

A Review of Methods to Measure Health-related Productivity Loss

Soeren Mattke, MD, DSc; Aruna Balakrishnan, BS; Giacomo Bergamo, BS;
and Sydne J. Newberry, PhD

Approximately \$260 billion in output is lost each year in the United States because of health-related problems, according to the Commonwealth Fund.¹ Seemingly harmless conditions such as back pain are suspected to translate into substantial losses because of their high prevalence. Stewart and coauthors² estimated the productivity loss attributable to common pain conditions at \$61.2 billion annually. Such revelations, particularly at a time when competition has employers searching for ways to cut costs, have sparked the interest of employers, policy makers, and others interested in this issue.

Findings from studies³⁻⁵ suggest that the cost of lost productivity may be several times greater than the direct medical costs; furthermore, presenteeism (being present at work but working at a reduced capacity) may account for a larger proportion of losses than absenteeism (being absent from work). For example, in a meta-analysis⁴ of 7 studies that estimated productivity losses, the overall cost of presenteeism was found to account for one fifth to three fifths of the total US dollars lost to 10 costly conditions (which also included absenteeism costs and direct medical costs). Another study⁵ found that days lost because of presenteeism were 7.5 times the number of days lost due to absenteeism when 17 common conditions were considered.

Awareness of the magnitude of these losses has driven employers and policy makers to search for remedies. Employers believe that better management of chronic conditions might help decrease their costs substantially. For some employers, such data have triggered a paradigm shift in that they have begun to regard their employees as critical assets, with the health-related benefits their organizations provide (such as group health insurance, wellness programs, and disability insurance) as an investment in those assets rather than just costly benefits. Policy makers are intrigued by the opportunity to align the social welfare objective of improving care for chronic conditions with the need to make the business case for quality improvement.

To pursue those opportunities, instruments that measure the effect of health on productivity and estimate its financial effect with reasonable accuracy are needed. To date, little effort has been made to assess the availability, validity, or reliability of instruments for productivity measurement. This article summarizes the findings of a systematic review of such instruments and inter-

Background: Annual US health-related productivity losses are estimated to reach some \$260 billion, attributable not only to absenteeism but also to presenteeism (being present at work but working at a reduced capacity). The search for remedies has been hampered by the lack of accurate estimates of the loss of productivity and its true costs. To date, little effort has been made to assess the availability of measurement instruments or the validity and reliability of those that exist.

Objectives: To systematically review the instruments used to measure productivity loss and its costs and to assess limitations in current research.

Design: A systematic search was conducted of the published and gray-market research literature from 1995 through 2005 on methods for estimating productivity loss and monetizing that loss.

Results: Twenty survey instruments were identified that assess the effect of health problems on absenteeism or presenteeism by attempting to quantify self-perceived or comparative impairment or by measuring unproductive work time. Some of the methods have been validated. The challenges of measuring presenteeism far exceed those of measuring absenteeism primarily because many jobs do not have easily measurable output. Methods to estimate the cost of lost productivity were also identified; however, none have been validated, to our knowledge.

Conclusions: The greatest impediment to estimating the cost of productivity lost to illness is the lack of established and validated methods for monetization. The issues raised in this review are intended to stimulate future research to validate and improve such methods.

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In this issue

Take-away Points / p216

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Appendix

For author information and disclosures, see end of text.

■ METHODS ■

■ **Table.** Characteristics of Worker Productivity Measurement Instruments That Assess Presenteeism*

Instrument	No. of Questions About Presenteeism	Conditions	Recall Period, Wk	Also Measures Absenteeism	Type of Presenteeism Questions			
					Perceived Impairment	Comparison of Productivity With Coworkers and With One's Norm	Estimate of Unproductive Work Time	Access
American Productivity Audit and Work and Health Interview (2001) ^{2,6}	6	General	2	Yes	Yes	No	No	Proprietary
Angina-Related Limitations at Work Questionnaire (1998) ^{7,8}	17	Angina	4	Yes	Yes	No	Yes	Proprietary
Endicott Work Productivity Scale (1997) ^{7,9}	25	General	1	Yes	Yes	No	No	Proprietary
Health and Labor Questionnaire (1995) ^{7,9,10}	30	General	2	Yes	Yes	Yes	Yes	Proprietary
Health and Productivity Questionnaire (2003) ^{11†}	44	General	1, 4‡	Yes	Yes	Yes	Yes	Proprietary
Health and Work Questionnaire (2001) ^{7,9,12,13}	24	General	1	No	Yes	Yes	No	Proprietary
Health-Related Productivity Questionnaire Diary ¹⁴	9	General	1	Yes	No	No	Yes	Proprietary
Migraine Disability Assessment Questionnaire ^{9,15}	7	Migraine	12	Yes	No	Yes	No	Public domain
Migraine Work and Productivity Loss Questionnaire ^{7,9,16}	28	Migraine	Most recent episode	Yes	Yes	Yes	No	Proprietary
Osterhaus Technique ^{7,17}	12	General	4	Yes	No	Yes	No	Unknown
Stanford Presenteeism Scale ^{3,7,18}	6	General	4	No	Yes	No	No	Proprietary
Unnamed Hepatitis Instrument ⁷	3	Hepatitis	Unknown	Yes	No	Yes	No	Unknown
Work Limitations Questionnaire ^{7,9,18,19,20}	25	General [§]	2	No	Yes	No	No	Proprietary
Work Productivity and Activity Impairment Questionnaire ^{7,9,21}	6	General	1	Yes	Yes	No	Yes	Public domain
Work Productivity and Activity Impairment Questionnaire—Allergic Rhinitis ⁹	9	Allergic rhinitis	1	Yes	Yes	No	Yes	Public domain
Work Productivity Short Inventory ^{18,22}	4	>12	2/12/52	Yes	No	No	Yes	Proprietary
Worker Productivity Index ^{7,21}	40 [¶]	General	Unknown	Yes	No	Yes	Yes	Unknown

*Adapted from Lofland et al⁷ and from Prasad et al.⁹

†Also called Health and Work Performance Questionnaire.

‡One week for clinical and 4 weeks for employer.

§Chronic conditions.

||Allergies, respiratory infections, arthritis, asthma, anxiety disorder, depression and bipolar disorder, stress, diabetes mellitus, hypertension, migraines, coronary heart disease or high cholesterol, and 4 caregiving conditions.

¶Approximate number.

views with eminent researchers in the field. Our aim was to inform the debate by describing the existing types of instruments and monetary conversion methods and by highlighting limitations and trends in current research. This information can help readers understand what is behind the numbers reported on health-related productivity losses and put such estimates into perspective. The review should also contribute to focusing the research agenda in this important and growing field.

METHODS

We identified instruments for measuring the effect of ill health on productivity because of absence from work (absenteeism) or because of reduced performance while at work (presenteeism) through searches of the published and unpublished literature and governmental and corporate communications from 1995 through 2005 using the following search terms: *absenteeism, presenteeism, workplace, employment, productivity, questionnaires, instruments, measurement, and cost of illness*. We contacted experts and searched the references of identified articles for additional leads. We retrieved supporting material, such as information on assessment of reliability and validity, for each identified instrument. Finally, we reviewed methods to derive monetary estimates of productivity loss from those instruments and conducted interviews with 5 recognized experts in the field of estimating cost of lost productivity to help put the findings into perspective and to shed light on current research trends.

RESULTS

We identified 17 survey instruments that assess the effect of respondents' health problems on absenteeism or presenteeism (Table). One instrument, the Stanford Presenteeism Scale, exclusively addresses presenteeism, but it is commonly combined with questions on absenteeism. The instruments vary substantially in length (range, 3-44 questions) and scope. Some address only specific conditions, some address a range of conditions, and others address all conditions. We identified several methods for estimating the cost of lost work time. The challenges involved in measuring presenteeism and its costs are far greater than those involved in measuring absenteeism because reduced performance on the job is less tangible than absence. Therefore, most of the findings we report herein pertain to measuring presenteeism.

Measuring Absenteeism

Absenteeism is measured by asking respondents how much time they missed from work because of ill health. The recall

periods range from 1 week to 3 months. Because such self-reported data have been found to be reliable and valid when the recall periods are short (ie, 1-2 weeks), they can serve as a reasonable substitute for lost time data, which most companies do not routinely collect.²³ Results derived based on longer recall periods should be viewed with caution.

Measuring Presenteeism

Measuring presenteeism is complex. Some attempts have been made to measure presenteeism directly (eg, by telephone call volume per employee in a call center).¹⁹ However, generating objective data for other types of work would require developing methods to suit the particular characteristics of a given firm, workplace, and profession or job description and collecting data on a regular basis. Furthermore, developing such methods for knowledge-based occupations might be impossible because such workers often produce no easily quantifiable output.

To overcome these obstacles, researchers have developed instruments that can be applied to various professions and employers.^{24,25} These instruments focus on the following 3 modes of conceiving presenteeism: (1) assessment of perceived impairment, (2) comparative productivity, performance, and efficiency (with those of others and with one's norm), and (3) estimation of unproductive time while at work.

Assessment of Perceived Impairment. The most common approach to measuring presenteeism is assessment of perceived impairment, accomplished by asking employees how much their illnesses hinder them in performing common mental, physical, and interpersonal activities and in meeting job demands. Tools that use this approach include the Health and Productivity Questionnaire, Health and Work Questionnaire, Stanford Presenteeism Scale, Work Limitations Questionnaire, and Work Productivity and Activity Impairment Questionnaire.

Questions about perceived impairment can range from the general to the specific. The following example of a general question is found in the Stanford Presenteeism Scale: "Despite having my [health problem], I felt energetic enough to complete all my work," to which the employee is invited to respond using a 5-point scale of responses ranging from "strongly disagree" to "strongly agree." An example of a specific question in the Work Limitations Questionnaire requires a respondent to rank on a 5-point scale the difficulty he or she had in using the "upper body to operate tools or equipment."

Comparative Productivity, Performance, and Efficiency. Measuring comparative productivity, performance, and efficiency is another way to capture presenteeism. This method, which is used by the Health and Productivity Questionnaire

■ METHODS ■

and the Health and Work Questionnaire, seeks to understand how an employee's performance differs from that of others or from his or her usual performance.

On a 10-point scale that ranges from "worst ever" to "best possible," the Health and Work Questionnaire asks respondents to rate the overall quality and amount of work produced in the preceding week and how efficiently it was performed. Using a 10-point scale that ranges from "worst performance" to "best performance," the Health and Productivity Questionnaire asks respondents to rate the job performance of workers in similar positions, their usual performance in "the past year or two," and their overall performance during the recall period (4 weeks). The Health and Productivity Questionnaire and the Health and Work Questionnaire include these comparative performance questions in addition to questions about perceived impairments.

Compared with measures of perceived impairment, measures of self-reported performance have 3 main advantages for expressing presenteeism as a single meaningful number. First, the attempt to benchmark one's perceived performance provides a reference against which loss can be measured. Questions about perceived impairment do not include any conception of what is a standard or usual level of impairment. Second, when based on a 10-point performance scale or a percentage scale, the results can more easily be incorporated into a monetization formula than agreements or disagreements with statements about perceived impairment. Third, attempts have been made to validate employees' self-reported performance evaluation by comparing them with their supervisors' assessments.²⁵

Estimation of Unproductive Time While at Work. Estimation of unproductive time to assess presenteeism (ie, asking employees to estimate lost time, as is done for absenteeism) is attempted by only a small number of instruments. For example, the Work Productivity Short Inventory asks employees to estimate how many unproductive hours they spent at work during the recall period. Although this approach would lead to the easiest monetization, no study (to our knowledge) has shown that employees can accurately transform their perceived impairments into a temporal measure.

Validation Studies for Presenteeism Measures

The validity of productivity survey instruments is difficult to establish. While it is conceptually straightforward to validate self-reported measures of absenteeism against factual data of workplace presence or absence, validating presenteeism poses significant challenges because of the nature of the data being collected. For certain types of employment and occupation, such as call centers, employee activity logs are

maintained. However, for most jobs there is no true account of productivity with which to assess an employee's performance. Nevertheless, researchers have attempted to validate presenteeism instruments. A detailed summary of published validation studies can be found in the online [Appendix](#) (available at www.ajmc.com).

Cost Estimation

Perhaps more complicated than trying to account for the total time lost by quantifying presenteeism is trying to understand the many competing methods for monetizing (ie, estimating the cost of) lost productivity. These methods comprise the following 3 main types: (1) salary conversion methods, which use survey responses and salary information to estimate productivity loss; (2) introspective methods, which use survey responses as a basis for thought experiments to give businesses an idea of the magnitude of their lost productivity; and (3) firm-level methods, which attempt to monetize productivity losses based on the cost of countermeasures used to deal with absenteeism and presenteeism.

Salary Conversion Methods. Salary conversion methods attempt to estimate productivity losses based on self-reported lost time or decreased productivity. The simplest version is the human capital approach (HCA), which expresses the loss as the product of missed workdays multiplied by daily salaries.²⁶ Originally developed for monetizing absenteeism, the method has been extended to presenteeism losses by using self-reported unproductive hours or self-reported percentage reduction of performance instead of missed days.^{24,27,28} The obvious attractions of this method are its computational ease, its intuitive plausibility, and its consistency with economic theory (assuming perfectly competitive labor markets) that wages should reflect a worker's marginal contribution to a firm's output. Although its validity has not yet been assessed (to our knowledge), there was consensus among the experts we interviewed that the HCA provides at least a lower-bound estimate for the true cost of lost productivity (telephone interviews with Sean Nicholson [February 22, 2005] and Thomas Parry, PhD [February 15, 2005]). To increase the accuracy of the estimate of productivity losses, one expert suggested also including the cost of fringe benefits (telephone interview with Ronald C. Kessler, PhD [February 8, 2005]). The HCA is the method typically used in studies reporting the economic effect of health-related productivity losses. Depending on the available data sources, authors have used actual salaries of the respondents,^{6,29} mean salaries for the corporation,³⁰ or national median wages⁴ for the conversion.

An extension of the HCA is the team production model developed by Pauly and colleagues,³¹ who argue that simple

A Review of Methods to Measure Health-related Productivity Loss

salary-based conversion is appropriate for workers performing discrete tasks in isolation, but the model fails to take into account the interdependence of job functions in the modern economy. For example, if the only surgeon in a hospital stayed home sick, the entire operating room would remain idle, causing much greater losses than just the surgeon's salary. The authors proposed to operationalize this interdependence by the following 3 criteria: (1) the replaceability of an employee, (2) the extent to which an employee works as part of a team, and (3) the time sensitivity of an employee's work.³¹ Initial empirical work by Nicholson and colleagues³² derived a set of multipliers that can be applied to a worker's salary for 35 different job categories. Simple jobs, like that of a fast-food cook, have a multiplier of 1.00, suggesting that the productivity loss equals the actual salary, while more demanding occupations, such as construction engineering, have higher multipliers that reflect overall effect on the firm. Different multipliers are used for short-term (3 day) and long-term (2 week) absences. Ongoing work aims at a larger set of multipliers and at methods to capture the interaction between medical conditions and job characteristics (telephone interview with Sean Nicholson, PhD [February 22, 2005]). This approach has 2 practical challenges. First, a large library of multipliers would have to be created and maintained. Second, the method is based entirely on individual-level characteristics and does not take firm-level factors into account. For example, it is conceivable that the absence of an analyst would have different implications for a consulting firm than for a not-for-profit research organization. Other firm-level factors, such as unionization and competitive position, may also modify the effect of loss of productivity in a given job category.

A more fundamental challenge was posed by Koopmanschap and colleagues,³³ who argued that the HCA overestimates the true absence-related productivity losses because short-term absences might be partially compensated with greater effort or unpaid overtime, whereas longer-term absences would lead to replacement of workers with new hires. Based on those considerations, the authors proposed the friction cost method that aims at estimating only the actual lost production, as opposed to the potential lost production estimated by the HCA. They tested their method on national data from the Netherlands and found the estimates of lost productivity to be consistently lower than those derived by the HCA.³³ We identified no attempt to apply the method to US data or to data at the company level. Other authors have challenged the friction cost method as inconsistent with concepts of standard economic theory, such as opportunity cost and profit maximization.³⁴ However, this discourse remains largely theoretical at this point because neither of the salary

conversion methods has been evaluated empirically, to our knowledge.

Introspective Methods. Introspective methods reflect an attempt to overcome the theoretical and practical challenges of converting self-reported productivity reduction into monetary units. Some researchers have argued that conversion should be abandoned in favor of providing guidance to firms on deriving their own estimates: for example, managers would be provided with an analysis of the productivity survey and asked to consider questions such as "How much would you be willing to pay a contractor who can raise everyone's productivity by 20%?" or "How many full-time employees could you cut if the productivity of your chronically ill workers increased by 20%?" (telephone interview with Ronald C. Kessler, PhD [February 8, 2005]). Another approach is to encourage managers to estimate the revenue that various staff members contribute and to use this number for conversion (telephone interview with Ronald C. Kessler, PhD [February 8, 2005]). The aim of such thought experiments is to illustrate the magnitude of the problem rather than to derive precise estimates. Although helpful, their validity remains untested (to our knowledge), and their results have not been compared with those of the HCA approach as far as we know.

Firm-level Methods. Firm-level methods represent a logical extension of the introspective methods and use a top-down approach that assesses firm-level information to derive cost estimates for lost productivity. These methods are based on the premise that managers have a good sense of how their company's productivity is affected by health-related problems and use countermeasures to deal with them. For example, they may have redundant staff to compensate for absences, or they may hire temporary workers or offer overtime payment to maintain output. Alternatively, they could forgo revenues. Economic theory suggests that a competitive firm combines these different strategies to maximize profits. Therefore, information about a firm's cost for those countermeasures can be used to approximate its lost productivity. The attraction of this approach is that it does not require detailed individual-level data and that the cost of many of the countermeasures (such as the fees paid to temporary employment agencies) is easy to quantify. The downsides are that some of the cost may be intangible and that forgone revenue estimation must rely on a manager's perceptions. It may also prove difficult to elicit countermeasures to presenteeism as opposed to absenteeism because presenteeism is not immediately visible to a firm and may not provoke a conscious response. Furthermore, the correct attribution of the cost items to health-related productivity losses needs to be

Take-away Points

This article reviews available methods to measure and monitor health-related productivity loss, a major concern to employers and policy makers as productivity losses may cost \$260 billion annually and may exceed direct medical costs:

- We identified 20 instruments that capture absenteeism and presenteeism based on employee self-reporting. Many have been validated and used in research and operations.
- Several methods to estimate the effect of productivity loss on cost have been developed, but none of them have been firmly established and validated to our knowledge.

assured, as (for example) part of the temporary staff could also be part of a firm's usual staffing mix.

As for other firm-level methods, empirical evidence remains sparse. One study³⁵ used staffing cost to cover short-term disability absences to estimate productivity losses, but no published evidence was found of attempts to generalize this approach into a broader framework for measurement.

DISCUSSION

The interest in measuring and monetizing the effect of health on corporate productivity has resulted in the development of numerous instruments to capture this important concept. Most have undergone validity testing and have gained acceptance as reliable tools for research and benefits decisions. Among those instruments, the biggest gap remains the lack of an established and validated method to derive monetary estimates of the cost of lost productivity. Although many users are comfortable in applying a salary conversion method and believe that it provides at least a lower-bound estimate, a more rigorous evaluation of this method and its alternatives is warranted before it becomes the basis for potentially far-reaching policy and managerial decisions. A first step could be to benchmark the different methods used to determine whether and to what degree estimates based on different methods differ.

Conducting such research is by no means a straightforward task because direct measurement of job productivity is difficult, particularly in knowledge-based occupations. This mandates that a research agenda should involve multiple disciplines or job descriptions. It should also reflect the interest of various stakeholders, as (for example) the weight of evidence that businesses will require for operational decisions will differ from the standards of the research community. Any method will also have to be tailored to the precise question it aspires to answer. For example, the social welfare perspective on measuring cost is different from a corporate perspective, and various sectors of the economy may require

different approaches. The review herein should stimulate interest in this field and contribute to endeavors that push it forward.

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Correspondence Author: Soeren Mattke, MD, DSc, RAND Corporation, 1200 S Hayes St, Arlington, VA 22202. E-mail: mattke@rand.org.

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A Review of Methods to Measure Health-related Productivity Loss

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