

# Mental Health, Absenteeism and Earnings at a Large Manufacturing Worksite

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## Abstract

**Background:** A few recent studies have examined the relationship between mental illness and labor market variables. The findings are inconsistent, however, and leave unanswered many questions concerning both the nature and magnitude of the relationship.

**Aims of the Study:** A recently available worksite-based data set is analyzed to explore the relationship between symptoms of emotional and psychological problems and employee absenteeism and earnings among employees at a large US worksite.

**Methods:** The analysis was based on data collected through a random and anonymous survey of workers at a large US manufacturing worksite. Two measures of absenteeism are combined—days absent during the past 30 days due to sickness or injury and days absent during the past 30 days because the employee did not want to be at work—to create both a dichotomous (i.e., ever absent) and a continuous (i.e., number of days absent) absenteeism variable. Annual earnings were measured as personal earnings from the primary job. Various statistical models were tested to determine the independent and joint (with alcohol and illicit drug use) relationship between symptoms of emotional problems and labor market variables.

**Results:** The analysis consistently finds that workers who report symptoms of emotional/psychological problems have higher absenteeism and lower earnings than otherwise similar coworkers. This finding is robust to model specification and to the inclusion of comorbid conditions such as alcohol and illicit drug use.

**Discussion:** This study contributes new information to the literature in this area by estimating the effects of emotional/psychological symptoms on two important labor market variables: absenteeism and earnings. Several specifications of the absenteeism and earnings equations were estimated to test the independent effect of emotional symptoms and the joint effects of emotional symptoms and other comorbid conditions. The results suggest that employers should consider the productivity losses associated with workers' mental health when designing worksite-based programs such as employee assistance programs (EAPs).

**Limitations:** Unlike national surveys of households or individuals,

the sample does not include unemployed individuals or those outside the labor force. Therefore, the decision to participate in the labor market can not be modeled. In addition, the study relies on voluntary self-reported survey data that may suffer from underreporting of substance use and emotional symptoms. Although respondents were repeatedly assured about confidentiality, if underreporting does exist, it may be more acute than in household surveys because respondents may be more worried about job loss if they self-report drug or alcohol use at the worksite.

**Conclusions:** All four measures of emotional symptoms had a positive and statistically significant relationship with absenteeism and a negative and statistically significant relationship with personal earnings. These findings were robust across all specifications, even when the effects of other potentially confounding factors (i.e., alcohol and drug use variables) are included. In addition, the number of days intoxicated and cigarette use in the past year appear to be significantly related to earnings even after controlling for emotional symptoms. Finally, the explanatory power of the models is relatively high for cross-sectional data, especially for the earnings regressions.

**Implications for Health Care Provision and Use:** The findings from this worksite suggest that employers might do well to reassess the priorities of their EAPs and consider directing more of their resources to diagnosing and assisting employees with emotional and psychological distress.

**Implications for Health Policy Formulation:** It is strongly suggestive that mental health status is related to absenteeism and earnings for employees at this worksite. However, most employer-based programs and policies are designed to dissuade the use of alcohol and illicit drugs by workers (e.g., employee drug and alcohol testing) rather than addressing other employee behaviors and problems.

**Implications for Further Research:** Numerous opportunities are present to collect similar data from other worksites and settings to determine whether these models and results are robust. ©1998 John Wiley & Sons, Ltd.

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## Introduction

The decision to participate in the labor market is influenced by many factors, perhaps the most important being the wage offer. However, for some workers other factors are equally or more important. These include nonlabor income, availability and affordability of child care<sup>1–3</sup> and personal

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conditions such as physical health status.<sup>4,5</sup> Although many empirical studies of labor supply behavior have examined the effects of wage rates on hours or weeks worked per year, relatively few have investigated the relationship between mental health and labor supply.

In light of the prevalence of mental illness in the US, it is surprising that so few studies have examined the relationship between mental health status and labor market variables. Based on data from the National Institute of Mental Health's (NIMH's) Epidemiological Catchment Area (ECA) study of noninstitutionalized individuals, the overall 6 month prevalence in the 1980s of any mental disorder was 18.7% of the total US population.<sup>7</sup> These mental disorders impose substantial costs on individuals and society. For example, Rice *et al.*<sup>8</sup> estimated that the total cost of mental illness in the US was \$103.7 billion in 1985.

The primary objective of this study is to estimate the relationship between relatively common symptoms of emotional and psychological problems, absenteeism and earnings among employees at a particular worksite. We combined two measures of absenteeism in our analysis—days absent during the past 30 days due to sickness or injury and days absent during the past 30 days because the employee did not want to be at work—to create both a dichotomous (i.e., ever absent) and a continuous (i.e., number of days absent) absenteeism variable. Our annual earnings measure was personal earnings from the primary job. We tested various statistical models to determine the independent and joint (with alcohol and illicit drug use) relationship between symptoms of emotional problems and labor market variables.

## Review of the Literature

Bartel and Taubman<sup>9</sup> were among the first to examine the relationship between mental health and labor market behavior. They explored the relationship between several diseases (including mental disorders) and individual earnings, wages, weekly hours worked, the probability of being out of the labor force, and the probability of being unemployed, using a sample drawn from a twins panel maintained by the National Academy of Science–National Research Council (NAS–NRC). Bartel and Taubman found that individuals diagnosed as either psychotic or neurotic had lower earnings, wages and weekly hours worked, and a greater probability of being out of the labor force. These results suggest that mental illness has a substantial impact in the labor market.

Bartel and Taubman<sup>10</sup> extended their earlier work on the NAS–NRC sample in three ways. First, they examined Social Security earnings for 1951–1974, rather than focusing only on 1973 earnings as in their earlier study. Second, they examined the effect of mental illness on marital status and other family outcomes. Third, they created three separate categorical variables for mental illness: psychoses, neuroses and other mental illnesses. This expanded analysis found that both psychoses and neuroses were negatively related to earnings and, as expected, the estimated impact of psychoses was larger in absolute value than the impact of neuroses.

In contrast to the Bartel and Taubman findings, Benham and Benham found that individuals diagnosed as neurotic earned 23% more than those classified as mentally healthy, but those diagnosed as psychotic earned 43% less than those who were well. However, Benham and Benham worked with a very specialized sample: patients enrolled at a child guidance clinic in St. Louis, MO, between 1924 and 1929 who were reinterviewed 30 years later.

One limitation of the Benham and Benham study is that the individuals studied were not randomly selected from the community. Several recent studies have overcome this limitation by using ECA data. Besides being a community-based sample, another strength of the ECA data is that mental disorders were assessed by interviewers using the Diagnostic Interview Schedule (DIS), rather than being self-reported. The DIS was designed to allow lay interviewers to make psychiatric diagnoses comparable to those made by a trained psychiatrist.

Mitchell and Anderson<sup>13</sup> used the ECA data to explore the relationship between mental health and the labor force participation of older workers, aged 50 to 64. Labor force participation was hypothesized to depend on age, education, gender, the number of children in the household, earnings, marital status, a Social Security eligibility variable, physical health variables and a mental illness index. The mental illness index was a count of the number of symptoms of depression and alcohol abuse experienced by the respondent. They found that mental illness negatively affected the labor force participation of older men but had no significant impact on the labor force participation of older women.

Mullahy and Sindelar<sup>7</sup> also used the ECA data to explore the labor force participation of men and women, but they did not limit their analysis to older workers. The probability of being employed was hypothesized to be a function of standard socioeconomic characteristics (e.g., age, education, nonlabor income), physical health and both self-reported and diagnosed mental health variables. These diagnosed mental health measures included six categorical variables indicating whether the individual experienced problems with substance abuse, depression, manic–depressive behavior, obsessive–compulsive behavior, schizophrenia or antisocial personality. Although coefficient estimates for many of the individual mental health variables were not significant, the set of diagnosed mental illness variables was jointly significant for men but not for women, while self-reported mental health variables were jointly significant for both men and women. Overall, the results of Mullahy and Sindelar provide some evidence in support of the hypothesis that mental illness decreases labor force participation.

In a related study, Mullahy and Sindelar<sup>14</sup> estimated the relationship between current symptoms of alcoholism and other mental health disorders and individual income (earnings plus other sources). The 'other' mental health disorders included antisocial personality, depression, mania, obsessive–compulsive behavior and schizophrenia–schizophreniform. They found that neither current alcoholism nor other mental disorder symptoms were significantly related to individual income. They did find, however, that individuals who had

symptoms of alcoholism before age 18 had lower educational attainment, which, in turn, led to lower earnings.

Anderson and Mitchell<sup>15</sup> studied the possible link between military service, mental health disorders and labor market outcomes. Among other things, they examined the impact of veteran status and Diagnostic and Statistical Manual of Mental Disorders (DSM-III) diagnoses on the probability of working in the labor force. They found that veteran status was not significantly related to employment, but mental health disorders categorized by DSM-III diagnoses were all negatively related to the probability of working. Furthermore, alcohol abuse, drug abuse and 'other DSM-III' categories were statistically significant. They concluded that military service was correlated with mental health problems, which indirectly reduced the employability of veterans relative to nonveterans.

As the discussion above highlights, several different measures of mental health have been used in exploring its relation to labor market variables. Frank and Gertler<sup>16</sup> assessed the potential measurement error bias caused by using alternative definitions. One common utilization-based measure defines mental illness by whether an individual has contacted a medical provider about a mental health problem. Because only a relatively small subset of individuals actually seek treatment for mental illness, a utilization-based measure is likely to underestimate the true prevalence of mental illness. In contrast, a population-based measure assesses mental illness from the responses to psychological questions. The population-based variable is independent of whether respondents are treated for a mental health problem. Frank and Gertler found that individuals who were classified as mentally ill based on a population-based mental health indicator had 21% lower earnings than otherwise healthy individuals. In addition, they found that relying only on a mental health care utilization measure without information on mental health status may lead to substantial downward bias in the estimated impact of mental illness.

This brief review of the existing literature reveals that many questions remain concerning the mental health/labor market relationship. For example, do certain types of mental disorder have a larger effect on labor supply and earnings than other types? What is the nature and magnitude of these impacts? Are adverse labor market effects concentrated in particular groups of individuals and workers? Are the adverse effects long lasting or do they tend to be temporary? What is the relationship between mental illness, labor supply and earnings for individuals in a particular worksite?

Many of these and other questions remain unanswered largely because of the lack of high-quality data sets that contain both mental health measures and economic variables. Although the ECA study has relatively weak indicators of labor market activity, many studies have used ECA data, which is one of the best data sources available for detailed mental health information. To address a broader range of labor market questions than is possible with public-domain data sets such as the ECA, we collected primary data through a survey administered to randomly selected employees at a large manufacturing worksite (approximately 6000

employees) in the US. This unique data set includes information on respondents' symptoms of emotional distress as well as their labor market behavior and earnings.

## Empirical Model

In the labor market, individuals with poor mental health may be less productive per hour and may be unable to supply as many hours per year to the labor market as mentally healthy individuals. Poor mental health can also negatively affect the amount of human capital investment an individual makes, leading to a reduction in educational attainment, which in turn has a profound impact on occupational choice. This situation would be especially true if a mental illness began during an individual's late teens or twenties, a period of intensive human capital investment. Evidence reveals that mental health also has an impact on marital status and the propensity for a spouse to enter the labor market.<sup>10</sup> Both these factors have well known effects on labor supply.

These considerations, along with the fact that mental health may be endogenous, suggest that no simple and direct way exists to portray the relationship between labor market variables and health status. Because of these complexities and data constraints, our analysis involves a reduced-form labor market model, which characterizes the relationship between labor supply and mental illness as follows:

$$H_i = \beta_0 + \beta_1 OF_i + \beta_2 Z_i + \beta_3 P_i + \beta_4 M_i + \epsilon_i \quad (1)$$

where  $H_i$  is hours of work for individual  $i$ ,  $OF_i$  is income for other family members,  $Z_i$  is a vector of exogenous sociodemographic variables,  $P_i$  is self-reported physical health status,  $M_i$  is an index of mental health, the  $\beta$  are parameters to be estimated and  $\epsilon_i$  is a stochastic error term. The sociodemographic variables used in our models include age, gender, race, education, marital status, school status, tenure at the current job and occupational dummy variables. The other income variable,  $OF_i$ , was derived by subtracting the respondent's reported personal income from the reported family income. Because family income was collected as a categorical variable, we used the midpoint of each category to create a continuous variable.

Based on the results of previous studies, we expect that mental illness decreases labor supply because less healthy people may not be able to provide as much time to market activities. Similarly, if we view mental illness as causing an exogenous decrease in the usable time available, the individual's reservation wage would increase, decreasing the probability that the individual would work in the labor market and decreasing the hours supplied for both market and nonmarket activities. Both of these effects imply a negative value for  $\beta_4$  in equation (1).

Using the same type of framework we outlined for labor supply, we also specified a reduced-form earnings equation (e.g. Mincer,<sup>17</sup> French and Zarkin,<sup>18</sup> French *et al.*<sup>19</sup>), represented by equation (2).

$$E_i = \alpha_0 + \alpha_1 OF_i + \alpha_2 Z_i + \alpha_3 P_i + \alpha_4 M_i + \epsilon_i \quad (2)$$

where  $E_i$  is a measure of earnings for individual  $i$ , and all other variables are as defined earlier (the  $\alpha$  represent the parameters to be estimated). For the same reasons that we expect mental illness to reduce labor supply (and increase absenteeism), we also hypothesize that mental health problems will lower earnings. We used equation (2) to test the relationship between symptoms of emotional problems and personal earnings.

Equations (1) and (2) treat mental health status as exogenous, but this may not be the correct specification (see, for example, Anderson and Mitchell,<sup>19</sup> Mullahy and Sindelar.<sup>20</sup> Although our data set contains only a limited number of potential instruments, we were able to test for the exogeneity of  $M_i$ , the index of mental health, in the earnings regression using a Hausman test.<sup>21,22</sup> To execute this test, we first regressed our mental health variable on the exogenous right-hand side variables (excluding mental health) in equation (1) plus three other variables—whether the worker believes their health insurance covers treatment for emotional problems, whether a family member had a drinking problem and whether a family member had a drug problem. These three variables are statistically significant in the mental health regression ( $F=4.52$ ,  $p=0.004$ ), which implies that they independently explain some of the variation in mental health status. We then regressed earnings on all the right-hand side variables in equation (1), including mental health, plus an additional variable, the predicted value of the mental health variable from the first-stage regression. This predicted mental health variable was statistically insignificant in the earnings regression ( $F=0.94$ ,  $p=0.33$ ), which means that we fail to reject the null hypothesis of exogeneity of mental health.

Finally, as an overall reliability check of our specification, we performed a test of the overidentifying restrictions of our model and we failed to reject the null hypothesis that the overidentifying restrictions hold ( $F=0.47$ ,  $p=0.63$ ). Based on this overidentification test and the exogeneity test discussed above, we treat mental health as exogenous in the earnings regression. We also performed the same tests for the linear specification of the absenteeism regression and the qualitative results were identical. Although the regression output from these tests is not presented in the paper, it is available from the corresponding author.

Despite the popularity and convenience of the Hausman test, the procedure has low power, which lowers the probability of rejecting the null hypothesis of exogeneity. Furthermore, the test is influenced to a large degree by the reliability of identifying variables in the first-stage regression.<sup>23</sup> As noted earlier, the identifying variables available to us are not ideal and at least one of the variables may also be endogenous (i.e., whether the worker believes their health insurance covers treatment for emotional problems).

Before presenting our findings, two additional limitations of our data should be noted. Unlike national surveys of

households or individuals, our sample does not include unemployed individuals or those outside the labor force. Therefore, we cannot model the decision to participate in the labor market. In addition, our study relies on voluntary self-reported survey data that may suffer from underreporting of substance use and emotional symptoms. Although respondents were repeatedly assured about confidentiality, if underreporting does exist, it may be more acute than in household surveys because respondents may be more worried about job loss if they self-report drug or alcohol use at the worksite. It is unclear how underreporting of substance use or emotional symptoms may affect our results, but the potential for bias in our findings should be acknowledged.

## Sample and Data

We administered a detailed questionnaire to a sample of randomly selected employees at a large manufacturing worksite. All respondents were promised anonymity and told that worksite personnel would not have access to any survey data. The main purpose of the employee survey was to determine current prevalence rates for tobacco, alcohol and illicit drug use and emotional/psychological problems among worksite personnel. The survey results also allow us to describe the relationship between these problems and labor market behavior.<sup>a</sup>

The company we studied is a manufacturing and service firm with approximately 36 000 employees organized into eight major divisions. We administered the survey to a sample of employees located at the company's two largest worksites (located very close to each other), which comprise approximately 20% of all company employees. Because the corporate headquarters is based at one of these worksites, most of the personnel are considered professional and administrative staff, but some manufacturing is also present at these sites.<sup>b</sup> We chose this worksite primarily because it had a relatively large workforce and because the company managers were interested in the results of the study, were very supportive of our research design, and allowed employees time away from work to complete the questionnaire.

We randomly selected 444 worksite employees from a roster of over 6000 workers to complete the employee survey. Of those selected, 408 completed the survey, for a 92% response rate. This number included 293 people who completed the survey in person and 116 who mailed in their responses because they had scheduling conflicts. **Table**

<sup>a</sup>The full questionnaire used for the employee survey is available from the corresponding author. Although the survey respondents were assured of anonymity, the company asked us not to release any identifying information for external analysis because of the sensitive nature of the questions and the possibility that the company could be identified. Thus, we can provide other researchers only with data on the variables used in our study.

<sup>b</sup>The company has a standard sick leave policy that applies to all employees at these worksites, regardless of division or occupation. In addition, fringe benefits, absenteeism policies and disciplinary actions are generally uniform across all workers. A small percentage of employees at these two worksites belong to a union, but they were excluded from the study because union management did not want to participate in the research.

1 displays a profile of the sampled employees in terms of demographics, earnings and labor supply, by gender.

The variable means in **Table 1** indicate that this work force is older (age = 42.5), more educated (grade = 14.33) and better compensated (earnings = \$45 477) than most worksites in the US.<sup>24,c</sup> A large proportion of the employees are white and married, and most employees have a tenure at the worksite exceeding 17 years. In addition, 'managerial or professional' was the most common job classification (44%). While these statistics do not conform to the US work force overall, our sample is representative of the population statistics for these two worksites.

In terms of labor supply and absenteeism, the vast majority of respondents worked 52 weeks per year (92%) and at least 40 hours per week (98%), but a nontrivial number of employees (23%) had been absent from work at least 1 day during the previous month. Because only seven respondents (2% of the sample) reported skipping work during the past 30 days, we combined the 'sick days' and 'skipped days' measures of absenteeism into one variable. In reality, the distinction between skipping work and being

sick may be inherently subjective to the respondent. Almost all the variables in **Table 1** display significant gender differences, except for the absenteeism measures.

We selected 26 questions to identify psychological symptoms, using a considerably shortened and revised version of the Hopkins Symptom Check List (HSCL<sup>25</sup>) scale. Time constraints on administration of the questionnaire required us to use a shortened list of questions from the HSCL. Nevertheless, our 'emotion score' variable is constructed in the same way as an aggregate measure of emotional distress from the full version of the HSCL. The HSCL has been shown to possess strong psychometric properties (i.e., reliability and validity) in studies using varying numbers of items from the scale: 58 items;<sup>25</sup> 90 items<sup>26</sup> and 21 items.<sup>27</sup> **Table 2** presents the distribution of responses for each emotional/psychological symptom.

**Table 3** reports prevalence of substance use and emotional/psychological symptoms, by gender. Current use of alcohol by employees at the worksite was common, but few employees reported using illicit drugs during the past 12 months. Specifically, 10% of the sample had never drunk

Table 1. Variable means for demographics and job characteristics by gender

Variable	Males (N=275)	Females (N=133)	Total (N=408)
Age	43.25	40.96	42.50**
White	0.98	0.95	0.97
Highest grade completed (mean) <sup>a</sup>	14.82	13.32	14.33**
Highest grade completed (median) <sup>a</sup>	16.00	13.00	14.00
Married	0.87	0.64	0.79**
Currently enrolled in school	0.07	0.08	0.07
Tenure in current job (years)	18.25	15.21	17.26**
Fair/poor health status	0.07	0.02	0.06**
Manager or professional	0.54	0.24	0.44**
Clerical	0.03	0.57	0.20**
Research	0.04	0.01	0.03**
Production	0.04	0.04	0.04
Maintenance	0.09	0.01	0.06**
Service	0.13	0.05	0.10**
Other	0.15	0.08	0.13**
Annual earnings			
Total family (\$)	70 771	51 474	64 669**
Total personal—all jobs (\$)	56 699	28 356	47 758**
Total personal—primary job (\$)	54 076	28 059	45 477**
Worked 52 weeks last year (yes/no)	0.94	0.87	0.92**
Worked 40+ hours per week (yes/no)	0.98	0.98	0.98
Average hours worked per week	45.40	42.32	44.39**
Absenteeism past 30 days			
Absent for any reason (yes/no)	0.21	0.27	0.23
Days absent for any reason	0.64	0.53	0.60
Absent due to injury or illness (yes/no)	0.19	0.27	0.22
Days absent due to injury or illness	0.61	0.50	0.57
Absent didn't want to be there (yes/no)	0.02	0.02	0.02
Days absent didn't want to be there	0.03	0.03	0.03

<sup>a</sup>We report both the mean and median for highest grade completed because the data were truncated at 17, the highest grade a respondent could report on the survey.

\*\*Gender differences statistically significant at the 0.05 level.

<sup>c</sup>Data from the *Statistical Abstract: 1991* indicate that the average worker in the US was 37 years old, had 13 years of formal education and had annual earnings of \$23 000.

Table 2. Prevalence of emotional/psychological symptoms during the past 12 months

Symptom	Prevalence		
	Very or fairly often (%)	Sometimes (%)	Rarely or never (%)
Sadness or depression	8.9	41.1	50.0
Nothing turns out the way I want	5.4	36.5	58.0
Confusion and trouble thinking	2.2	18.1	79.7
Useless	2.5	11.6	86.0
Nothing was worthwhile anymore	3.2	7.9	88.9
Sudden attacks of fear and panic	1.7	6.2	92.1
All kinds of body ailments	4.0	17.3	78.7
Nervous, fidgety or tense	7.4	27.4	65.2
Lonely	6.2	19.7	74.1
Long periods of no appetite	1.5	3.2	95.3
Fear of being left alone or abandoned	1.0	4.2	94.8
Restless	6.9	27.1	66.0
Headaches or pains in the head	14.0	33.7	52.2
Unable to concentrate	1.7	25.1	73.2
Bothered by cold sweats	0.2	2.7	97.0
Completely helpless	1.0	3.2	95.8
Anxious	4.9	27.4	67.7
Fear that something terrible will happen	3.2	9.4	87.4
Completely hopeless	1.5	3.5	95.0
Confident	77.9	16.4	5.7
Going crazy or losing my mind	1.5	4.2	94.3
Physical symptoms when angry	1.7	12.9	85.4
Extreme fear of a place or object	0.2	2.7	97.0
No sex drive	4.0	22.0	74.0
Unable to sleep	7.9	24.1	68.0
Angry for no real reason	2.0	13.1	85.0

Table 3. Prevalence of substance use and emotional/psychological symptoms by gender

Variable	Males (N=275)	Females (N=133)	Total (N=408)
Alcohol use			
No use in lifetime	0.07	0.16	0.10**
No use in past 12 months, but use in lifetime	0.19	0.13	0.17
Estimated drinks per year	92.72	64.14	83.37
Daily drinker <sup>a</sup>	0.08	0.06	0.07
Reported number of days drunk in past 12 months	1.64	2.47	1.91
Smoked cigarettes in past 12 months	0.25	0.27	0.26
Illicit drug use			
Any use past 12 months	0.02	0.05	0.03
Ever used	0.28	0.27	0.27
Nonmedical use of prescription drugs	0.15	0.20	0.16
Emotional/psychological symptoms			
≥ 1 emotional symptoms past 12 months	0.23	0.41	0.29**
≥ 3 emotional symptoms past 12 months	0.05	0.23	0.11**
≥ 6 emotional symptoms past 12 months	0.02	0.11	0.05**
Emotional Symptom Score <sup>b</sup>	1.66	1.97	1.76**

<sup>a</sup>Daily drinking is defined as drinking on 20 or more days in the past thirty days.

<sup>b</sup>The emotional symptom score is derived by summing the individual emotional symptom scores and then dividing the sum by the number of symptom responses.

\*\*Gender differences statistically significant at the 0.05 level.

alcohol in their lives, 17% had drunk in their lives but not in the past year and 7% were daily drinkers<sup>d</sup>. Moving to both a quantity and frequency perspective on alcohol use, we estimate that the average employee had 83 drinks during the past year and the average reported number of days drunk in the past year was approximately 2 days.<sup>e</sup> In comparison to the alcohol results, only 3% of the sample reported using illicit drugs during the past 12 months, yet 27% said they had used illicit drugs at least once during their lifetime.

From the emotional/psychological symptoms derived from the HSCL and reported in **Table 2**, we constructed four summary measures.<sup>25</sup> The first summary measure of psychological problems is an emotional symptom score (called Emotion Score). The emotional symptom score is derived by summing the individual scores for each emotional/psychological symptom and then dividing the sum by the total number of symptom responses. Individual item scores range from 1 to 5: 1 indicates the individual never experienced that particular symptom in the past year, 5 represents experiencing the symptom very or fairly often. Because we divide by the number of responses, the values of our emotional symptom score can range from 1 to 5 as well. Other studies using the HSCL use a similar method to compute a general index of emotional health.<sup>30</sup> The mean score as shown in **Table 3** was approximately 1.76. Males had an average score of 1.66 and females had an average score of 1.97, a gender difference that was statistically significant at the 0.05 level.

The remaining three measures are dichotomous variables related to the sum of the number of symptoms that occurred 'very or fairly often' during the past 12 months for each respondent. We decided on three alternative levels for symptom prevalence—greater than or equal to one, three and six symptoms. As shown in **Table 3**, 29% of the sample experienced at least one symptom very or fairly often last year, 11% experienced three or more and 5% experienced six or more symptoms. Females had a significantly higher prevalence than males on all three of these measures. Although our dichotomous measures are more descriptive than diagnostic, they do provide a way to examine the robustness of the relationship between absenteeism, earnings and mental health across various definitions of emotional distress.

## Results

Our primary objective was to estimate the relationship between symptoms of emotional distress, absenteeism and

earnings after controlling for other factors that may also affect these variables. We report the results for annual personal earnings from the respondent's primary job and two measures of absenteeism: a dichotomous variable for absenteeism during the last 30 days<sup>f</sup> and a continuous absenteeism variable measured as the number of days absent during the last 30 days. Because the results were qualitatively identical for each of the three dichotomous emotional/psychological symptom measures discussed earlier, we report only the regression results for the 'three-symptom variable' (experienced three or more symptoms in the past year, called 'Emotion3') and for the more conceptually appealing emotional symptom score ('Emotion Score').<sup>g</sup>

**Table 4** reports the full set of estimates for the models that estimate the independent effects of emotional/psychological symptoms on absenteeism and earnings. The first two columns present the estimated odds ratios from a logit model. The third and fourth columns present the estimated incident rate ratios from a count data model in which we assumed the binomial distribution. The final two columns present the coefficient estimates from an ordinary least squares (OLS) regression.

As the first two columns of **Table 4** show, both emotional/psychological variables had a positive and statistically significant ( $p < 0.05$ ) independent effect on the dichotomous measure of absenteeism. The estimated odds ratio for Emotion3 indicates that a person who experiences three or more emotional symptoms fairly or very often is 2.75 times as likely to be absent as otherwise similar co-workers.<sup>31</sup> The large and highly significant odds ratio for Emotion Score also indicates that higher levels of emotional distress substantially increase a worker's probability of being absent.

In the second set of equations, we used the reported number of days absent in the past 30 days and estimated the relationship between absenteeism and emotional/psychological symptoms. Because of the discrete nature of absenteeism, we estimated this relationship using a count data model. We first estimated the relationship via a Poisson regression, but rejected that model in favor of a negative binomial regression<sup>32</sup> because the data did not conform well to the strict assumptions of the Poisson technique (e.g., that the mean is equal to the variance).

The qualitative results from the negative binomial models are the same as those from the logit models, with highly significant incident rate ratio estimates (i.e.,  $p < 0.05$ ) for both the Emotion3 variable and the Emotion Score variable. The incident rate ratio for Emotion3 indicates that an employee who experiences three or more emotional symptoms very or fairly often is absent at a rate almost three times that of other employees. Although an interpretation of the incident rate ratio for Emotion Score is not as straightforward as that

<sup>d</sup>The National Household Survey on Drug Abuse (NHSDA) defines 'daily' alcohol use as drinking on 20 or more days during the past 30 days<sup>28,29</sup>. We used reported information on the frequency of any alcohol use in the past 12 months to create a measure for daily use that is consistent and comparable with the NHSDA measures.

<sup>e</sup>We estimated the number of drinks in the past year for a respondent by taking the product of the number of days the respondent drank any alcohol during the past 12 months and the typical number of drinks they had on those days.

<sup>f</sup>The dichotomous absenteeism variable equals 1 if the respondent was absent for 1 day or longer for any reason during the past 30 days and 0 otherwise.

<sup>g</sup>A complete set of regression results is available on request from the authors.

Table 4. Estimation results for the absenteeism and earnings regressions

Independent variables	Absent past 30 days <sup>a</sup> (logit)		Days absent past 30 days <sup>b</sup> (negative binomial)		Log of personal earnings—primary job <sup>c</sup> (OLS)	
Emotion3 (yes/no)	2.748** (1.032)	—	2.768** (1.063)	—	-0.137** (0.055)	—
Emotion Score	—	3.759** (1.126)	—	3.557** (1.002)	—	-0.103** (0.037)
Intercept	—	—	—	—	8.508** (0.390)	8.618** (0.393)
Age	1.085 (0.146)	1.093 (0.152)	1.047 (0.155)	1.050 (0.152)	0.018 (0.018)	0.019 (0.018)
Age squared	0.999 (0.002)	0.999 (0.002)	1.000 (0.002)	1.000 (0.002)	-1.27 × 10 <sup>-4</sup> (2.12E-4)	-1.34E-4 (2.11E-4)
Male	1.583 (0.641)	2.090* (0.887)	1.489 (0.612)	2.073* (0.877)	0.263** (0.047)	0.253** (0.048)
White	1.956 (1.670)	1.791 (1.552)	2.150 (0.1845)	2.102 (1.797)	-0.055 (0.094)	-0.040 (0.094)
Grade	0.849** (0.063)	0.830** (0.063)	0.792** (0.059)	0.743** (0.056)	0.061** (0.010)	0.063** (0.010)
Married	0.624 (0.209)	0.587 (0.203)	0.639 (0.222)	0.639 (0.224)	0.079* (0.046)	0.085* (0.046)
School	1.340 (0.674)	1.490 (0.777)	1.139 (0.629)	1.302 (7.15)	-0.032 (0.065)	-0.037 (0.065)
Tenure (years)	0.914 (0.051)	0.906 (0.052)	0.887** (0.050)	0.891** (0.049)	0.044** (0.008)	0.044** (0.007)
Tenure squared	1.002 (0.001)	1.002 (0.001)	1.002 (0.001)	1.002 (0.001)	-0.001** (1.90E-4)	-0.001** (1.90E-4)
Physical health	2.878** (1.408)	2.042* (1.038)	5.846** (2.987)	5.892** (2.958)	-0.185** (0.076)	-0.156** (0.077)
Other income	1.000 (6.43E-6)	1.000 (6.51E-6)	1.000 (7.48E-6)	1.000 (7.40E-6)	8.73E-7 (7.70E-7)	9.10E-7 (7.70E-7)
Occupation:						
Manager	0.912 (0.393)	1.000 (0.446)	1.510 (0.645)	1.609 (0.697)	0.249** (0.054)	0.236** (0.053)
Clerical	1.377 (0.711)	1.366 (0.733)	1.168 (0.612)	1.288 (0.680)	-0.190** (0.067)	-0.192** (0.067)
Research	1.169 (0.952)	1.430 (1.183)	0.927 (0.836)	0.887 (0.800)	-0.145 (0.104)	-0.166 (0.103)
Production	1.137 (0.817)	1.616 (1.182)	2.082 (1.443)	2.219 (1.493)	-0.026 (0.099)	-0.045 (0.099)
Maintenance	0.124* (0.137)	0.096* (0.107)	0.167* (0.154)	0.122** (0.113)	0.021 (0.082)	0.035 (0.082)
Service	0.734 (0.402)	0.742 (0.420)	0.415 (0.262)	0.431 (0.276)	-0.027 (0.067)	-0.027 (0.067)
R <sup>2</sup>	0.092	0.125	0.109	0.131	0.708	0.709

Note: Standard errors in parentheses.

<sup>a</sup>Reported estimates are odds ratios.

<sup>b</sup>Reported estimates are incident rate ratios.

<sup>c</sup>Reported estimates are OLS coefficients.

\*Statistically different from zero at the 0.10 level.

\*\*Statistically different from zero at the 0.05 level.

for Emotion3, the large and highly significant incident rate ratio indicates that higher values of Emotion Score are associated with higher rates of absenteeism.

The final set of regressions in **Table 4** uses OLS to test the effect of emotional/psychological symptoms on the natural logarithm of personal earnings.<sup>h</sup> Because the cleanest earnings data were for total annual earnings from the

<sup>h</sup>We also used 'weeks worked per year' and 'hours worked per week' to estimate weekly and hourly wages. The regression results using wages are very similar to the earnings results, which is not surprising given that over 90% of the sample worked 52 weeks per year and 40 hours per week.

respondents' primary jobs, we report the results for this variable. We also ran identical models for total personal earnings from all jobs. The qualitative results were the same for both variables, but the relationships were weaker for the specification with earnings from all jobs. **Table 4** illustrates that both Emotion3 and the Emotion Score had a negative and statistically significant ( $p < 0.05$ ) impact on the log of personal earnings. The interpretation is that workers with three or more emotional/psychological symptoms had 13% lower earnings than workers without these symptoms, all else equal. Similarly, individuals with higher values on



Table 5. Selected estimation results for the absenteeism and earnings regressions—Emotion3

Independent variables	Absent past 30 days <sup>a</sup> (logit)	Days absent past 30 days <sup>b</sup> (negative binomial)	Log of personal earnings—primary job <sup>c</sup> (OLS)
Emotion3 (yes/no)	2.220** (0.756)	2.694** (1.033)	-0.137** (0.055)
Nonmedical use of prescription drugs in the past year	2.819** (1.069)	1.450 (0.516)	-0.009 (0.046)
Emotion3 (yes/no)	2.677** (1.007)	2.767** (1.061)	-0.135** (0.055)
Drug use ever	1.385 (0.434)	1.166 (0.375)	-0.057 (0.039)
Emotion3 (yes/no)	2.574** (0.984)	2.773** (1.045)	-0.140** (0.056)
Estimated number of drinks in the past year	1.001* (0.001)	1.001** (0.001)	-1.13 × 10 <sup>-4</sup> (8.53 × 10 <sup>-5</sup> )
Emotion3 (yes/no)	2.765** (1.042)	2.621** (1.011)	-0.138** (0.056)
Daily drinker	1.861 (0.855)	2.105* (0.952)	-0.006 (0.062)
Emotion3 (yes/no)	2.733** (1.032)	2.530** (0.987)	-0.135** (0.055)
Reported number of days drunk in the past year	1.023 (0.017)	1.026 (0.016)	-0.005** (0.002)
Emotion3 (yes/no)	2.615** (1.003)	2.743** (1.092)	-0.141** (0.055)
Smoked cigarettes in past year	1.704* (0.511)	1.463 (0.446)	-0.076** (0.038)

Note: Standard errors in parentheses.

\*Statistically different from zero at the 0.10 level.

\*\*Statistically different from zero at the 0.05 level.

<sup>a</sup>Reported estimates are odds ratios

<sup>b</sup>Reported estimates are incident rate ratios

<sup>c</sup>Reported estimates are OLS coefficients

Emotion Score had lower personal earnings. It is also worth noting that the predictive power of the earnings regressions is very high for cross-sectional data, with an  $R^2$  of 0.71, presumably due in large part to analyzing data from a single, relatively homogeneous worksite.<sup>1</sup>

The descriptive statistics presented in **Tables 1 and 3** indicate that male and female employees differ significantly in several areas. Other researchers have also recognized that gender differences may be present in the relationship between mental health and labor market variables.<sup>7,13</sup> To examine the possibility of gender differences in our sample, we reestimated the models reported in **Table 4** separately for males and females. The gender-specific estimates were similar in sign, magnitude and statistical significance to those reported in **Table 4**. Thus, we report only findings for the full sample of employees.

<sup>1</sup>Although our findings are consistent with intuition and statistically significant for both absenteeism and earnings, the characteristics of our sample may limit the generalizability of our results. Specifically, our sample is somewhat atypical in that it comprises primarily white, older, better educated, married and better compensated individuals than the general population. However, if this sample is more motivated at work and successful than the general population, our results may actually be conservative.

Recognizing that alcohol and other drug use may interact in some way with emotional/psychological problems to influence absenteeism and earnings, we tested several model specifications to determine the joint effects of all these variables.<sup>1</sup> **Tables 5 and 6** report the results for a representative set of the models. Our approach was to include two measures of drug use, three measures of alcohol use and one measure of smoking together with each of the emotional/psychological variables in the regression models specified earlier to see whether the coefficient estimates for the emotional/psychological variables were robust in the presence of other potential performance inhibitors. Each group of coefficient estimates reported in **Tables 5 and 6** is part of an equation that includes all the control variables listed in **Table 4**, but we did not report all estimates to save space.<sup>k</sup>

**Table 5** shows the results for the Emotion3 variable

<sup>1</sup>We also interacted the emotional/psychological variables with the substance-use variables to test whether interactive effects were present between mental health and substance use. In all but a few cases, the interaction terms were not statistically significant. These results are available on request.

<sup>k</sup>A complete set of estimation results is available from the corresponding author.

Table 6. Selected estimation results for the absenteeism and earnings regressions—Emotion Score

Independent variables	Absent past 30 days <sup>a</sup> (logit)	Days absent past 30 days <sup>b</sup> (negative binomial)	Log of personal earnings—primary job <sup>c</sup> (OLS)
Emotion Score	3.553** (1.076)	3.517** (1.007)	-0.103** (0.037)
Nonmedical use of prescription drugs in the past year	1.815* (0.639)	1.086 (0.395)	0.004 (0.046)
Emotion Score	3.740** (1.131)	3.627** (1.029)	-0.097** (0.038)
Drug use ever	1.193 (0.385)	0.916 (0.299)	-0.047 (0.040)
Emotion Score	4.240** (1.347)	3.664** (1.046)	-0.111** (0.038)
Estimated number of drinks in the past year	1.001 (0.001)	1.001 (0.001)	$-1.02 \times 10^{-4}$ ( $8.53 \times 10^{-5}$ )
Emotion Score	3.959** (1.218)	3.440** (1.006)	-0.106** (0.038)
Daily drinker	1.562 (0.745)	1.489 (0.686)	0.009 (0.062)
Emotion Score	3.863** (1.194)	3.374** (1.003)	-0.101** (0.038)
Reported number of days drunk in the past year	1.014 (0.017)	1.010 (0.016)	-0.004* (0.002)
Emotion Score	3.635** (1.111)	3.556** (1.033)	-0.096** (0.038)
Smoked cigarettes in the past year	1.523 (0.466)	1.244 (0.378)	-0.066* (0.039)

Note: Standard errors in parentheses.

\*Statistically different from zero at the 0.10 level.

\*\*Statistically different from zero at the 0.05 level.

<sup>a</sup>Reported estimates are odds ratios

<sup>b</sup>Reported estimates are incident rate ratios

<sup>c</sup>Reported estimates are OLS coefficients

when we control for alternative sets of comorbid conditions. In all regressions, the Emotion3 variable remains statistically significant at the 0.05 level or lower. It continues to have a positive effect on absenteeism and a negative impact on earnings. Note also that the estimated number of drinks in the past year appears to have the most significant comorbid effect on the number of days absent, while the reported number of days drunk in the past year and cigarette use in the past year appear to have the strongest comorbid effect on personal earnings.

Following the same approach for the Emotion Score, we see that the results reported in **Table 6** are consistent with the Emotion3 findings reported in **Table 5**. The earnings regression maintains the same pattern of comorbid effects as in **Table 5**, but the absenteeism regressions do not. Specifically, in **Table 6** we see no consistent pattern of comorbid effects of substance use and mental health on absenteeism.

## Conclusion

Mental illness has the potential to seriously impair a worker's ability to perform effectively on the job. Despite the commonsense belief that emotional problems will lead to lower productivity, relatively few studies have examined the relationship between mental health status and productivity indicators, and no study to our knowledge has analyzed this relationship for a single worksite. Our study contributes new information to the literature in this area by estimating the effects of emotional/psychological symptoms on two important labor market variables: absenteeism and earnings. We conducted the analysis on a recently available data set of workers from a large manufacturing firm.

We created three dichotomous measures of emotional/psychological problems based on the number of symptoms an individual experienced 'very or fairly often' during the previous year. We also created a continuous emotional symptom score measure based on the HSCL,

which accounts for the prevalence and intensity of symptom occurrences for 26 items.<sup>25</sup> A descriptive analysis of the data indicates that 29% of the sample experienced one or more symptoms very often during the past year, but only 5% of the sample experienced six or more symptoms very often. The mean value for the emotional symptom score was 1.76, with a value of 1 indicating no problem and 5 representing acute distress. Females had a higher reported prevalence of emotional/psychological symptoms than males for each of the four variables. These differences were statistically significant at the 0.05 level or lower for all four measures.

Recognizing that comorbidity may occur between emotional problems and alcohol and drug abuse, we created variables to characterize the quantity and frequency of alcohol and drug use. Overall, very few individuals reported using illicit drugs during the past year, but nonmedical use of prescription drugs and illicit drug use at any time in one's life were higher. Furthermore, a large majority of individuals drank some alcohol during the past year, and approximately 7% were daily drinkers.

We estimated several specifications of the absenteeism and earnings equations to test the independent effect of emotional symptoms and the joint effects of emotional symptoms and other comorbid conditions. The findings can be summarized as follows. First, all four measures of emotional symptoms had a positive and statistically significant relationship with absenteeism and a negative and statistically significant relationship with personal earnings. These findings are robust across all specifications even when the effects of other potentially confounding factors (i.e., alcohol and drug use variables) are included. Second, the number of days drunk and cigarette use in the past year appear to be significantly related to earnings even after controlling for emotional symptoms. And lastly, the explanatory power of the models is relatively high for cross-sectional data, especially for the earnings regressions.

These results are interesting from a purely academic perspective, but the findings also have implications for workplace policy. It is strongly suggestive that mental health status is related to absenteeism and earnings for employees at this worksite. However, most employer-based programs and policies are designed to dissuade the use of alcohol and illicit drugs by workers (e.g., employee drug and alcohol testing) rather than addressing other employee behaviors and problems (e.g., Hartwell *et al.*<sup>33,34</sup>). It would be interesting to see whether our results hold up at other worksites as well. However, our findings from this worksite suggest that employers might do well to reassess the priorities of their EAPs and consider directing more of their resources to diagnosing and assisting employees with emotional and psychological distress.

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