

# Stanford Presenteeism Scale: Health Status and Employee Productivity

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*Workforce productivity has become a critical factor in the strength and sustainability of a company's overall business performance. Absenteeism affects productivity; however, even when employees are physically present at their jobs, they may experience decreased productivity and below-normal work quality—a concept known as decreased presenteeism. This article describes the creation and testing of a presenteeism scale evaluating the impact of health problems on individual performance and productivity. A total of 175 county health employees completed the 34-item Stanford Presenteeism Scale (SPS-34). Using these results, we identified six key items to describe presenteeism, resulting in the SPS-6. The SPS-6 has excellent psychometric characteristics, supporting the feasibility of its use in measuring health and productivity. Further validation of the SPS-6 on actual presenteeism (work loss data) or health status (health risk assessment or utilization data) is needed. (J Occup Environ Med. 2002;44:14–20)*

**W**orkforce productivity has become a critical factor in the strength and sustainability of a company's overall business performance. Absenteeism, which can be estimated through readily available data, reduces individual-level and workforce productivity. However, even when employees are physically present in their jobs, they may experience decreased productivity and below-normal work quality—a concept known as decreased *presenteeism*. Although productivity losses attributable to decreased presenteeism may be substantial, appropriate measurement tools are still in their infancy.

Workforce productivity can be related to a variety of factors, which may influence productivity directly (eg, the occupational environment or on-the-job training) or indirectly (eg, the effect of health and well-being).<sup>1</sup> In a recent health and productivity literature review, McCunney noted that although productivity in some occupations can be assessed by total items produced in a workday, productivity in occupations that center on cognitive tasks is more challenging to assess.<sup>2</sup>

Decrements in *health-related productivity* can manifest as either absenteeism or lower presenteeism. A decrease in presenteeism can hurt productivity in a way similar to an increase in absenteeism.<sup>3</sup> A number of studies have shown that, on average, workers who suffer from any of a number of health problems have higher absenteeism levels.<sup>4–8</sup> Alleviating and managing health problems should improve productivity significantly, not only through lower absen-

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teeism but also by increased presenteeism, as supported by the results of several studies.<sup>9-12</sup> Health-related productivity also may be tied to the effectiveness of the health care services that the workforce receives. The use of comprehensive corporate health promotion programs has demonstrated reductions in absenteeism and short-term disability costs.<sup>13,14</sup>

Employers continue to be alarmed at the rising cost of health care benefits, and they still have insufficient evidence and limited assessment tools with which to gauge the value of the services received. From an economic perspective, this is an investment in human capital. If improved health management lowers absenteeism and increases presenteeism, then employers need assessment tools that can deliver meaningful data on the status of and improvements in the health and productivity of their workers. Previous research has already demonstrated the economic costs to a company from absenteeism, employee turnover, and medical disability.<sup>15-18</sup>

Our concept of presenteeism is that of active employee engagement in work. It is inclusive, with a focus on cognitive, emotional, and behavioral engagement during work, which seems particularly appropriate for assessing presenteeism among employees in positions of mid- to upper-management. It also assesses work beyond the boundaries of normal work hours and the formal worksite.

We developed the Stanford Presenteeism Scale (SPS-32) to begin to assess the relationship between presenteeism, health problems, and productivity in working populations. This scale measures a worker's ability to concentrate and accomplish work despite health problems. A variety of existing scales study the relationship between various health problems and work output.<sup>3,6-8,19-25</sup> The SPS-32 embodies our concept of presenteeism in its measures of cognitive, emotional, and behavioral aspects of concentration. This encom-

passes the processes and outcomes of work and the worker's perception of his or her ability to overcome the distraction of a health problem while accomplishing work-related goals. Although self-report methods of assessing work functioning may have some limitations, they can play a meaningful role in assessment if psychometric evidence indicates that the tool is consistent and valid.<sup>26,27</sup>

Our primary research objective was to encapsulate the cognitive, emotional, and behavioral aspects of worker concentration into a practical, concise measurement tool with excellent psychometric properties. To this end, we conducted pilot work with two employers—an academic department at the Stanford University School of Medicine and the US Postal Service—to formulate a scale from our presenteeism concept. The results of this work have been described previously.<sup>28</sup> Here we discuss the results of our pilot work with the employees of California's San Mateo County, in which we use psychometric analysis to identify the items from the SPS-32 that would be most useful for inclusion in a shortened scale.

## Methods

Our research methods comprised instrument development, statistical procedures, sample selection, measurements, and item reduction and scoring.

### Instrument Development

The first step in instrument development was to prepare the SPS-32. The 32 items were developed to reflect various cognitive, emotional, and behavioral aspects of accomplishing work, despite possible health problems. Content was based on a review of the relevant literature and on our collective experience in working on health issues with worksite-based programs. We created a 2 × 3 table of specifications that supported the content validity of this instrument based on two major dimensions of presenteeism: work fo-

cus (process outcome of work) and psychological focus (emotion, cognition, and behavior). Then, we generated items that fit within each of the six cells framed by this table. After a series of iterations, we generated the 32 items that were included in the SPS-32. This instrument is presented and discussed in a previous publication.<sup>28</sup> An item-reduction strategy yielded a six-item scale, the SPS-6, as displayed in the Appendix. The sum of the six items then produces a total Presenteeism Score.

### Statistical Procedures

To assess the psychometric properties of the SPS-6, we conducted a series of statistical procedures to detect the presence of any normative differences within the population and to evaluate the scale's internal consistency and construct validity.

*Normative differences.* To detect the presence of any normative differences related to demographic characteristics, we computed *t* tests or one-way analysis of variance to examine the relationship of each demographic characteristic (eg, gender, type of occupation) as the group variable, with SPS-6 total scores as the dependent variable. For a continuous demographic variable such as age, we used a few categories (eg, <35 years of age, 35 to 50, >50) and then conducted an analysis of variance by these categories on the SPS-6 total score.

*Internal consistency.* Cronbach's  $\alpha$  was used to identify how well the six items are internally consistent in assessing a single overall construct.

*SPS-6 structure.* To create the structure of the SPS-6, we conducted classical factor analysis of the SPS-32 using the Varimax rotation with Kaiser Normalization on the items. This procedure maximized the variance accounted for by the individual factors produced. In turn, this allowed us to detail the content of the items comprising the scale. We used the completed surveys from the San Mateo County employees. This revealed two principal factors: one em-

phasized presenteeism in achieving the outcomes of work, and the other focused on avoidance of distraction in the process of doing work. Because our goal was to produce a scale that could be used widely, we reduced the number of items in two steps: from 32 to 12, and from 12 to 6. In the first item reduction, we selected items that were consistent not only with these two dimensions but also with an additional criterion—we wanted a balance in the number of questions using positive or negative wording: agreement and disagreement with an equal number of items would reflect greater presenteeism. In the second item reduction, we used the additional consideration that items would be generalizable across work settings and occupations.

*Construct validity.* Validity is the extent to which SPS-6 scores reflect true differences in presenteeism for individuals over time, and/or between individuals, and not differences due to constant or random error. Because there is no definitive standard and therefore no direct way to determine the validity of the SPS-6, we measured construct validity indirectly, through comparison with relevant evidence. Construct validity is a complex concept that incorporates all available evidence to determine the extent to which an instrument measures what it was intended to measure. We present three types of evidence assessing the construct validity of the SPS-6:

1. Concurrent validity indicates the level of agreement for individuals between similar measures, such as comparing an individual's "presenteeism score" on the SPS-32 with his or her "presenteeism score" on the SPS-6.
2. Criterion validity is tested by comparing presenteeism scores with a specific and measurable criterion, such as the presence of a physical disability.
3. Discriminant validity indicates whether the construct of presenteeism can be differentiated from other related constructs, such as job satisfaction and job stress.

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*Concurrent validity.* Spearman's rank-order correlation coefficients were computed to evaluate the relationship of the SPS-6 total score with scores on other items, such as those developed to measure presenteeism that use different content and response options (a 0-to-100 percentage response scale). Items were as follows: "When my (health problem) bothered me, the percentage of my time that I was as productive as usual was . . ."; "Compared to my usual level of productivity, when my (health problem) bothered me, the percentage of my work that I was able to accomplish was . . ."; and "When my (health problem) bothered me, the percentage of my work time that I was likely to make more mistakes than usual was . . ." Also, we examined the correlation between the total scores on the SPS-6 and the SPS-32 to determine how well the SPS-6 captured the assessment made by the SPS-32.

*Criterion validity.* *t* tests were computed to compare the mean SPS-6 total score obtained by employees reporting a work-related or non-work-related disability compared with those indicating that they had no disability.

*Discriminant validity.* Spearman's rank-order correlation coefficients were computed to evaluate the relationship of the SPS-6 with scores on measures of other constructs that should be related, but not strongly, including job satisfaction and job stress. When evaluating the psychometric properties of instruments, *test-retest reliability* is usually an important additional consideration. Test-retest reliability reflects the extent to which an instrument measures consistently over time, demonstrating that individuals respond with similar responses each time it is administered to them. We did not consider this to be an appropriate criterion for evaluating a presenteeism

instrument, however, given that it was defined relative to an individual's usual performance. Because we defined presenteeism to vary as a person's experience varied, stability over time would not be expected. For example, chronic health problems can be quite dynamic and can have differential rates of impact from one day to the next because of acute flare-ups and exacerbations. Therefore, we did not evaluate test-retest reliability of the SPS-6, because we expect that individuals who complete this instrument will not complete it consistently over time.

### Sample Selection

Between April and June 2001, after approval was obtained from the appropriate institutional review board, we collected survey data from 675 employees of San Mateo County. Each respondent reviewed and signed a consent form indicating that participation was voluntary, that the individual had the right to withdraw consent or discontinue participation at any time without penalty, and that the individual's privacy would be maintained. Each respondent was provided \$10 for participation. San Mateo County employees were assigned to one of six occupational risk category levels, as defined by the State of California workers' compensation program. From each category, 100 individuals were randomly chosen to receive a survey packet, sent through interdepartmental mail.

### Measurements

*Demographics.* Seven items assessed demographic characteristics of the survey respondents: age, gender, ethnicity, years of education, marital status, and employment status (not employed, part- or full-time, and type of job).

*Work stress and satisfaction.* Each employee was asked: "How would you rate the stress of your current job?" Possible responses were 1 = extremely low, 2 = low, 3 = moderate, 4 = high, and 5 = extremely

high. Then, each employee was asked, "Overall, how satisfied are you with your job?" Possible responses were 1 = completely dissatisfied, 2 = moderately dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = moderately satisfied, and 5 = completely satisfied.

**Health/disability status.** The employees identified their health/disability status by indicating whether they had a work-related (occupational) disability, a non-work-related disability, or no disability.

**SPS-32 Scale.** The measure comprised 32 items. Its content validity was supported by its consistency with both the relevant literature and our concept of presenteeism across occupations (relationship of cognitive, emotional, and behavioral concentration on accomplishing work). The SPS-32 is presented and discussed in a previous publication.<sup>28</sup>

### Item Reduction and Scoring

We obtained feedback from an expert (Kessler, personal communication, March 30, 2001) to assist in designing our strategy for item reduction and identifying items that would be most applicable to employees with a range of occupations. We also examined each item's frequency distribution to avoid "ceiling" or "floor" effects that occur when nearly all respondents score high or low on an item. After identifying the six items for the short version of the scale, we computed a total score. This first required reverse-scoring three of the items so that the numeric value of the response was flipped to its mirror image (1 = 5, 2 = 4, 3 = 3, 4 = 2, and 5 = 1). The SPS-6 total score is the sum of the values of the reverse-scored and the other items in the brief version of the scale. A high SPS-6 score indicates a high level of presenteeism; ie, a greater ability to concentrate on and accomplish work despite health problem(s).

### Results

Approximately 75 employees returned the survey, declining to

**TABLE 1**  
Demographic Characteristics and Disability Status

Characteristic	%
Gender	
Men	52.1
Women	47.9
Age*	
Ethnic background	
Black/African American	4.9
Asian American	10.5
Hispanic/Latino	14.2
White/European American	63.6
Other	6.8
Current relationship status	
Single	17.8
Currently married or in a relationship similar to marriage	68.2
Divorced	13.4
Other	0.6
Employment status	
Not employed	0.6
Part-time (<30 hrs/wk)	1.8
Full-time (≥30 hrs/wk)	97.5
Education completed	
High school graduate/trade school	7.9
Some college	28.0
Bachelor's degree	23.8
Some graduate school	12.2
Advanced degree	28.0
Type of job	
Service maintenance	3.0
Clerk	9.6
Protective service worker	7.4
Technician or paraprofessional	17.8
Official, administrator, or professional	50.4
Other	11.9
Disability	
Work-related	10.5
Non-work-related	10.5
None	79.1

\* Mean ± SD: 46.5 ± 9.4.

participate. They were replaced by 75 additional individuals by using the same selection method. A total of 675 surveys were mailed, and 175 were completed and returned (a response rate of 26%). Of the 175 respondents, 11 indicated that they did not perceive themselves to have a health problem and thus they did not complete the rest of the survey. Therefore, we report the results for the 164 respondents who provided complete survey data. The mean age of the respondents was 46.5 years, and 52.1 percent were male. Table 1 summarizes demographic characteristics and disability status.

### Descriptive Statistics and Scale Correlations

The mean score for the SPS-6 was 22.9 (SD, 4.0) and for the SPS-32 it was 108.1 (SD, 14.9). Total scores on the two versions were strongly correlated, ( $r_s = 0.89$ ,  $P < 0.001$ ), suggesting that the SPS-6 will be useful in assessing what is covered by the SPS-32.

### Internal Consistency

With a Cronbach's  $\alpha$  of 0.80, our survey results indicated that the SPS-6 showed high internal consistency.

**TABLE 2**  
Factor Loadings of SPS-6\* Items Using Varimax Rotation Procedure

Item	Factor 1: Completing Work	Factor 2: Avoiding Distraction
Despite having my (health problem), I was able to finish hard tasks in my work.	0.88	0.11
At work, I was able to focus on achieving my goals despite my (health problem).	0.86	0.17
Despite having my (health problem), I felt energetic enough to complete all my work.	0.71	0.31
Because of my (health problem), the stresses of my job were much harder to handle.	0.15	0.87
My (health problem) distracted me from taking pleasure in my work.	0.12	0.85
I felt hopeless about finishing certain work tasks, due to my (health problem).	0.36	0.68

\* SPS, Stanford Presenteeism Scale.

**TABLE 3**  
Mean SPS-6\* Total Scores by Demographic Characteristics

Characteristic	Mean ± SD	Test Statistic (df)
Gender		$t(161) = 0.30$
Men	23.0 ± 3.9	
Women	22.9 ± 4.2	
Age		$F(2, 159) = 1.60$
<35 yrs	21.9 ± 4.0	
35–50 yrs	23.5 ± 4.3	
>50 yrs	22.8 ± 3.7	
Ethnic background		$F(4, 157) = 1.15$
Black/African American	22.4 ± 5.7	
Asian American	23.4 ± 4.0	
Hispanic/Latino	21.3 ± 4.2	
White/European American	23.3 ± 3.7	
Other	22.9 ± 5.0	
Education completed		$F(4, 159) = 1.85$
High school graduate/trade school	23.8 ± 4.6	
Some college	21.6 ± 4.7	
Bachelor's degree	23.7 ± 3.3	
Some graduate school	23.0 ± 3.8	
Advanced degree	23.3 ± 3.5	
Marital status		$F(2, 153) = 0.84$
Single	22.2 ± 4.5	
Married or in a similar relationship	23.2 ± 3.8	
Divorced	22.6 ± 3.9	
Type of job		$F(5, 129) = 2.32^\dagger$
Service maintenance	21.0 ± 3.7	
Clerk	21.8 ± 4.5	
Protective service worker	20.3 ± 4.6	
Technician or paraprofessional	22.3 ± 3.7	
Official, administrator, or professional	23.6 ± 3.5	
Other	24.4 ± 4.3	

\* SPS, Stanford Presenteeism Scale.

†  $P < 0.05$ .

## Construct Validity

Table 2 shows the results of the classic factor analysis using the Varimax rotation with Kaiser Normalization on the SPS-6 completed by the main study participants. The results suggest that two underlying dimensions of presenteeism were tapped by this scale. The two factors derived from the Principal Components Analysis account for 71% of the variance of responses, with the first factor accounting for 51% of variance and the second accounting for an additional 20% of variance. All three of the positively worded items in the SPS-6 loaded strongly on this first factor, which we labeled Completing Work. All three of the SPS-6 negatively worded (reverse-scored) items loaded weakly on the first factor but strongly on the second factor, which we labeled Avoiding Distraction.

*Concurrent validity.* The SPS-6 total score was significantly correlated in the expected directions with scores on other measures of presenteeism—the total score had a strong positive relationship with respondents' ratings of the percentage of their time that they were productive in their work despite their health problem ( $r_s = 0.53, P < 0.001$ ); the total score also had a strong positive relationship with respondents' ratings of their self-reported proportion of work accomplished ( $r_s = 0.47, P < 0.001$ ). A significant but more moderate correlation was obtained between the SPS-6 total score and the item, "When my (health problem) bothered me, the percentage of my work time that I was likely to make more mistakes than usual was. . ." ( $r_s = -0.31, P < 0.001$ ).

*Criterion validity.* The mean SPS-6 total score obtained by employees reporting a work or non-work-related disability was significantly lower (mean, 21.0; SD, 3.9) compared with that of employees who reported no disability (mean, 23.5; SD, 3.8;  $t[159] = 3.54; p = 0.001$ ).

*Discriminant validity.* SPS-6 total scores also correlated positively with job satisfaction ( $r_s = 0.15, P < 0.05$ ) and negatively with job stress ( $r_s = -0.22, P < 0.01$ ). As expected, however, neither of these relationships showed a strong degree of magnitude, suggesting that presenteeism as assessed by the SPS-6 can be distinguished from the related constructs of job satisfaction and job stress.

*Demographic differences.* Table 3 shows mean SPS-6 total scores by demographic characteristics. Significant differences were found only for the demographic characteristic of occupational categories. Post hoc tests using the least squared difference method showed that mean SPS-6 total scores were significantly lower among "protective service workers" than among employees in the category of official/administrator/professional ( $P = 0.01$ ) and among those in the category of "other" type of occupation ( $P < 0.01$ ). The protective service worker category represents a heterogeneous set of occupations ranging from police officer to trained therapists working in child protective services.

## Discussion

The results suggest that the SPS-6 has excellent psychometric properties that should make it useful as an

assessment tool in future research on worker health and productivity. This scale showed very good internal consistency overall. Factor analysis indicated that the SPS-6 captured both dimensions of presenteeism that we intended to assess, including a focus on work process (Avoiding Distractions) and work outcome (Completing Work). This analysis provides evidence for the construct validity of the SPS-6 scale.

Other findings further support the validity of this scale. It is consistent with our underlying construct: the employee's ability to focus on work without being distracted by health problems. The results show good concurrent validity for the self-reported measures of productivity in general. Total scores on the SPS-32 and SPS-6 were strongly correlated, suggesting that the SPS-6 assesses what was covered by the SPS-32.

The SPS-6 reflects good divergent validity in being only somewhat negatively correlated with stress on the job and only somewhat positively associated with job satisfaction. The lack of strong correlations suggests that our concept of presenteeism is sufficiently distinct from tapping merely into job stress or job satisfaction, although we consider it reasonable that some degree of relationship would exist generally among employees.

Given that only one demographic characteristic—type of occupation—shows significant differences in mean SPS-6 total scores, our findings suggest that this scale has fairly generalizable value for worksites across varying demographic characteristics. It is not surprising, however, that presenteeism differed somewhat by job type, a likely reflection of major differences in the nature of jobs. We do not know why protective service workers reported less presenteeism than professionals, administrators, and officials, but it is possible that one or more characteristics of the nature of work in protective services hinder higher levels of presenteeism.

The SPS-6 has excellent psychometric characteristics, supporting the feasibility of its use in future research on measurement and improvement of employee health status and productivity. Such research should address a number of limitations of the current study pertaining to sampling and assessment methods. Furthermore, future research should examine changes in this instrument in response to specific treatments for health problems among employees. Finally, further validation of the SPS-6 on actual presenteeism (work loss data) or health status (health risk assessment or utilization data) is needed.

## APPENDIX

### Stanford Presenteeism Scale (SPS-6): Health Status and Employee Productivity

**Directions:** Below we would like you to describe your work experiences in the **past month**. These experiences may be affected by many environmental as well as personal factors and may change from time to time. For each of the following statements, please circle one of the following responses to show your agreement or disagreement with this statement in describing *your* work experiences in the past month.

**Please use the following scale:**

Circle:

- 1 if you strongly disagree with the statement
- 2 if you somewhat disagree with the statement
- 3 if you are uncertain about your agreement with the statement
- 4 if you somewhat agree with the statement
- 5 if you strongly agree with the statement

Statement	Your work experience in the past month:				
1. Because of my (health problem),* the stresses of my job were much harder to handle.	1	2	3	4	5
2. Despite having my (health problem),* I was able to finish hard tasks in my work.	1	2	3	4	5
3. My (health problem)* distracted me from taking pleasure in my work.	1	2	3	4	5
4. I felt hopeless about finishing certain work tasks, due to my (health problem).*	1	2	3	4	5
5. At work, I was able to focus on achieving my goals despite my (health problem).*	1	2	3	4	5
6. Despite having my (health problem),* I felt energetic enough to complete all my work.	1	2	3	4	5

\* Note that the words "back pain," "cardiovascular problem," "illness," "stomach problem," or other similar descriptors can be substituted for the words "health problem" in any of these items.

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## References

- Berger ML, Murray JF, Xu J, Pauly M. Alternative valuations of work loss and productivity. *J Occup Environ Med.* 2001;43:18-24.
- McCunney RJ. Health and productivity: a role for occupational health professionals. *J Occup Environ Med.* 2001;43:30-35.
- Burton WN, Conti DJ, Chen C, Schultz AB, Edington DW. The role of health risk factors and disease on worker productivity. *J Occup Environ Med.* 1999;41:863-877.
- Burton WN, Conti DJ, Chen C, Schultz AB, Edington DW. The impact of allergies and allergy treatment on worker productivity. *J Occup Environ Med.* 2001;43:64-71.
- Aldana SG, Pronk NP. Health promotion programs, modifiable health risks, and employee absenteeism. *J Occup Environ Med.* 2001;43:36-46.
- Dewa CS, Lin E. Chronic physical illness, psychiatric disorder and disability in the workplace. *Soc Sci Med.* 2000;51:41-51.
- Schwartz BS, Stewart WF, Lipton RB. Lost workdays and decreased work effectiveness associated with headache in the workplace. *J Occup Environ Med.* 1997;39:320-327.
- Keech M, Scott AJ, Ryan PJ. The impact of influenza and influenza-like illness on productivity and healthcare resource utilization in a working population. *Occup Med.* 1998;48:85-90.
- Cady RC, Ryan R, Jhingran P, O'Quinn S, Pait DG. Sumatriptan injection reduces productivity loss during a migraine attack: results of a double-blind, placebo-controlled trial. *Arch Intern Med.* 1998;158:1013-1018.
- Cockburn IM, Bailit HL, Berndt ER, Finkelstein SN. Loss of work productivity due to illness and medical treatment. *J Occup Environ Med.* 1999;41:948-953.
- Testa MA, Simonson DC. Health economic benefits and quality of life during improved glycemic control in patients with type 2 diabetes mellitus. *JAMA.* 1998;280:1490-1496.
- Adelsberg BR. Sedation and performance issues in the treatment of allergic conditions. *Arch Intern Med.* 1997;157:494-500.
- Bunn WB, Pikelny DB, Slavin TJ, Paralkar S. Health, safety and productivity in a manufacturing environment. *J Occup Environ Med.* 2001;43:47-55.
- Serxner S, Gold D, Anderson D, Williams D. The impact of a worksite health promotion program on short-term disability usage. *J Occup Environ Med.* 2001;43:25-29.
- Goetzel RZ, Guindon AM, Turshen J, Ozminkowski R. Health and productivity management: establishing key performance measures, benchmarks, and best practices. *J Occup Environ Med.* 2001;43:10-17.
- Rizzo JA, Abbott TA III, Berger ML. The labor productivity effects of chronic backache in the United States. *Med Care.* 1998;36:1471-1488.
- Clarke CE, MacMillan L, Sondhi S, Wells NEJ. Economic and social impact of migraine. *QJM: Monthly Journal of the Association of Physicians.* 1996;89:77-84.
- van Tulder MW, Koes BW, Bouter LM. A cost-of-illness study of back pain in the Netherlands. *Pain.* 1995;62:233-240.
- Davies GM, Santanello N, Gerth W, Lerner D, Block GA. Validation of a migraine work and productivity loss questionnaire for use in migraine studies. *Cephalalgia.* 1999;19:497-502.
- Fulton-Keohoe D, Franklin G, Weaver M, Cheadle A. Years of productivity lost among injured workers in Washington State: modeling disability burden in worker's compensation. *Am J Ind Med.* 2000;37:656-662.
- Lerner D, Amick BC, Rogers WH, Malspeis S, Bungay K, Cynn D. The work limitations questionnaire. *Med Care.* 2001;39:72-85.
- Ungar WJ, Coyte PC. Measuring productivity loss days in asthma patients. *Health Econ.* 2000;9:37-46.
- Follick KJ, Smith TW, Ahern DK. The sickness impact profile: a global measure of disability in chronic low back pain. *Pain.* 1985;21:67-76.
- Kopec JA, Esdaile JM. Occupational role performance in persons with back pain. *Disabil Rehabil.* 1998;20:373-379.
- Lerner DJ, Amick BC III, Malspeis S, et al. The migraine work and productivity loss questionnaire: concepts and design. *Quality of Life Research.* 1999;699-710.
- Greenberg PE, Birnbaum HG, Kessler RC, Morgan M, Stang P. Impact of illness and its treatment on workplace costs: regulatory and measurement issues. *J Occup Environ Med.* 2001;43:56-63.
- Simon GE, Barber C, Birnbaum HG, et al. Depression and work productivity: the comparative costs of treatment versus nontreatment. *J Occup Environ Med.* 2001;43:2-9.
- Lynch W, Riedel J. *Measuring Employee Productivity. A Guide to Self-Assessment Tools.* Phoenix and Scottsdale, AZ: William M. Mercer, Inc, and The Institute for Health and Productivity Management; 2001:22-43.