The Effects of Chronic Medical Conditions on Work Loss and Work Cutback

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Although work performance has become an important outcome in cost-of-illness studies, little is known about the comparative effects of different commonly occurring chronic conditions on work impairment in general population samples. Such data are presented here from a large-scale nationally representative general population survey. The data are from the MacArthur Foundation Midlife Development in the United States (MIDUS) survey, a nationally representative telephone-mail survey of 3032 respondents in the age range of 25 to 74 years. The 2074 survey respondents in the age range of 25 to 54 years are the focus of the current report. The data collection included a chronic-conditions checklist and questions about how many days out of the past 30 each respondent was either totally unable to work or perform normal activities because of health problems (work-loss days) or had to cut back on these activities because of health problems (work-cutback days). Regression analysis was used to estimate the effects of conditions on work impairments, controlling for sociodemographics. At least one illness-related work-loss or work-cutback day in the past 30 days was reported by 22.4% of respondents, with a monthly average of 6.7 such days among those with any work impairment. This is equivalent to an annualized national estimate of over 2.5 billion work-impairment days in the age range of the sample. Cancer is associated with by far the highest reported prevalence of any impairment (66.2%) and the highest conditional number of impairment days in the past 30 (16.4 days). Other conditions associated with high odds of any impairment include ulcers, major depression, and panic disorder, whereas other conditions associated with a large conditional number of impairment days include heart disease and high blood pressure. Comorbidities involving combinations of arthritis, ulcers, mental disorders, and substance dependence are associated with higher impairments than expected on the basis of an additive model. The effects of conditions do not differ systematically across subsamples defined on the basis of age, sex, education, or employment status. The enormous magnitude of the work impairment associated with chronic conditions and the economic advantages of interventions for ill workers that reduce work impairments should be factored into employer cost-benefit calculations of expanding health insurance coverage. Given the enormous work impairment associated with cancer and the fact that the vast majority of employed people who are diagnosed with cancer stay in the workforce through at least part of their course of treatment, interventions aimed at reducing the workplace costs of this illness should be a priority. (J Occup Environ Med. *2001;43:218–225*)

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There has been growing interest in the impact of chronic medical conditions on work performance among health policy analysts in recent years.[1] This interest can be traced to the conjunction of two facts. First, the incidence of chronic conditions in the general population is increasing as the age structure of society shifts upward and medical advances increase our ability to keep people alive with chronic conditions. Second, there has been a proliferation of costly therapies to treat these conditions in recent years. The conjunction of these two facts has led to a dramatic growth in the cost of medical care that strains the ability of society to provide medical treatment for all people who suffer from chronic conditions.[2] Health care administrators have attempted to deal with this problem by developing triage rules to allocate resources across conditions so as to confer the maximum aggregate health benefit to the entire population.[3,4] Cost-effectiveness analysis and cost-benefit analysis have been the tools used to develop these rules.[5] Work performance has become an important consideration in both of these types of analyses because impairments in work performance are among the most important, and the most easily monetized, indirect societal costs of illness.

Research that has estimated the effects of illness on work impairment suggests that these indirect costs are enormous. For example, depression, the mental disorder thought to have the largest effect on work disability,[6,7] is estimated to cause an annual salary-equivalent loss of $24 billion

in work absenteeism and at-work performance declines in the United States.[8] Results such as this suggest that the indirect cost reductions from treatment of disorders that substantially impair work performance represent important cost savings that should be considered when evaluating the relative costs and benefits of treatment.

Employers are aware that certain health programs are cost-effective in increasing worker performance, as illustrated by employer-sponsored initiatives for flu vaccination and substance-dependence treatment. Some health researchers believe that aggressive outreach and treatment would be cost-effective for a much larger set of illnesses. However, accurate information on this possibility is not available. One important beginning step in assembling information on this issue is to conduct comparative studies that examine the relative effects of many different chronic conditions on workplace functioning. The current report presents a nationally representative study of this sort. Although the data presented here do not address the ability of treatment to reduce work impairment, they can be used to provide preliminary estimates of the upper-bound effects of treatment and to target the conditions that are sufficiently costly in terms of work impairment to warrant more detailed investigation.

Methods

Sample

The study data were from the Midlife Development in the United States (MIDUS) survey. MIDUS is a nationally representative survey of 3032 persons, 25 to 74 years of age, in the noninstitutionalized civilian population of the 48 conterminous United States. MIDUS was carried out by the John D. and Catherine T. MacArthur Foundation Network on Successful Midlife Development between January 1995 and January 1996. All respondents completed a 30-minute telephone interview (70.0% response rate) and filled out two mailed questionnaires that were estimated to take a total of 90 minutes to complete (86.8% conditional response rate in the subsample of telephone respondents). The overall response rate (0.700×0.868) was 60.8%. The data were weighted to adjust for differential probabilities of selection and nonresponse. More details on the MIDUS survey design, field procedures, and sampling weights are available elsewhere.[9,10] The data analyzed in this report are limited to the 2074 MIDUS respondents in the 25- to 54-year age range, which excludes the age distribution in which sizable proportions of respondents are still attending school (younger than 25) or are retired (older than 54).

Measures

The MIDUS self-administered questionnaire included questions on the 12-month prevalences of a wide range of chronic medical conditions. These conditions were assessed in a standard checklist preceded by the question, "In the past 12 months, have you experienced or been treated for any of the following?" In the case of four mental disorders—major depression, panic, generalized anxiety disorder, and substance dependence—brief screening scales were also used to refine the diagnostic classifications.[11] The same questionnaire asked about the 30-day prevalence of work-loss days and work-cutback days (ie, how many days out of the past 30 that respondents were "totally unable to work or carry out your normal household work activities because of your physical health or mental health"; and how many additional days out of the past 30 that respondents were able to work but had to "cut back on work or how much you got done because of your physical health or mental health"). Information on work-loss and work-cutback days was combined into a summary measure of work-impairment days on a scale in which a work-cutback day was counted as one-half of a work-loss day. This weighting scheme is based on results from a national phone survey pilot for MIDUS, in which respondents estimated that they were about half as productive on reported work-cutback days as on normal workdays.

Analysis Procedures

We examined the aggregate distribution of work-impairment days in the total sample as a function of number and type of chronic conditions. A series of regression equations then evaluated whether some conditions are more powerful than others in predicting work impairment. Because some people have more than one condition, these equations also evaluated the nonadditive effects of comorbidity. Finally, a series of moderated regression equations evaluated the relative effects of different conditions on impairment as a function of age, sex, education, and occupational status.

All results reported here are based on weighted data that adjust for differential probabilities of selection within households and for differences between the sample distribution and the census population distribution on a range of sociodemographic variables. Statistical significance was evaluated using 0.05 level two-sided tests. These tests did not consider the design effects introduced by weighting because simulations using jackknife repeated replications[12] found that the inflation of standard errors in design-based estimates was quite small.

Results

Prevalences of Work-Loss Days and Work-Cutback Days

As shown in Table 1, 17.5% of MIDUS respondents in the age range considered here reported at least 1 work-loss day in the past 30 days, whereas 20.2% reported at least 1 work-cutback day. The monthly averages for number of work-loss days

TABLE 1
Thirty-Day Prevalences of Work Loss, Work Cutback, and Work Impairment* in the Total Sample (n = 2074)†

	Those With Any (%)		Those With Any Mean		Total Sample (mean)	
	%	SE	Mean	SE	Mean	SE
Work loss	17.5	0.8	6.3	0.4	1.1	0.1
Cutback	20.2	0.9	5.4	0.3	1.1	0.1
Total work impairment	22.4	0.9	6.7	0.4	1.5	0.1

* Work-impairment days are the sum of work-loss days plus one-half of work-cutback days.
† SE, standard error of % of mean estimates.

among those with any work loss and for number of cutback days among those with any cutback were 6.3 and 5.4, respectively. Over one-fifth of respondents (22.4%) reported at least 1 work-loss or work-cutback day, with a monthly average of 6.7 impairment days among those with at least 1 day of either sort. The estimated average per capita number of work-impairment days in the total sample is 1.5 per month. This is equivalent to an annualized national estimate of over 2.5 billion work-impairment days in the age range of the sample.

Bivariate Associations of Conditions With Work Impairment

The results in Table 2 present the prevalences of commonly occurring conditions assessed in the survey, along with gross data on the 30-day work impairments associated with these conditions without adjustments for age, sex, or other potential confounding variables. The most commonly occurring disorders, according to respondent reports, are depression (16.5%), asthma (14.6%), arthritis (12.6%), and high blood pressure (12.4%). A full 50% of respondents reported having at least one of the conditions in Table 2, and close to one-fourth reported having two or more of these conditions.

The results in the remainder of Table 2 show that cancer has by far the highest reported prevalence of any 30-day work impairment

TABLE 2
Prevalences of Conditions and 30-Day Work Impairment in the Total Sample (n = 2074)*

	Conditions		Any Work Impairment Among Those With the Condition		Mean Impairment Days Among Those With Any Impairment		Mean Impairment Days Among Those With the Condition	
	%	SE	%	SE	Mean	SE	Mean	SE
I. Types of conditions								
Arthritis	12.6	0.7	39.0	3.0	10.1	0.9	4.0	0.5
Asthma	14.6	0.8	35.8	2.8	8.4	0.8	3.0	0.4
Diabetes	3.7	0.4	38.2	5.6	9.4	1.7	3.6	0.8
High blood pressure	12.4	0.7	34.2	3.0	11.4	1.0	3.9	0.5
Autoimmune disease	4.3	0.4	38.5	5.3	8.3	1.5	3.2	0.7
Ulcer	4.4	0.5	48.6	5.4	11.8	1.5	5.8	1.0
Cancer	0.5	0.2	66.2	16.7	16.4	2.8	10.9	3.2
Heart disease	3.4	0.4	47.6	5.8	13.8	1.8	6.6	1.2
Major depression	16.5	0.8	44.5	2.7	9.5	0.8	4.3	0.4
Panic	7.9	0.6	52.0	3.9	9.7	1.0	5.1	0.6
Generalized anxiety disorder	4.0	0.4	53.5	5.7	10.1	1.3	5.5	0.9
Substance dependence	7.2	0.6	33.9	3.8	6.5	0.9	2.3	0.4
II. No. of conditions								
0	50.0	1.1	13.9	1.1	3.5	0.4	0.5	0.1
1	27.6	1.0	20.6	1.7	5.6	0.7	1.2	0.2
2	12.4	0.7	33.1	2.9	6.9	0.8	2.3	0.3
3	5.5	0.5	46.0	4.5	1.1	1.4	5.2	0.8
4	1.7	0.3	69.3	7.1	9.5	1.4	6.6	1.2
5 or more	2.9	0.4	69.1	6.7	13.0	1.6	9.0	1.4

* SE, standard error of % of mean estimates.

(66.2%) and the highest conditional number of impairment days per month (16.4 days). The other conditions are associated with between 33% and 52% of sufferers being impaired for at least 1 day and average conditional impairments in the range between 6 and 14 days per month. There is a clear dose-response relationship between the number of conditions and both probability of any work impairment and mean number of impairment days, from a low of less than 14% any impairment and 3.5 conditional impairment days for respondents with no conditions to a high of over 69% any impairment and 13.0 conditional impairment days for respondents with five or more conditions.

Multivariate Associations of Conditions With Work Impairment

The results of multivariate analyses to evaluate the effects of conditions and sociodemographic controls are presented in Table 3. Part I shows, consistent with Table 2, that people with cancer have the highest adjusted relative odds of any impairment (4.3 times as high as other respondents) and the highest adjusted number of 30-day impairment days (5.7). Of the three other conditions with statistically significant effects on any impairment having odds ratios greater than 2.0, two are mental disorders (depression and panic disorder) and one is a physical disorder (ulcers). Aside from cancer, the conditions associated with the largest conditional number of impairment days are heart disease and high blood pressure.

Part II of Table 3 shows that (1) women are significantly more likely to report any impairment than men, (2) people in the age range of 25 to 34 years are more likely to report any impairment than those 35 to 54 years old, and (3) employed people are less likely to report any impairment than either homemakers or respondents classified with other occupational statuses (mostly unemployed, but also including small numbers of students, disabled, and retired). Conditional number of impairment days among those with any impairment is also highest among respondents in the other occupation category and among respondents with fewer than 12 years of education.

Types of Conditions Versus Number of Conditions

We evaluated the possibility that number of conditions is more important than type of conditions in predicting work impairments. The notion here is that differences in the slopes of the conditions might be statistically insignificant and that the most parsimonious way of characterizing the multivariate effects of the conditions on work impairment is by counting the number of conditions reported. The evaluation was based on prediction equations that added a series of dummy predictor variables for number of conditions to the equations in Table 3. As shown in the first row of Table 4, the conditions, as a set, remained significant even after introducing these controls. It is noteworthy that the test statistics presented in the first row of Table 4 are considerably smaller than those presented in Table 3. This is because the latter evaluate the significance of the overall effects of the separate conditions, whereas the test statistics in Table 4 evaluate the significance of the differential effects of the conditions after adjusting for the fact that a particular respondent experienced a given number of conditions. The significant Table 4 test statistics can be interpreted as showing that there are meaningful differences in the effects of the various conditions on the outcomes. This means that it is not merely number of conditions but also types of conditions that matter in predicting work impairments.

The second row of Table 4 shows test statistics for the incremental effects of number of conditions after controlling for types of conditions. As shown there, number of conditions is not significant net of types of conditions in predicting either any impairment or conditional number of impairment days. Number of conditions is significant, in comparison, in predicting unconditional number of impairment days net of the effects of types of conditions.

The Effects of Comorbidity

The finding that number of conditions has an incremental effect in predicting unconditional number of work-impairment days is consistent with the possibility that there are nonadditivities in the joint effects of comorbid conditions. As noted above, we found that nearly one-fourth of respondents reported having two or more conditions. It is conceivable that particular combinations of these conditions are associated with more or less impairment than predicted on the basis of a model, like the one used to generate the results in Table 3, that assumes additive effects across conditions.

We evaluated this possibility by expanding the prediction equations to include a series of interactions involving multivariate profiles among various combinations of disorders. However, there are 66 logically possible pairs among the 12 conditions considered here, and 220 sets of three, 495 sets of four, and so forth, for a total of 4083 logically possible combinations of two or more disorders. Several hundred of these possibilities are observed in the MIDUS data, and none of these combinations characterizes a large number of respondents. As a result, we abandoned attempts to evaluate the significance of particular combinations of disorders. Instead, we evaluated the significance of the 12 overlapping combinations that include one of the specific disorders with any of the others (eg, arthritis with at least one other condition, asthma with at least one other condition), controlling for the marginal effects of sociodemographic predictors,

TABLE 3
Multivariate Effects of Conditions on 30-Day Work Impairment, Controlling for Sociodemographics[a]

	Any Work Impairment (n = 2073)		Mean Impairment Days Among Those With Any Impairment (n = 459)		Mean Impairment Days in the Total Sample (n = 2073)	
	OR	95% CI	b	SE	b	SE
I. Types of conditions						
Arthritis	1.7*	1.2–2.4	1.6*	0.8	1.3*	0.3
Asthma	1.5*	1.1–2.0	0.7	0.8	0.6*	0.3
Diabetes	1.1	0.6–1.9	−2.1	1.4	−0.3	0.5
High blood pressure	1.4	1.0–1.9	3.1*	0.9	1.3*	0.3
Autoimmune disease	1.1	0.6–1.8	−0.9	1.3	−0.3	0.5
Ulcer	2.2*	1.3–3.6	2.8*	1.1	2.4*	0.5
Cancer	4.3	1.0–19.1	5.7*	2.7	6.9*	1.3
Heart disease	1.6	0.9–2.8	4.8*	1.3	2.8*	0.5
Mood	2.3*	1.7–3.1	2.7*	0.7	2.0*	0.3
Panic	2.1*	1.4–3.1	0.9	0.9	1.7*	0.4
GAD	1.6	1.0–2.7	−0.1	1.1	1.1*	0.5
Substance dependence	1.6*	1.1–2.4	−0.7	1.1	0.2	0.4
II. Sociodemographics						
Sex						
Female	1.8*	1.4–2.4	−0.1	0.7	0.3	0.2
Male	1.0	–	0.0	–	0.0	–
Age						
25–34	1.0	–	0.0	–	0.0	–
35–44	0.6*	0.5–0.8	−0.0	0.8	−0.3	0.2
45–54	0.8	0.6–1.1	−0.4	0.8	−0.2	0.2
Employment status						
Employed	1.0	–	0.0	–	0.0	–
Homemaker	1.6*	1.1–2.3	−0.7	1.0	0.4	0.3
Other	2.6*	1.9–3.8	7.3	0.9	4.2*	0.3
Education (years)						
0–11	1.0	0.6–1.5	3.7	1.2	0.4	0.4
12	1.0	0.8–1.4	1.4	0.9	0.2	0.2
13–15	1.1	0.8–1.5	1.4	0.9	0.2	0.2
16+	1.0	–	0.0	–	0.0	–
	χ^2_{12} = 154.5**		$F_{438,12}$ = 7.6**		$F_{2052,12}$ = 31.2**	

[a] OR, odds ratio; CI, confidence interval; GAD, generalized anxiety disorder; b, unstandardized linear regression coefficient; SE, standard error of the regression coefficient.

* Significant to the 0.05 level, two-sided test.

** Incremental effects of the 12 conditions as a set over and above the effects of the controls. These incremental effects are significant at the 0.05 level in all three equations.

number of conditions, and types of conditions.

Six of the 12 interactions (ie, one for each of the 12 conditions) evaluated in this way were found to be significant (0.05 level of significance, two-sided tests). This is a much greater proportion of significant interactions than we would expect by chance. The conditions involved in the interactions include two physical disorders (arthritis and ulcers) and four mental disorders (major depression, panic, generalized anxiety disorder, and substance dependence). Inspection of the interactions shows that they are all positive (ie, the joint effects of multiple conditions are greater than the sum of their individual effects) and are associated with having at least three comorbid conditions. The joint effects of having fewer than three conditions are additive (ie, these effects are approximately equal to the sum of the individual effects reported in Table 3).

Summary results are reported in Table 5. The first column shows subgroup linear regression coefficients for the significantly interacting conditions predicting unconditional mean 30-day work-impairment days in the subsample of respondents with between zero and two conditions. Three of the six unstandardized linear regression coefficients are significantly greater than zero (arthritis, ulcer, and major depression), with regression coefficients in the range 0.9 to 1.3. Four of the six coefficients are significant, in comparison, in the subsample of respondents with three or more conditions, with values much larger than those in the other subsample (in the range 2.7 to 7.2).

TABLE 4
Significance Tests for the Incremental Effects of Types of Conditions and Number of Conditions[a]

	Any Work Impairment (χ^2)	Mean Impairment Days Among Those With Any Impairment (*F* Test)	Mean Impairment Days in the Total Sample (*F* Test)
Types of conditions	22.2*	2.9*	11.2*
df	12	433, 12	2047, 12
No. of conditions	6.5	1.2	11.2*
df	5	433, 5	2047, 5

[a] χ^2, chi-squared test statistic; df, degrees of freedom of the test.
* Significant at the 0.05 level, two-sided test.

Subgroup Variations

We also investigated whether the effects of the conditions on work impairments vary as a function of four sociodemographic variables: age, sex, education, and employment status. This was done by estimating equations that included interactions between types of conditions and each of the sociodemographic variables. Results were cross-validated in an effort to correct for chance significance. The number of consistently significant interactions was no more than would be expected on the basis of chance in this large number of replications.

Decomposing the Effect of Cancer

The effect of cancer was so much greater than for other conditions that we attempted to investigate specifications of its effect as a function of three physical symptoms found to be commonly reported by cancer patients: fatigue, physical pain, and difficulties in sleeping. As in the analysis of subgroup variation, this was done by estimating equations that included interactions. In this particular case, though, the interactions were between the dummy variable for cancer and dummy variables for these three physical symptoms. In predicting unconditional number of work-impairment days in the total sample, only the fatigue interaction was significant. Subsample decomposition showed that the 6.9 adjusted mean increase in impairment days associated with cancer in Table 3 increased to 8.9 (with a standard error of 1.4) when we restricted our attention to cancer patients with fatigue. Cancer without fatigue, in comparison, was not significantly related to work impairment. Although caution is needed in interpreting these results because of the small numbers in the subsamples, this result implies that the impact of cancer on work impairment is likely mediated by fatigue.

Discussion

Limitations

Three limitations are important to note. First, the comparatively low response rate of the MIDUS survey mandates caution in generalizing the findings. Second, errors in respondent retrospective self-reports about work impairments could lead to additional bias in estimates. This is an issue of special concern for mental disorders, because evidence exists that some types of mental disorders lead to distorted and pessimistic perceptions about personal self-worth that could help explain the finding that the reported work impairments due to mental disorders are higher than those for most physical disorders.[13] Third, the use of respondent self-reports to classify conditions could introduce error due to recall bias, misunderstanding of the true nature of the disorder, and unwillingness to report stigmatizing conditions.

Consistency of Results With Previous Research

Within the context of these limitations, the MIDUS results are quite similar to those of the small number of related results that have been reported in the literature. The MIDUS estimate of 1.1 days of work loss per month per capita is equivalent to an annualized national projection of approximately 2.8 million lost productivity years in the age range of the sample and 4.0 million in the unrestricted population of people 18 and older. The second of these projections is close to the 4.5 million lost productivity years estimated in the most recently published data from the US National Health Interview Survey (NHIS).[14] The MIDUS estimate of 1.5 days of total work impairment per month per capita is close to the estimated 1.6 days in the most recently published data from the Centers for Disease Control Behavioral Risk Factor Surveillance Survey (BRFSS).[15] The MIDUS finding that work-cutback days are as common as work-loss days is consistent with data from the one other recent survey that asked about both work loss and work cutback.[16]

Finally, the MIDUS finding that chronic conditions are associated with substantial work impairment is consistent with the results of two similar general population survey investigations involving somewhat different lists of conditions in the NHIS[17] and the BRFSS.[15] Our finding that cancer .is associated with more work impairment than other

TABLE 5
Multivariate Effects of Six Significantly Interacting Conditions on 30-Day Work Impairment, Controlling for Sociodemographics, Noninteracting Conditions, and Number of Conditions, in Subsamples of Respondents with Zero to Two vs Three or More Conditions[a]

	Total No. of Conditions			
	Zero to Two		Three or More	
	b	SE	b	SE
Arthritis	0.9*	0.3	4.0*	1.9
Ulcer	1.3*	0.5	6.2*	1.9
Major depression	0.9*	0.3	7.2*	2.0
Panic	−0.3	0.5	5.8*	1.9
Generalized anxiety disorder	−0.2	0.7	3.6	2.1
Substance dependence	−0.1	0.4	2.7	2.3

[a] b, unstandardized linear regression coefficient; SE, standard error of the regression coefficient.

* Significant at the 0.05 level, two-sided test.

conditions is also supported by both of these other studies. The NHIS report presented information on the proportions of people with each of seven chronic physical conditions who experienced limitations in role functioning due to those conditions. Cancer (44.5% among respondents in the 45-to-64 age range) and ischemic heart disease (45.6%) had the highest proportions among the seven conditions investigated. The BRFSS report presented information on the average number of activity limitations in the past month associated with 12 specific physical conditions and one composite mental condition defined as "depression, anxiety, or other emotional problems." Cancer (an average of 12.6 days) and the composite mental condition (12.2 days) had much higher averages than any of the other conditions included in this report.

We are aware of no previous published research that has investigated the possibility that the joint effects of comorbid conditions on work impairment differ significantly from the additive effects of the individual conditions in the comorbid cluster. Our finding that such interactions exist is substantively plausible. The fact that mental disorders were consistently found to be involved in such interactions is indirectly consistent with evidence suggesting that comorbid mental disorders can complicate the management and exacerbate the course of chronic physical conditions.[18]

Our failure to document consistent specifications of effects based on sociodemographic variables, finally, is inconsistent with the finding of Verbrugge and Patrick[17] that the effects of some conditions on work functioning are different for older and younger people. Conversely, the MIDUS results are consistent with Verbrugge and Patrick's failure to find meaningful variation in condition-specific impairments by sex. We are aware of no previous research that investigated variation in condition-specific impairments by level of educational attainment or employment status.

Implications

The enormous magnitude of the work impairment associated with the chronic conditions studied here should be considered in the current debate on universal health insurance. The cost of lost productivity due to chronic conditions would almost certainly be reduced by aggressive treatment of currently untreated conditions in conjunction with improved treatment of conditions that are currently not being treated adequately. Available evidence suggests that such cost savings could be substantial. For example, simulations based on secondary analyses of clinical trials for the treatment of depression suggest that the direct costs of outreach and treatment of depression among employed people could be totally offset by the indirect cost savings associated with the decreased work impairment that occurs when depression remits.[19] Rational economic evaluation of outreach and best practices interventions for this and other conditions should be factored into employer cost-benefit calculations of expanding health insurance coverage.

The results presented here show clearly that cancer should be the first target for evaluations of this sort. Cancer has a much more powerful effect on work impairment than any of the other conditions in MIDUS. This is not surprising in light of the many physical and cognitive symptoms of cancer and the serious side effects of some cancer treatments. Indeed, quality-of-life studies among cancer patients consistently document substantial decrements in role functioning.[20–22] This is important from an employer perspective because the MIDUS data suggest that as many as 87.8% (standard error, 7.3%) of employed people who develop cancer remain at work after receiving their diagnosis and during at least some part of their treatment. Given the enormous amount of work impairment associated with cancer, more focused evaluations of the workplace cost savings that could be achieved by disease management strategies aimed at reducing these impairments are clearly warranted. This is especially true when considering that experimental trials have shown that some elective interventions for cancer can significantly increase role functioning.[23,24] Our post hoc finding that the effect of cancer may be mediated by fatigue provides a promising clue regarding potentially useful intervention opportunities.

Moving beyond cancer to a consideration of all conditions examined here, the MIDUS finding that work-cutback days are as common as

work-loss days is worthy of special comment. We noted above that this finding is consistent with data from other recent surveys, and it is important from an employer cost-perspective for at least two reasons. First, most previous research on the workplace costs of specific illnesses has ignored cutback days and therefore substantially underestimates productivity loss due to illness. Second, work-cutback days often represent hidden costs that are extremely difficult for employers to control. Work-loss days, in comparison, are visible and manageable through caps on paid sickness leave and disability insurance. The intangibility of work cutback, or "presenteeism" as it is sometimes called, means that cutback days might actually pose greater downside risks for employer than work-loss days. The difficulty of measuring and monetizing presenteeism poses a challenge for future research in this area that must be addressed by developing valid measures that can be used as outcomes in treatment trials and demonstration projects.

Acknowledgments

Preparation of this article was supported, in part, by Research Scientist Award K05 MH00507 (Dr Kessler) and Research Scientist Development Award K01-MH01651 (Dr Wang) from the National Institute of Mental Health; by the John D. and Catherine T. MacArthur Foundation Initiative on Depression and Workplace Performance; and by Ortho Biotech, Inc. The MIDUS survey was supported by the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development, O.G. Brim, Director. The authors appreciate helpful comments from Paul Cleary and Richard Frank on a previous version of this article.

References

1. Murray CJL, Lopez AD. *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability From Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020*. Cambridge, MA: Harvard University Press; 1996.
2. Burner ST, Waldo DR, McKusick DR. National health expenditures projections through 2030. *Health Care Financing Review*. 1992;14:1–29.
3. Hillner BE, Smith TJ. Efficacy and cost-effectiveness of adjuvant chemotherapy in women with node-negative breast cancer. *N Engl J Med*. 1991;324:160–168.
4. Pauker SP, Pauker SG. The amniocentesis decision: ten years of decision analytic experience. *Birth Defects*. 1987;23: 151–169.
5. Weintein MC, Fineberg HV. *Clinical Decision Analysis*. Philadelphia: WB Saunders; 1980.
6. Conti DJ, Burton WN. The economic impact of depression in a workplace. *J Occup Environ Med*. 1994;36:983–988.
7. Kouzis AC, Eaton WW. Emotional disability days: prevalence and predictors. *Am J Public Health*. 1994;84:1304–1307.
8. Greenberg PE, Stiglin LE, Finkelstein SN, Berndt ER. The economic burden of depression in 1990. *J Clin Psychiatry*. 1993;54:405–418.
9. Kessler RC, Mickelsen KD, Zhao S. Patterns and correlates of self-help group membership in the United States. *Soc Policy*. 1997;27:27–46.
10. Ryff CD, Kessler RC. *A Portrait of Midlife in the US*. Chicago, IL: University of Chicago Press. In press.
11. Kessler RC, Andrews G, Mroczek D, Ustun B, Wittchen H-U. The World Health Organization Composite International Diagnostic Interview Short Form (CIDI-SF). *Int J Methods Psychiatr Res*. 1998;7:171–185.
12. Kish L, Frankel MR. Inference from complex samples. *J R Stat Soc*. 1974;36: 1–37.
13. Coyne JC, Gotlib IH. The role of cognition in depression: a critical appraisal. *Psychol Bull*. 1983;94:472–505.
14. Hoffman C, Rice D, Sung HY. Persons with chronic conditions: their prevalence and costs. *JAMA*. 1996;276:1473–1479.
15. Centers for Disease Control and Prevention. Health-related quality of life and activity limitation—eight states, 1995. *MMWR Morb Mortal Wkly Rep*. 1998;47: 134–139.
16. Kessler RC, Frank RG. The impact of psychiatric disorders on work loss days. *Psychol Med*. 1997;27:861–873.
17. Verbrugge LM, Patrick DL. Seven chronic conditions: their impact on US adults' activity levels and use of medical services. *Am J Public Health*. 1995;85: 173–182.
18. Stoudemire A. *Psychological Factors Affecting Medical Conditions*. Washington, DC: American Psychiatric Press; 1995.
19. Kessler RC, Barber C, Birnbaum HG, et al. Depression in the workplace: effects on short-term work disability. *Health Aff (Millwood)*. 1999;18:163–171.
20. List MA, Mumby P, Haraf D, et al. Performance and quality of life outcome in patients completing concomitant chemoradiotherapy protocols for head and neck cancer. *Qual Life Res*. 1997;6:274–284.
21. Malone M, Harris AL, Luscombe DK. Assessment of the impact of cancer on work, recreation, home management and sleep using a general health status measure. *J R Soc Med*. 1994;87:386–389.
22. Smith DS, Carvalhal GF, Schneider K, Krygiel J, Yan Y, Catalona WJ. Quality-of-life outcomes for men with prostate carcinoma detected by screening. *Cancer*. 2000;88:1454–1463.
23. van Holten-Verzantvoort AT, Zwinderman AH, Aaronson NK, et al. The effect of supportive pamidronate treatment on aspects of quality of life of patients with advanced breast cancer. *Eur J Cancer*. 1991;27:544–549.
24. Giovagnoli AR, Tamburini M, Boiardi A. Quality of life in brain tumor patients. *J Neurooncol*. 1996;30:71–80.