "In the past 2 weeks, did you feel sad, blue, or down in the dumps?" and "In the past 2 weeks, did you have little interest or pleasure in doing things?" All participants who responded affirmatively to at least 1 of these 2 questions were invited to participate (n=865) in the Depressive Disorders Study. A group-matched stratified (by age, sex, occupation eligibility, and date of interview) random sample (1:4) of those reporting "no" to both questions was also invited to participate (n=602). A total of 733 (692 met employment criteria) respondents who screened positive and 457 (435 met employment criteria) who screened negative completed the extended interview. Respondents received a $10 incentive. Participation in the extended interview was 86%. The study protocol and informed consent statement were approved by the Essex institutional review board, Lebanon, NJ.

The extended interview included the Primary Care Evaluation of Mental Disorders (PRIME-MD) Mood Module[31] along with the module for most recent depressive episode (ie, time since last depressive episode and the duration of episode). The PRIME-MD is a validated diagnostic interview. The mood module contained 9 items to identify individuals with depression using *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition* (*DSM-III-R*) criteria.[32] Subsequently, the 26-item Somatic Symptom Inventory (SSI)[33] was administered. For each of 26 physical symptoms, respondents reported the extent to which they were bothered by each symptom in the past month ("not at all," "a little bit," "moderately," "quite a bit," and "a great deal"). The association between physical symptoms and depression was assessed by calculating the prevalence of depression for each symptom cluster and for respondents who did not meet criteria for any symptom cluster. Finally, 11 questions were asked about medical care and treatment for depression (ie, frequency of talking with a physician about depression, physician's diagnosis, whether or not a medication was prescribed, which medication was prescribed, use and effectiveness of the medication, and rating of medication adverse effects).

PRIME-MD diagnostic criteria based on the *DSM-III-R* were used to assign the diagnosis of a specific depressive disorder. A total of 29.8% (n=206) of those who screened positive for depression met diagnostic criteria for major depressive disorder, dysthymia, or partial remission or recurrence of major depressive disorder. Only 3.0% (n=13) of those who answered in the negative to both screening questions met diagnostic criteria for depression. All 13 met criteria for dysthymia and 1 also met criteria for major depressive disorder.

Clustering of physical symptoms using factor analysis was evaluated to provide a structured summary of SSI data. Factor solutions differed for respondents with and without depression; we used the factor solutions for those with depression. Orthogonal and oblique rotation models did not differ; we relied on the oblique models. An item was included in a factor if its absolute value was greater than 0.4 and it did not load significantly on more than 1 factor. The number of factors was defined from scree plots and limited to those with an eigenvalue >1.0. A 7-factor solution was deemed optimal among respondents with depression: (1) pain, weakness, and fatigue (7 items, 27.3% of variance); (2) gastrointestinal complaints (3 items, 13.5% of variance); (3) panic or anxiety (3 items, 15.4% of variance); (4) faintness or dizziness (4

items, 15.6% of variance); (5) autonomic instability with anxiety (2 items, 12.4% of variance); (6) ringing in the ears, or head or nose fullness (2 items, 9.4% of variance); and (7) sensory or nerve impairment (2 items, 9.4% of variance). Only gastrointestinal complaints and panic or anxiety were common to individuals with and without depression. A dichotomous variable defined the presence of a factor-based symptom cluster. For each factor, the cutpoint was defined at the 10th percentile of respondents without depression.

Analyses were completed to estimate the prevalence of depression in the US workforce and to estimate LPT and associated costs among individuals with depression compared with those without depression. Three mutually exclusive categories were defined: major depressive disorder (ie, major depressive disorder only and major depressive disorder plus dysthymia), dysthymia (ie, any dysthymia excluding major depressive disorder with dysthymia), and partial remission or recurrence of major depressive disorder (ie, excluding partial remission or recurrence of major depressive disorder with dysthymia). Depression prevalence was estimated in 2 steps. First, age- and sex-specific prevalences were calculated based on the sampling fraction of those responding in the positive and in the negative to the 2 depression screening questions. Second, using direct adjustment, age and sex stratum–specific prevalence estimates were multiplied times the corresponding age- and sex-specific population size of the US workforce. Lost productive time in respondents with and without depressions were calculated as total LPT for any health-related reason. Excess LPT was defined as the difference in mean LPT in respondents with depression compared with an expected value in those without depression. The expected value was estimated by applying rates of LPT from specific age and sex groups without depression to the same demographic subgroups of individuals who met criteria for depression. This same method was used to estimate mean LPT for depression with and without a specific symptom cluster and for the corresponding expected value among respondents without depression. Lost labor costs were estimated from lost productive hours and self-reported annual income (ie, hourly wage equaled annual income divided by the mean number of hours worked per week times 52 weeks). Lost dollars were calculated by multiplying lost hours by the hourly wage.

Benchmarking and weighting variables with missing data (ie, 0.9%) were imputed using the age- and sex-specific mode for categorical variables, and the age- and sex-specific median for continuous variables. If only 1 of the 5 variables used to calculate presenteeism was missing, the mean value of the remaining 4 variables was substituted, reducing the proportion with missing presenteeism estimates from 4.5% to 3.3%. Salary information was missing for 18.7% of all respondents. Missing salary data were modeled using multiple linear regression. SAS version 8.2 was used for all analyses (SAS Institute Inc, Cary, NC) and $P<.05$ was used to determine statistical significance.

RESULTS

Participation in the American Productivity Audit has been described in detail elsewhere (unpublished data available from W.F.S. on request). Among audit participants, women made up 56.1% of the sample and respondents were equally distributed across the 4 age groups. A majority of respondents were white (77.0%), formally educated beyond high school (66.6%), and working more than 30 hours per week (82.9%) with an annual income less than $40 000 (51.3%). During the 2-week recall period, 10.0% of workers were absent from work for a personal health reason and 38.1% reported unproductive time due to personal health on at least 1 workday. Overall, workers lost a mean of 1.89 hours per week of productive work time for either a personal or family health reason. Reduced performance at work due to personal health accounted for 65.3% (1.32 h/wk) of the lost time.

Respondents who met PRIME-MD criteria for any depressive disorder with a treatment indication (ie, major depressive disorder, dysthymia, or partial remission or recurrence of major depressive disorder) were of similar sex, age, race, annual salary, and employment status as those without a depressive disorder (TABLE 1). Among all participants, the majority were women (65.6%), between 35 and 65 years of age (66.0%), white (76.2%), earning less than $40 000 annually (66.2%), and working more than 30 hours per week (80.7%). In contrast, respondents with a depressive disorder were significantly more likely than those without depression to have a lower education level (43.0% vs 33.7% with a high school education or less; $P = .01$), and to have at least 1 of the 7 physical symptom clusters derived from factor analysis (78.1% vs 41.4%; $P<.001$) (Table 1).

Compared with those with other depressive disorders, those with major depression were significantly more likely to have a lower educational level ($P<.01$ for all comparisons), earn less than $20 000 annually ($P<.01$), and report physical symptoms associated with pain, weakness, and fatigue ($P<.001$), panic or anxiety ($P<.001$), and autonomic instability ($P<.001$) (Table 1). In contrast, those with dysthymia were, on average, significantly more likely to have attained a higher level of formal education ($P<.01$), report a higher annual salary ($P<.01$), and work more than 30 hours per week (Table 1).

Prevalence of Depressive Disorders

The 2-week prevalence of any depressive disorder in the US workforce was estimated at 9.4% (TABLE 2). Dysthymia was the most prevalent (3.6%), followed by major depression (3.4%), and partial remission or recurrence of major depressive disorder (2.4%) (Table 2). Any depression was close to 2 times more prevalent in women than in men, with a marked difference in the prevalence of major depression (women, 5.3%; men, 1.6%). Other notable patterns included a strong inverse gradient with increasing education level and,

Table 1. Distribution of Employed American Productivity Audit Respondents, by Selected Demographic, Employment, and Health Characteristics

Characteristic	Depression, No. (%)			Depressive Disorder, No. (%)			
	Any (n = 219)	None (n = 908)	*P* Value*	Major Depression (n = 87)	Dysthymia (n = 74)	Partial Remission of Major Depression (n = 58)	*P* Value†
Sex							
Men	64 (29.2)	324 (35.7)	.07	20 (23.0)	24 (32.4)	20 (34.5)	.12
Women	155 (70.8)	584 (64.3)		67 (77.0)	50 (67.6)	38 (65.5)	
Age, y							
18-34	74 (33.8)	309 (34.0)	.95	30 (34.5)	25 (33.8)	19 (32.8)	>.99
35-49	95 (43.4)	384 (42.3)		37 (42.5)	33 (44.6)	25 (43.1)	
50-65	50 (22.8)	215 (23.7)		20 (23.0)	16 (21.6)	14 (24.1)	
Sex and age, y							
Men, 18-34	23 (10.5)	126 (13.9)	.59	7 (8.1)	9 (12.2)	7 (12.1)	.96
Men, 35-49	28 (12.8)	132 (14.5)		9 (10.3)	11 (14.9)	8 (13.8)	
Men, 50-65	13 (5.9)	66 (7.3)		4 (4.6)	4 (5.4)	5 (8.6)	
Women, 18-34	51 (23.3)	183 (20.2)		23 (26.4)	16 (21.6)	12 (20.7)	
Women, 35-49	67 (30.6)	252 (27.7)		28 (32.2)	22 (29.7)	17 (29.3)	
Women, 50-65	37 (16.9)	149 (16.4)		16 (18.4)	12 (16.2)	9 (15.5)	
Race							
White	160 (73.0)	693 (76.2)	.29	57 (65.5)	57 (77.0)	46 (79.3)	.06
Black	28 (12.8)	84 (9.3)		14 (16.1)	5 (6.8)	9 (15.5)	
Other	30 (13.7)	125 (13.8)		16 (18.4)	11 (14.9)	3 (5.2)	
Not stated	1 (0.5)	6 (0.7)		0	1 (1.4)	0	
Education							
<12th grade; no diploma	18 (8.2)	40 (4.4)	.01	11 (12.6)	2 (2.7)	5 (8.6)	.01
High school graduate or GED	76 (34.8)	266 (29.3)		32 (36.8)	26 (35.1)	18 (31.0)	
Some college; no degree	59 (26.9)	218 (24.0)		20 (23.0)	19 (25.7)	20 (34.5)	
Associates degree	18 (8.2)	79 (8.7)		8 (9.2)	7 (9.5)	3 (5.2)	
Bachelors degree	36 (16.4)	217 (23.9)		12 (13.8)	12 (16.2)	12 (20.7)	
Graduate degree	12 (5.5)	87 (9.6)		4 (4.6)	8 (10.8)	0	
Not stated	0	1 (0.1)		0	0	0	
Annual salary, $							
<10 000	26 (11.9)	84 (9.3)	.10	7 (8.1)	11 (14.9)	8 (13.8)	.01
10 000-19 999	38 (17.4)	127 (14.0)		25 (28.7)	5 (6.8)	8 (13.8)	
20 000-29 999	39 (17.8)	162 (17.8)		12 (13.8)	17 (23.0)	10 (17.2)	
30 000-39 999	41 (18.6)	127 (14.0)		18 (20.7)	7 (9.5)	16 (27.6)	
40 000-49 999	21 (9.6)	90 (9.9)		9 (10.3)	9 (12.2)	3 (5.2)	
≥50 000	30 (13.7)	188 (20.7)		7 (8.1)	15 (20.3)	8 (13.8)	
Not stated	24 (11.0)	130 (14.3)		9 (10.3)	10 (13.5)	5 (8.6)	
Employment status, h/wk							
>30	177 (80.8)	686 (75.5)	.16	70 (80.4)	64 (86.5)	43 (74.1)	.49
20-30	18 (8.2)	116 (12.8)		7 (8.1)	4 (5.4)	7 (12.1)	
<20	14 (6.4)	58 (6.4)		6 (6.9)	5 (6.8)	3 (5.2)	
Not stated	10 (4.6)	48 (5.3)		4 (4.6)	1 (1.4)	5 (8.6)	
Depression screening status‡							
Positive	206 (94.1)	486 (53.5)	.01	86 (98.9)	62 (83.8)	58 (100)	.01
Negative	13 (5.9)	422 (46.5)		1 (1.1)	12 (16.2)	0	
Presence of physical symptom clusters							
Pain, weakness, or fatigue	107 (48.9)	121 (13.3)	.01	51 (58.6)	30 (40.5)	26 (44.8)	.01
Gastrointestinal complaints	66 (30.1)	92 (10.1)	.01	30 (34.5)	18 (24.3)	18 (31.0)	.01
Panic or anxiety	49 (22.4)	70 (7.7)	.01	28 (32.2)	12 (16.2)	9 (15.5)	.01
Faintness or dizziness	45 (20.6)	39 (4.3)	.01	20 (23.0)	11 (14.9)	14 (24.1)	.01
Autonomic instability	71 (32.4)	100 (11.0)	.01	43 (49.4)	13 (17.6)	15 (25.9)	.01
Ears ringing, head or nose fullness	83 (37.9)	156 (17.2)	.01	35 (40.2)	28 (37.8)	20 (34.5)	.01
Sensory or nerve impairment	92 (42.0)	176 (19.4)	.01	43 (49.4)	26 (35.1)	23 (39.7)	.01
None present	48 (21.9)	532 (58.6)	.01	16 (18.4)	20 (27.0)	12 (20.7)	.01

Abbreviation: GED, General Educational Development (test).
*Not stated category excluded from calculation of χ^2 statistic between "any" and "none" groups.
†Not stated category excluded from calculation of χ^2 statistic among depressive disorder and "none" groups.
‡See "Methods" section for description of measurement of depression screening status.

Table 2. Prevalence of Any Depression and Specific Depressive Disorders in the US Workforce, by Selected Demographic, Employment, and Health Characteristics*

Characteristic	Any Depression	Depressive Disorder		
		Major Depression	Dysthymia	Partial Remission or Recurrence of Major Depression
Overall 2-week prevalence	9.4	3.4	3.6	2.4
Sex				
Men	6.8	1.6	3.1	2.1
Women	12.2	5.3	4.2	2.7
Age, y				
18-34	8.2	3.1	3.1	2.0
35-49	10.7	3.5	4.5	2.7
50-65	9.1	3.5	3.0	2.6
Sex and age, y				
Men, 18-34	5.4	1.8	2.0	1.6
Men, 35-49	8.7	1.5	4.5	2.7
Men, 50-65	6.5	1.5	2.7	2.3
Women, 18-34	12.5	5.1	4.7	2.7
Women, 35-49	12.6	5.5	4.4	2.7
Women, 50-65	11.4	5.4	5.3	2.8
Race				
White	9.2	2.9	3.8	2.5
Black	10.6	4.3	2.2	4.1
Other	9.2	5.5	2.9	0.9
Not stated	13.5	0.0	13.5	0.0
Education				
<12th grade; no diploma	13.9	8.9	0.7	4.3
High school graduate or GED	10.9	4.3	3.7	2.8
Some college; no degree	10.8	3.6	3.8	3.5
Associates degree	7.5	2.8	3.9	0.8
Bachelors degree	7.3	1.5	3.9	1.9
Graduate degree	4.9	1.3	3.6	0.0
Not stated	0.0	0.0	0.0	0.0
Annual salary, $				
<10 000	12.6	3.1	5.0	4.5
10 000-19 999	15.2	9.7	2.6	2.9
20 000-29 999	8.3	2.1	3.8	2.4
30 000-39 999	11.6	5.0	2.2	4.5
40 000-49 999	6.5	2.6	2.7	1.2
≥50 000	7.5	0.9	5.1	1.5
Not stated	7.1	2.7	3.2	1.2
Employment status, h/wk				
>30	9.5	3.4	4.0	2.1
20-30	6.8	1.9	1.3	3.6
<20	10.9	5.1	4.1	1.8
Not stated	10.1	2.9	1.9	5.3
Depression screening status†				
Positive	27.4	11.2	7.9	8.2
Negative	1.8	0.1	1.8	0.0
Presence of physical symptom clusters				
Pain, weakness or fatigue	32.0	14.9	8.0	9.1
Gastrointestinal complaints	26.9	11.6	6.9	8.3
Panic or anxiety	23.9	14.1	5.9	3.9
Faintness or dizziness	34.9	12.5	9.5	12.9
Autonomic instability	30.8	19.8	5.2	5.9
Ears ringing, head or nose fullness	23.9	9.2	8.5	6.2
Sensory or nerve impairment	18.6	8.1	4.8	5.7
None	4.0	1.0	2.3	0.7

Abbreviation: GED, General Educational Development (test).
*An iterative proportional fitting procedure (ie, raking) was used to perform the population weighting adjustment, benchmarking to 4 variables common to both the American Productivity Audit and the Current Population Survey (CPS). Raking ensured that the weights assigned to individual respondents led to marginal distributions on auxiliary variables that were equivalent to the CPS.
†See "Methods" section for description of measurement of depression screening status.

in general, higher prevalence of any depression in relation to lower annual salary levels. Prevalence appears to be lowest among those working 20 to 30 hours per week (6.8%) compared with those working more (9.5%) or fewer (10.9%) hours. The greatest difference in prevalence of depression was observed in relation to physical symptom status. Prevalence of major depression was particularly elevated among those reporting symptoms of autonomic instability (19.8%), pain, weakness, or fatigue (14.9%), and panic or anxiety (14.1%) (Table 2).

Average LPT and National Cost Estimates

Lost productive time was expressed as an average across all individuals who met criteria for depression (TABLE 3). On average, workers with depression reported significantly more total health-related LPT than those without depression (mean, 5.6 h/wk vs an expected value of 1.5 h/wk in the absence of depression) (Table 3). A total of 77.1% of individuals with depression reported some LPT during the 2-week recall period. The expected number of LPT hours was estimated by applying rates of LPT for those without depression from specific age and sex groups to the same demographic subgroups of individuals who met criteria for a depressive disorder. Overall, LPT among depressed individuals was primarily explained by LPT while at work (82.1%). Average total LPT per week was considerably higher for major depression (mean [SE], 8.4 [1.3] h/wk), followed by total LPT for partial remission of major depression (5.3 [1.1] h/wk), and dysthymia (3.3 [0.6]h/wk) (Table 3).

Physical symptom clusters were common among individuals with depression. Pain, weakness, or fatigue was the most common cluster (49%), followed by sensory or nerve impairment (40%), and ringing ears or head fullness (38%). Individuals with major depression consistently reported the most LPT when it co-occurred with a physical symptom cluster—in particular, when it co-occurred with pain, weakness, or fa-

tigue (mean [SE], 10.0 [1.2] h/wk), gastrointestinal complaints (10.7 [1.5] h/wk), and sensory or nerve impairment (10.0 [1.4] h/wk) (Table 3). In the absence of depression, autonomic instability was associated with the most LPT (6.5 h/wk), and gastrointestinal complaints were associated with the least LPT (2.0 h/wk) (Table 3).

Physical symptom clusters often cooccurred and were moderately correlated. We used ordinary least-squares regression to simultaneously estimate the association of each symptom cluster with LPT, adjusting for depression status, sex, and age. In this model, significant associations were observed for only 3 symptom clusters, the most common being pain, weakness, or fatigue ($\beta = 3.0$; SE = 0.5); the least common being faintness or dizziness ($\beta = 2.1$; SE = 0.7); and autonomic instability ($\beta = 2.9$; SE = 0.5). Coefficients for the other symptom clusters were close to zero.

United States workers with depression are estimated to cost employers $44.01 billion per year in LPT, an excess of $30.94 billion per year when compared with an expected cost in workers without depression (TABLE 4). A total of 81.1% of the LPT costs are explained by reduced performance while at work. Major depression accounts for almost half (48.5%) of the LPT among workers with depression, again with the majority of the cost explained by reduced performance while at work (Table 4).

Treatment Status

We examined self-reported treatment (TABLE 5) for depression in the 12 months prior to interview. Individuals with depression were dichotomized by symptom burden (ie, 2 or 3 vs 0 or 1 of the symptom clusters significantly associated with LPT [pain, weakness, or fatigue; autonomic instability; faintness or dizziness]). For any depression, we observed overall that less than one third of workers with depression reported receiving a prescription drug in the past 12 months for depression or anxiety. Most workers reported taking the medication in the past 12 months, with 69% to 81% reporting taking it in the past 2 days. Overall, self-reported treatment effectiveness was moderate (5 on a 0-10 anchored continuous scale) and appeared to be lower for workers with a high symptom burden compared with those with a low symptom burden. The differences, however, were not statistically significant ($P > .05$).

COMMENT

Our estimate of the LPT cost due to depression offers unique information regarding hidden costs that is consistent with the widely held notion that depression is a leading cause of disability.[34] Our estimate of $31 billion in excess LPT refers to time lost among individuals actively engaged in work (ie, worked at least 1 day in the previous week). It does not include labor costs associated with disability leave.

Previous studies consistently indicate that the lost work-time cost from

Table 3. Average Lost Productive Time (LPT), in Hours per Worker per Week, Among US Workers With Depression and Expected LPT in the Absence of Depression, by Type of LPT and Presence of Physical Symptoms*

		Depressive Disorder, Mean (SE)			
Type of LPT	Any Depression, Mean (SE)	Major Depression	Dysthymia	Partial Remission or Recurrence of Major Depression	Expected Mean LPT in the Absence of Depression
Absenteeism	1.0 (0.2)	1.2 (0.4)	0.5 (0.2)	1.5 (0.5)	0.4
Presenteeism	4.6 (0.5)	7.2 (1.3)	2.7 (0.6)	3.8 (0.7)	1.1
Total LPT	5.6 (0.6)	8.4 (1.3)	3.3 (0.6)	5.3 (1.1)	1.5
Pain, weakness or fatigue	7.8 (0.7)	10.0 (1.2)	4.6 (1.0)	7.4 (1.8)	5.1
Gastrointestinal complaints	7.1 (0.9)	10.7 (1.5)	2.8 (1.0)	5.8 (2.2)	2.0
Panic or anxiety	6.9 (1.3)	9.3 (1.7)	3.7 (1.9)	3.2 (0.8)	4.1
Faintness or dizziness	6.1 (1.3)	8.9 (2.4)	2.9 (1.8)	6.1 (1.9)	4.5
Autonomic instability	8.1 (1.1)	9.5 (1.9)	3.2 (1.6)	7.8 (3.1)	6.5
Ears ringing, head or nose fullness	5.5 (0.8)	8.1 (1.2)	4.1 (1.0)	3.6 (0.8)	2.8
Sensory or nerve impairment	6.8 (0.7)	10.0 (1.4)	4.1 (1.2)	4.5 (1.0)	3.2
None	4.0 (1.3)	5.8 (3.7)	3.0 (1.2)	5.3 (3.0)	0.8

*See Table 2 footnote for description of population weighting adjustment.

Table 4. Total Cost of Lost Productive Time (LPT), in $Billion per Year (2002 Dollars), in US Workers With Depression, and Expected Cost of LPT in the Absence of Depression, by Type of LPT*

		Depressive Disorder, Mean (SE)			
Type of LPT	Any Depression, Mean (SE)	Major Depression	Dysthymia	Partial Remission or Recurrence of Major Depression	Expected Total Cost in the Absence of Depression
Absenteeism	8.27 (2.3)	3.18 (1.1)	2.54 (1.3)	2.55 (1.0)	3.90
Presenteeism	35.73 (5.3)	18.18 (4.0)	10.29 (2.5)	7.27 (2.2)	9.17
Total LPT	44.01 (6.3)	21.36 (4.1)	12.83 (3.3)	9.82 (3.0)	13.07

*See Table 2 footnote for description of population weighting adjustment.

depression is substantial,[22,23,35-42] exceeding direct medical costs. However, estimates based on studies of specific employers[38,42] pose challenges in extrapolating to the US workforce. Prevalence and impact of depression appear to vary by occupation.[43] Moreover, employer-specific studies often underestimate lost labor costs because they usually focus only on absence time and rely on medical claims data to identify employees with depression. Costs of LPT are not captured for depressed individuals who have not sought care or who have sought care for other reasons (eg, physical symptoms).

Previous national projections of the labor cost of depression were based primarily on the Epidemiologic Catchment Area (ECA) studies[23,35-37,39] completed in the 1980s. Greenberg et al[23] estimated lost labor costs of $24 billion in 1990 and of $33.5 billion in 2002 after adjusting for inflation. Five important differences distinguish our study from that by Greenberg et al. First, Greenberg et al captured some of the costs due to disability (ie, hospitalization, bed-days), but the LPT cost from reduced performance at work is incomplete. Second, the estimate of Greenberg et al includes major depression (1-year prevalence), dysthymia (lifetime prevalence), and bipolar disorders, but not partial remission of major depression. Third, in using ECA data, Greenberg et al made assumptions about the average number of hospital (ie, treated patients) and bedridden days (untreated individuals), the number of days used for outpatient care, the average impact of depression outside of inpatient care and days at work, and other factors. In contrast, our questionnaire specifically captured LPT due to both work absence and reduced performance while at work. Fourth, in the ECA study by Greenberg et al, details regarding episodes of depression were recalled over a 1-year period[35] vs the 2-week period in our study. Finally, clinical care and management of depression has changed substantially since the 1980s.[26,44-46]

Our study indicates that 81% of the LPT costs from depression were explained by reduced performance while at work. This finding is consistent with observations for numerous other conditions. A substantial share of the LPT costs are explained by reduced work performance, not work absence.*

Using the PRIME-MD, we estimated depression prevalence to be 9.4%. Comparing our estimate with those from other studies is difficult. For example, the ECA studies used the Diagnostic Interview Schedule. There is no formal link to the PRIME-MD. Prevalence estimates are not usually confined to individuals working for pay. Nonetheless, for comparison with other studies we have focused on major depression because the criteria have not changed and because major depression accounts for a substantial share of the LPT costs from depressive disorders.

Based on ECA data, the 1-year prevalence of major depression among work-

*References 3, 4, 7, 12, 16, 17, 20, 23, 47-51.

Table 5. Medical Treatment in US Workers With Depression, by Presence or Absence of 2 or More Symptom Clusters*

			Depressive Disorder					
	Any Depression		Major Depression		Dysthymia		Partial Remission or Recurrence of Major Depression	
Characteristic	2-3 Clusters (n = 62)	0-1 Cluster (n = 157)	2-3 Clusters (n = 33)	0-1 Cluster (n = 54)	2-3 Clusters (n = 12)	0-1 Cluster (n = 62)	2-3 Clusters (n = 17)	0-1 Cluster (n = 41)
Received a prescription medication for depression or anxiety in the past 12 mo, No. (%)	28.2	30.7	43.2	30.5	18.4	35.1	8.3	23.2
Received different types of prescription medications, No. (%)								
Anxiolytic only	1.1	2.1	2.2	2.0	0	3.3	0†	0†
Antidepressant only	5.8	6.5	6.4	10.7	12.9	7.1	0	0.3
Antidepressant and anxiolytic	21.3	22.1	34.6	17.8	5.5	24.7	8.3	22.9
Received a medication, No. (%)								
Took medication in past 12 mo	100	95.4	100.0	90.2	100	98.9	100	95.0
Took medication in past 2 d	69.0	80.7	62.1	77.1	85.0	87.9	79.0	66.6
Took a medication in past 12 mo								
Mean (SE) effectiveness of medication (10-point scale)‡	4.4 (0.7)	6.0 (0.6)	4.2 (0.9)	4.2 (0.7)	6.5 (1.7)	7.6 (0.5)	1.8 (0.6)	4.0 (1.9)
Mean (SE) adverse effects rating (10-point scale)§	2.2 (0.9)	2.6 (0.5)	1.7 (1.0)	3.5 (0.8)	1.1 (1.5)	2.2 (0.8)	7.1 (3.2)	2.2 (1.6)

* See Table 2 footnote for description of population weighting adjustment. Symptom clusters were those significantly associated with LPT (pain, weakness, or fatigue; autonomic instability; faintness or dizziness). Ns refer to study sample size on which population weighting adjustments were made.
†Projection to the US population was close to but not equal to zero.
‡0 indicates that "medication does not work at all"; 10, that "medication completely relieves symptoms."
§0 indicates "no adverse effects"; 10, "adverse effects so bothersome that you won't take the medication."

ing populations is 4%, excluding symptoms attributable to alcohol, drugs, physical injury, and illness.[43] This prevalence is comparable with our prevalence estimates of 3.4% for major depression and 2.4% for partial remission. We followed existing criteria and did not make the same exclusions as Eaton et al.[43] Broader population-based estimates of the 1-year prevalence of major depression in adults aged 18 years to 54 years range from 6.5% (ECA studies) to 11.1%.[52] Our estimate of major depression prevalence should be lower than previous estimates (ie, those with a 12-month time frame) since we capture data only from individuals who are currently experiencing a depressive episode and are actively working. We do not capture data from individuals who experience recurrent episodes of depression[53-56] but from those who are between episodes. Enumerating these cases is not essential to an accurate estimate of LPT from depression. In contrast, we are likely to have relatively complete capture of dysthymia, since it is an inherently chronic condition by definition, lasting 2 years or longer.

Workers with major depression and physical symptoms account for a disproportionate share of the LPT due to depression. While physical symptoms in some individuals with depression are due to other conditions (eg, diabetes) comorbid with depression, there is growing recognition that physical symptoms are often directly associated with depression. More than 80% of patients with depression who seek care present with physical symptoms.[57] Moreover, disability from depression appears to be correlated with number of physical symptoms. The strong relation between depression and physical symptoms is thought to be a common product of dysfunctional serotonergic and noradrenergic pathways that project throughout the central nervous system and spinal cord.[58] It is noteworthy that our data suggest that individuals with depression and an elevated symptom burden (ie, at least 2 symptom clusters significantly associated with LPT) appear to report the lowest treatment effectiveness. If this relationship is real, workers with depression and a high physical symptom burden are likely to be an important target for intervention to reduce both direct medical costs and LPT. However, larger studies of depression treatment status in the US workforce are required to accurately determine whether this relationship is real and whether the relatively low proportion of workers prescribed a treatment is an indication of unmet need.

The association of physical symptoms and mood disorders also may be sustained because individuals who are impaired by an illness are entitled to the dispensations of the "sick role"[59] that includes a reduction in expected performance of normal role functions. To establish the sick role, the patient must be perceived as having a legitimate medical condition beyond their control. Compared with physical symptoms, it is more difficult to establish the sick role for depression. Stigmatization is associated with mental disorders, physicians often fail to detect mood disorders, and individuals may doubt whether depression is truly beyond personal control. Therefore, even when role impairment is linked to a mood disorder, the sick role is often constructed on the basis of physical symptoms that also may have a direct pathophysiological relationship with the mood disorder,[58] even though the symptoms themselves may not cause impairment.

Our study has several potential limitations that could influence the accuracy of estimated LPT attributable to depression. First, the Work and Health Interview was designed to focus only on estimating work loss incurred by individual workers reporting a health condition during the recall period. Although this is the primary driver of employer costs associated with lost productive work time, we recognize that health-related LPT estimates could be refined by considering other factors such as the hiring and training of replacement workers or the concomitant impact among coworkers.[60] These other factors could increase, decrease, or have no net effect on health-related LPT cost estimates. Second, depression-related LPT costs could be overestimated because of the predisposition of individuals to overstate work impairment when in the acute phase of a depressive episode.[61] While data on this issue are limited, we cannot exclude the possibility of reporting bias leading to an overestimate of LPT costs among individuals with depression. Finally, our US population estimate of LPT is based on a strategically selected but modest sample size of 219 employed individuals who met PRIME-MD criteria for depression, of whom 87 had symptoms of major depression. The uncertainties inherent in the sample size for this study must be considered when interpreting our cost estimates and especially when considering self-reported treatment data.

Author Contributions: Dr Stewart, as principal investigator of the Depressive Disorders Study, had full access to all of the data and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design; drafting of the manuscript: Stewart, Ricci, Hahn.
Acquisition of data: Stewart, Ricci.
Analysis and interpretation of data; critical revision of the manuscript for important intellectual content; statistical expertise: Stewart, Ricci, Chee, Hahn, Morganstein.
Obtained funding; study supervision: Stewart.
Administrative, technical, or material support: Stewart, Ricci, Chee, Hahn.
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Comment. We found that healthy, young, nonobese women with Turner syndrome exhibit an atherogenic lipid profile compared with 46,XX women of the same age and body composition with premature ovarian failure. Since advancing age is associated with decreasing levels of HDL-C and increasing levels of LDL-C, this unfavorable lipid profile may contribute to the excess mortality in women with Turner syndrome.[1] Interestingly, in contrast to the obesity-related "metabolic syndrome," insulin sensitivity measured by fasting levels of insulin and glucose appears to be normal in these young women with Turner syndrome. Because the 2 groups in this study are similar in gonadal status, adiposity, and lifestyle factors influencing lipid metabolism, the atherogenic lipid profile in Turner syndrome may be caused by haploinsufficiency for as-yet unknown X-chromosome gene(s). Given that a number of X-chromosome genes escape inactivation yet do not have a Y-chromosome homologue,[7] some of these genes may contribute to the the more favorable lipid profiles of healthy 46,XX women compared with men.

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CORRECTION

Incorrect Data in Abstract and Table and Incorrect Text and Date in Figure: In the Original Contribution entitled "Cost of Lost Productive Work Time Among US Workers With Depression" published in the June 18, 2003, issue of THE JOURNAL (2003;289:3135-3144), incorrect data appeared on pages 3135 and 3142. On page 3135, in the "Results" section of the abstract, the self-reported use of antidepressants should be <33% [not <30%]. In Table 5 on page 3142, the values in the "Received a prescription medication for depression or anxiety in the past 12 mo" row, from left to right, should be 32.4, 33.0, 43.1, 34.9, 36.6, 36.4, 10.9, and 24.7. In the Figure on page 3137, the study referred to in the title should be the Depressive Disorders Study [not the Depression Disorders Study], and the text and dates in the topmost box should read "Survey of American Productivity Audit Subsample (5/20/02-7/11/02)" [not "American Productivity Audit Survey (11/20/01-7/11/02)"].