Productivity and Health: Best Practices for Better Measures of Productivity

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Objective: Interest in quantifying the relationship between health status and lost productivity has accelerated among employers, researchers, and benefits advisors. Our objective was to engage a dialogue to highlight important productivity measurement issues for consideration in an overall business strategy. **Methods:** Critical review of selected topical literature. **Results:** Four functions of productivity measurement are described: 1) the purposes of a measurement initiative, 2) norms and benchmarking, 3) health and productivity cost estimators, and 4) reporting results. Each function is described in detail; challenges are noted; examples are provided. **Conclusions:** This article supports the Integrated Benefits Institute consensus statements on productivity, underscoring the need to develop a conceptual framework of productivity measurement that guides the maturation of instruments and sets forth recommendations for their application consistent with the descriptive, comparative, and evaluative functions that foster health, well-being, and work performance.

Learning Objectives

- Discuss the need to develop a set of productivity tools that can usefully be applied to "real world" business challenges, consistent with the ACOEM/IBI Consensus Statements.
- Outline the purposes for measuring productivity, including the three interrelated types of measurement and questions discussed by Schwartz and Riedel.
- Summarize key issues related to norms and benchmarking, monetization, cost estimators, and report output in productivity measurement.

The high cost of health care, including health-related productivity impairment, is accepted as a serious threat to the competitiveness of US employers.[1–3] Employers are spending an estimated $13,000 per employee per year in total direct and indirect (productivity-related) health costs.[4–6] This economic reality is driving many employers to address health and productivity management as an integral part of business strategy.[4] This emerging strategy aims to reduce health care expenditures, retain valuable employees (also known as human capital), and optimize employee productivity. Consequently, there is attendant interest in quantifying the clinical and economic effect of health-related lost productivity in work settings and, more importantly, quantifying the return on investment associated with worksite health promotion programming.[3,7–11]

The sheer magnitude of the costs associated with health-related productivity impairment raises essential questions about operational definitions of productivity and measurement methodology. Given the growing usage of self-report measures of productivity and the likelihood of increased usage by employers, researchers, and a range of employer benefits vendors, the field of health and productivity management would be well served by a clear articulation of the characteristics of sound instrumentation and "real world" application. A 2008 Summit on Workforce Health and Productivity convened by the American College of Occupational and Environmental Medicine and the Integrated Benefits Institute (IBI) concluded that, "as an evolving discipline, integrated health and productivity measurement methodologies should be studied continuously, improved, and more consistently applied."[6] This summit yielded 10 consensus statements regarding the current state of and future direction for health and productivity management.

The purpose of this article is to support and extend several of the Summit's recommendations by describing the characteristics of sound instrumentation that are essential for assuring the evolution of a set of useful productivity assessment tools and the application of these tools to real-world business challenges. It should be noted that validity and reliability issues have been addressed by a number of authors and, although essential to sound application, are not included in this article. In addition, there are a number of measurement challenges related to methodology, data collection, and analysis of productivity data that are also beyond the scope of this article and will only be touched upon when relevant. Although these challenges are important for all measurement tools and related data collection procedures, the authors have chosen to address a limited range of other measurement issues that, to date, have not been well articulated. Specifically, we direct our attention to the purposes of measurement, approaches to the use of benchmarks, and normative data for interpretation of findings including determination of the productivity level that might be recaptured through favorable population risk modification. We also address conceptual approaches to monetizing impairment and reporting measurement results, all with an eye toward how employers are most likely to engage in health and productivity measurement. Finally, we offer a set of suggestions for moving the field forward in developing its evidence base via future research and development.

THE PURPOSE OF MEASUREMENT

Many organizations, faced with developing a health and productivity strategy, opt to generate data from their own workforce. Because organizations differ significantly based on workforce characteristics, only direct measurement of their employees can provide the level of specificity required to determine the appropriate elements of a strategy for improving health-related productivity. Each measurement tool has unique characteristics that need to be taken into account to fully meet the productivity assessment function. For example, the Health and Productivity Questionnaire (HPQ)[12] incorporates many different dimensions of performance. It embeds a variety of items for measuring productivity loss and provides prevalence rates of chronic conditions to

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quantify total productivity loss as a percentage of total productivity and to monetize from an item on the HPQ embedded with a health risk assessment (HRA). The Work Limitations Questionnaire (WLQ)[13] focuses on four aspects of performance including time management, physical demands, mental/interpersonal demands, and output demands. The Work Productivity and Activity Impairment questionnaire (WPAI)[14] outcomes include percent time missed due to a health problem, the percent impairment while working due to a health problem, and the overall percent of work impairment.

The first consideration in choosing an approach to measuring productivity is to understand the purposes for which the measurement is intended and how the resulting data are to be used. These purposes for measurement can be conceptually separated into three interrelated categories. 1) Descriptive measurement determines the degree to which health status affects worker performance. 2) Comparative measurement is the assessment of the differential effect that various health risks and chronic conditions or combinations of risks and conditions have on performance. 3) Evaluative measurement assesses change over time, particularly as part of program evaluation. It is through a combination of these functions that employers can begin to determine the magnitude of the problem and evaluate the effect of targeted solutions. Given the questions that might be asked of productivity data, it is important to consider other qualities of the assessment tool when evaluating the proper measurement tools to use (independent of the tool's specific psychometric properties). Early consideration of these factors can optimize the tools overall functioning within a certain context or when trying to meet certain business goals.

Descriptive Questions

Descriptive questions are the most fundamental and primarily focus on determining the degree to which health status of the workforce compromises the productivity of the organization. This can be illustrated via the strength of the relationship between a global index of impairment and a similar index of health status. Typically, these data provide answers about whether to go forward with health and wellness programming and can justify the application of resources to the problems as a part of the overall business strategy.

The literature is replete with information on the overall costs of lost productivity (absenteeism and presenteeism) relative to direct medical costs, and the published costs are quite high.[4,6,15,16] Several studies that measured all health-related lost productivity have shown that employers, on average, lose $3 dollars of health-related productivity for every $1 dollar of medical or pharmacy spend.[4] The Integrated Benefits Institute found that, for 88 employers with 3.3 million covered lives, lost productivity associated with absence alone accounted for nearly half of all health-related expenditures (IBI). Berger et al.[15] estimated that health related problems reduce the effectiveness of the US workforce by 5% to 10%. The Commonwealth Fund surveyed working age Americans and found that an estimated 18 million Americans aged 19 to 64 years are not working because of health reasons.[17]

Some employers may choose to survey their own workforce to identify the magnitude of productivity impairment among their employees. This allows the employer to gauge the importance of health and productivity as a business strategy relative to other strategic priorities. The WPAI, provide a comprehensive measure of the percentage of absenteeism, presenteeism, and total productivity loss due to health problems. Others, like the WLQ, segment productivity loss into four dimensions of work function including Time, Physical, Mental, and Output. The Stanford Preseentism Scale, as the name implies, focuses on presenteeism and measures the ability to concentrate on work despite the effect of pain or other health symptoms on job performance.

Comparative Questions

Comparative questions go beyond simple quantification of magnitude. They allow for greater specificity as to which health risks or chronic conditions are driving impaired productivity and, depending on the measures used, can also determine the relative effect on key job functions (eg, the WLQ). Data relating to comparative questions can aid in prioritizing problems to target and inform the allocation of resources to address prioritized problems.

The primary areas of comparison are health risks and chronic conditions. Nevertheless, most measurement tools do not incorporate health risks or chronic conditions into their question sets. The user must determine the health status of employees by either adding measures of health risks and chronic conditions of greatest interest to the productivity assessment or nesting the productivity measure within a broader HRA. This allows health status and productivity impairment to be assessed contemporaneously and also enhances data capture for both assessment domains (ie, health status and productivity).

There is an accumulating number of research articles that specify a relationship between specific health risks and impaired productivity. For instance, Aetna[1] measured the relationship between health risks and work productivity using the WPAI. They found significant differences in both absenteeism and presenteeism by risk factor. Even more significant was the cumulative increase in productivity impairment by number of risks. Burton et al.[18] measured the association of medical conditions and presenteeism using the WLQ. This study demonstrated unique productivity deficit patterns (eg, time, physical, mental, and output) by health condition. Collins et al.[19] assessed the relationship of chronic conditions to presenteeism, absenteeism, and total economic effect using the Stanford Presenteeism Scale and the WLQ and found that costs associated with presenteeism far exceeded costs due to absenteeism or direct health care expenditures.

Evaluative Questions

For the connection between health and productivity to establish its relevance within an overall business strategy, interventions associated with health and productivity management must demonstrate that as health status improves so does productivity. This can be accomplished only by using evaluative, time series, or repeated measures that are sensitive to the changes in key parameters over time. These comparisons should spotlight the degree to which guideline-based risk modification and chronic condition management have been achieved and the degree to which this change affects productivity. Time-series evaluation (measuring the same individuals over time) and between-series evaluation (comparing over time those exposed to the interventions with those not exposed to the interventions) provide a comprehensive understanding of population change. To conduct the between-series analysis, the issue of selection bias (inherent in any program evaluation that does not use randomized assignment to condition) must be dealt with practical means such as matching procedures and statistical adjustment. A detailed treatment of this issue is beyond the scope of this article.

Although arguably the most important index of change and therefore effectiveness, pre- and postmeasurement are not well established in the research literature. Such program evaluation is resource intensive and therefore expensive to undertake in a comprehensive fashion. Nevertheless, building out this literature is essential to the formation of an evidence-based approach to health and productivity management. Organizations must consider an evaluation plan if they are to determine the value of their health and wellness programming. Methodologies such as the randomized clinical trial, so often used in evidence-based research, will very likely be impractical if not inappropriate for most organi-

zations. Program evaluation methodologies can have significant relevance here.[20]

Although the outcomes research literature is scarce, some compelling examples exist. For instance, Burton[21] used the WLQ to quantify the association between health risk change and presenteeism change. Pelletier et al.[21] used the WPAI to assess the change in health risks and work productivity over time and found that reductions in health risks corresponded to positive changes in work productivity.

Our focus in this section is on addressing the issue of measurement purpose. Yet there are several other measurement factors that are necessary to consider once the purpose is determined. Measures of functional impairment assess the degree to which health is impacting specific employee functionality within the work role. For instance, in a manufacturing environment, the physical domain is important. In an engineering company, timeliness and accuracy may be the key issues. In an emergency room or urgent care center, teamwork may be the primary focus. As an example, the WLQ is organized to address the following four unique domains: time management, physical demands, mental/interpersonal demands, and output demands.

Scales and Subscales

Scales and subscales are particularly important if your purpose is comparative or evaluative. Minimally, a productivity measurement tool should distinguish between absenteeism and presenteeism. It may also incorporate scales that represent role function and job classification, health risks, and chronic conditions. The HPQ is particularly suited to examine the effect of a wide range of chronic conditions, whether they are being actively treated, and their differential influence on both absenteeism and presenteeism.

Response Burden

Response burden is particularly important with regard to completion rates. Here the issue is one of balancing the need for comprehensive data against the burden of time that a long questionnaire puts on the respondent. The obvious caveat is to include only those questions that are germane to the measurement purpose. Increasingly, users are nesting health and productivity questions within existing data assessment processes. A good example is inclusion within a HRA. Employers typically offer a HRA to determine the areas of greatest health concern among their workers. Adding productivity questions to the HRA eliminates the need to conduct two separate measurement initiatives and provides an integrated format for robust analysis of a wide range of health factors on productivity. The WPAI is perhaps the least burdensome due to its brief nature. The HPQ long version, although quite comprehensive, requires considerable time to complete.

Recall Time Frame

Recall time frame is a very practical issue that must be addressed. Each of the instruments available in the market uses different time frames. The issues here have to do with recall bias and distortion. Time frames that are long (yearly for instance) are prone to errors of memory. Users have a difficult time remembering how often they were absent or came to work late 8 to 9 months before. Short time frames (the past week) will make it easy for the respondent to recall events but may be misleading because of acute conditions (flu and hay fever) that did not occur during that time frame. Typical recall time frames are the past week, the past 2 weeks, or the past month.

Response Anchors

Response anchors are the references used that determine how a respondent describes their level of productivity. For example, rating one's performance relative to peers has a very different meaning than rating performance relative to your own optimal level. The use of different anchors can dramatically change the meaning (and thus the usefulness) of the data captured. Examples include how would you rate your job performance during the past week?; how would you rate your usual job performance?; how would you rate the job performance of most workers on your job?; how would you rate your job performance?; and how would you rate your job performance during the past week in relation to your most productive level?

NORMS AND BENCHMARKING

To ensure that productivity measures are useful, the relationship of the scores to benchmarks or normative data must be made. Such comparisons add meaning by establishing a reference by which to gauge the distance a given score is from the reference (typically operationalized as an average, expected, or otherwise relevant score). Although the terms norm and benchmark have similar meanings and functions, for the sake of this discussion, they have nuanced differences worth acknowledging. Benchmarks can be used to interpret change over time relative to targets established by data coming from within the organization. Normative data are more typically based on the data distribution for a standard or representative group that exists outside a given organization and can allow for comparisons relative to industry or competitor standards. Ideally, both data sources can be refined so that more granular comparisons on relevant factors like age, gender, business type, or job type can be made.

Comparators can be established in several ways. Each has its own unique value depending on the purpose of measurement. Each of the approaches described are illustrated in Fig. 1.

Average Impairment

The use of mean scores for the target population is a standard that has been the basis of normative tests and measures in psychological and behavioral science measurement. This approach relies on establishing a sufficiently large normative database for the population and selected subsamples (based on age cohorts, ethnicity, health status/conditions, occupational classification, etc) so that a "normal" distribution is established. Interpretation is then based on how far a given score deviates from the mean, indicated by the blue line (typically measured in terms of standard deviations).

Prototyping

The prototyping approach defines a "realistic" profile as the point of comparison. Ideally, the prototype reflects a level of health status that represents an achievable normative goal for a given population. Impairment averages and variability of productivity impairment are then determined from a sufficiently large sample of individuals fitting the prototypic health profile much in the same fashion as with the average impairment method. Such profiles can be defined broadly (eg, based on national prevalence rates) or locally (based on company prevalence rates), depending on the desired degree of generalization.

For example, in Figure 1, the level of average productivity impairment identified by the green line is operationalized using a prototype that includes overweight, somewhat stressed, not depressed, and managing 0–1 chronic conditions as the comparator. Variance above or below this prototype then becomes the measure of realistic productivity loss or gain in an individual or group. An important challenge to this approach is defining an acceptable set of prototypic characteristics.

The Interdependence of Comorbid Factors

Because many health conditions cluster together (eg, hypertension, cholesterol, obesity, diabetes, cardiovascular disease, etc), determining the level of productivity impairment independently associated with any single health risk or chronic condition can be

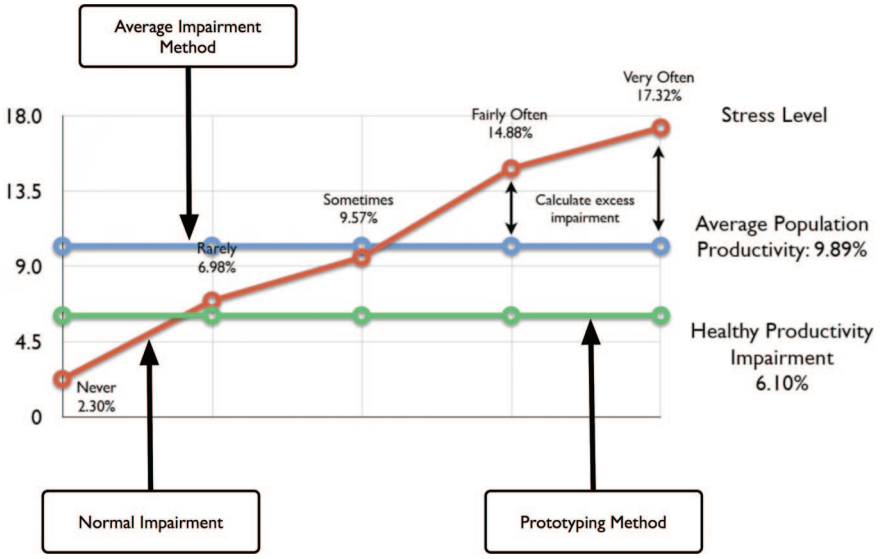

FIGURE 1. Norms and benchmarking.

problematic. When two or more risks or conditions are present, their effect on productivity is typically not additive but rather less due to the correlation between the risks. This begs questions like "how much variance in productivity impairment is accounted for by sedentary lifestyle that is "comorbid" to BMI?" This has colloquially been referred to as the "double counting" problem. The use of multivariate regression modeling can assess the unique contribution of a given risk or condition to productivity impairment relative to the presence of other risk and conditions. The impairment associated with no risks serves as the constant within the regression equation, and each risk factor is given a beta weight that reflects the truly additive contribution to impaired productivity. This is reflected in the red line in Figure 1. Such modeling once developed can identify the top health drivers of productivity impairment in ways that allow an organization to evaluate the most appropriate placement of health and productivity management resources.

Normal Impairment Factor

Riedel et al.[22] have articulated a normative framework for productivity termed the "normal impairment factor" (NIF). This approach provides realistic targets against which one can gauge the amount of productivity loss that might be recaptured with population health management strategies. It also helps quantify the lost productivity a company would likely continue to incur if it chose to do nothing. Given that factors other than health can affect productivity (eg, equipment malfunction, competing work demands, miscommunications, or interpersonal conflict), the central value of NIF is that it provides employers with a realistic expectation regarding the amount of productivity that can be recaptured through favorable health risk modification of their workforce.

The NIF uses, as the benchmark comparator, the amount of productivity loss experienced by individuals who have no health risks and therefore represents the level of productivity loss that health improvement initiatives will not affect. The authors studied 772,750 individuals representing 106 employers. Using a general question of presenteeism from the HPQ embedded into the Staywell HealthPath Health Assessment Version 5.0 (StayWell Health Management, Saint Paul, MN), the NIF was determined to be 3.4% (~1.8 weeks of lost productivity per year). The NIF was conceptualized and developed by building a regression model of key drivers of productivity impairment on the basis of a large (1.3 million individuals) database data collected from within a HRA.

MONETIZATION

Although monetizing productivity impairment is not always relevant to every measurement circumstance, it is a common output requirement and some instruments lend themselves to monetization better than others. Mattke et al.[3] summarized the three primary approaches to monetizing productivity impairment: 1) salary conversion methods, 2) introspective methods, and 3) firm-level methods. Collectively, these methods expense the percentage of impairment by annualized salaries. It has been suggested that these methods could be refined by including fringe benefits into the monetized costs of impairment.[12]

The double counting issue noted in the interdependence of comorbid conditions section aforementioned applies to the process of monetizing impairment. When comorbid conditions are not accounted for, costs will be inflated in circumstances where considerable comorbidity is present. Greater precision can be gained using the same regression modeling whereby the weights associated with each risk factor or chronic condition in the model make them truly additive, allowing for consideration of the interdependence in the monetization of impairment as well. Figure 2 illustrates this formula as it pertains to eight drivers of productivity impairment using a loaded salary and fringe benefits of $50,000.

COST ESTIMATORS

For those employers that are hesitant to spend resources to measure productivity loss through a workforce survey, several productivity loss estimators are available such as the Blueprint for Health [BFH][23] and the H & P Snapshot.[24] Figure 3 displays the total cost of productivity loss from absenteeism and presenteeism in the BFH and contrasts that with overall health care costs.

The advantage of these estimators is that they allow the user to input workforce factors such as age, gender, geographic location, exempt/nonexempt, and deductible level to more closely approximate actual costs for a specific employer.

Cost estimators typically incorporate some health risks and conditions, but the list is not exhaustive. Based on the incorporation of a user's workforce characteristics, these tools can provide a reasonable approximation of productivity loss. For example, the BFH covers several medical conditions including diabetes, hypertension, insomnia, high cholesterol, and obesity. The fact that these estimators do not cover a comprehensive list of conditions makes them less robust than an employee survey that captures all condi-

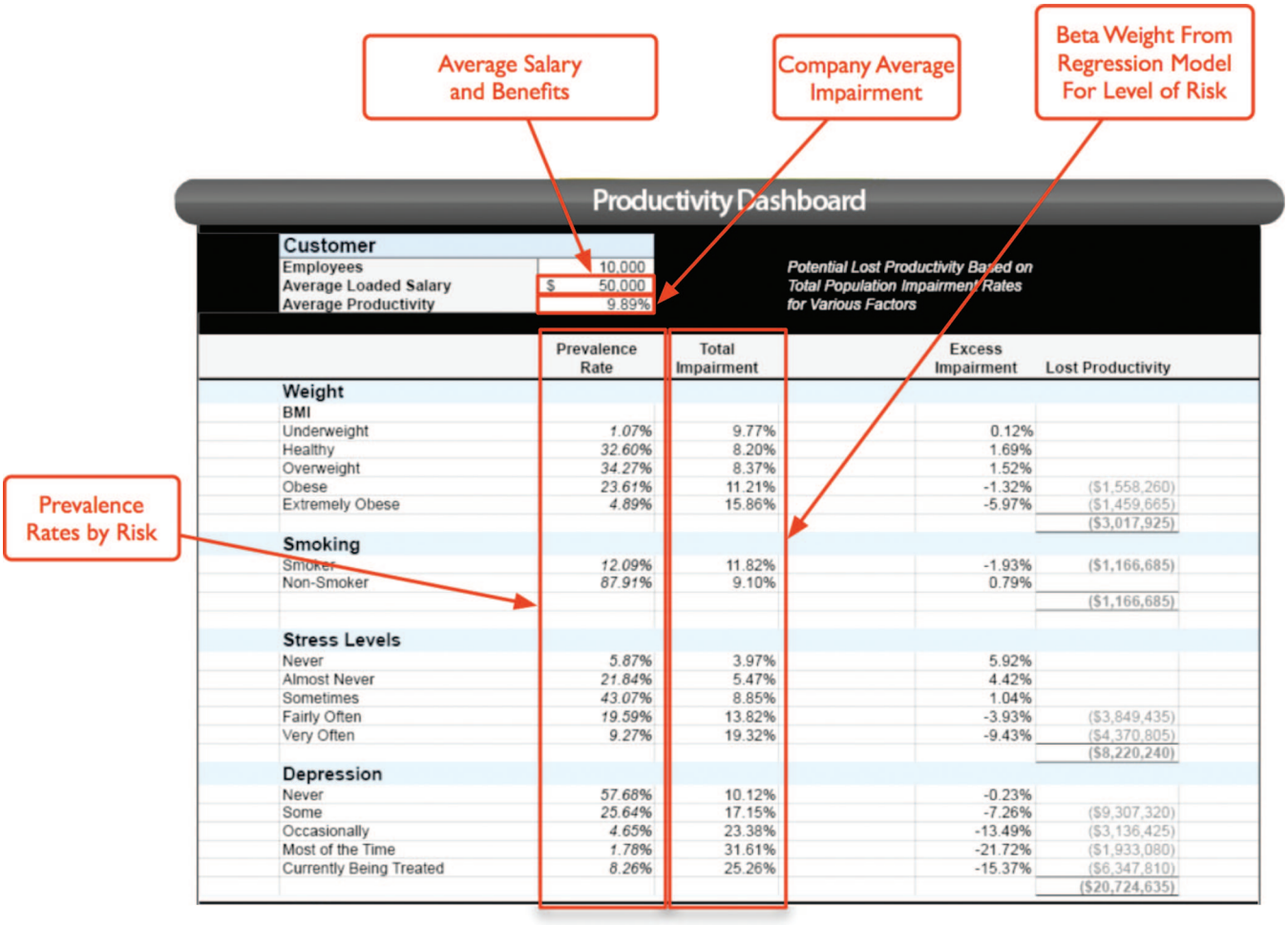

FIGURE 2. Productivity dashboard.

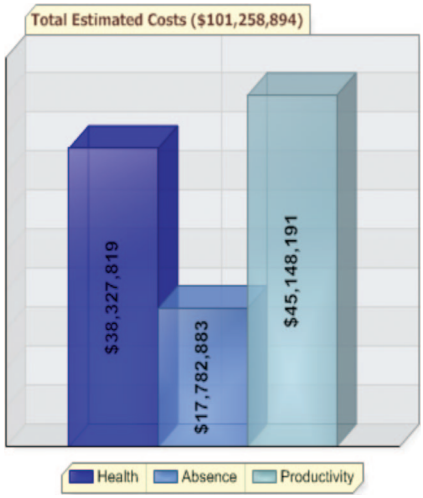

FIGURE 3. Cost of productivity loss.

tions. Also, cost estimator tools, because they do not use organizational data but rather rely on algorithms and large, multi-employer productivity databases to quantify productivity loss, cannot measure change in either health or performance over time. Nevertheless, they can provide rough estimates of savings expectations relative to health risk modification targets or goals and can play a much greater role in developing the intervention strategies on the basis of defined health targets.

REPORT OUTPUT

Too often organizations are data rich but interpretation poor. Consequently, evaluation and reporting are essential functions of any health and productivity measurement initiative. Ultimately, the report form should follow both the purpose for measurement (ie, descriptive, comparative, and evaluative) and program logic (ie, presumed causal relationships among health programming elements). Program evaluation and performance measurement methods[20] are more flexible than traditional clinical trial methodologies, making them particularly well suited to diversity inherent in evaluating real world health and productivity management initiatives. Program evaluations should consider factors such as the time intervals for analysis (including likelihood of detecting significant change), the fidelity of program implementation, and the levels of analysis (ie, macular versus granular focus). For example, shorter periods may produce better recall of health events and job performance but are also more influenced by acute but temporary health conditions. Longer intervals subject to memory error but will capture more stable health events and productivity.

Businesses are relying more and more on dashboard formats for presenting progress toward business targets. Although certainly

not the sole mechanism for reporting output, we believe dashboards have special relevance in health and productivity measurement. Dashboards must, at a minimum, address three functions. First, they integrate data from a variety of sources. Second, they filter the data according to rules of logic and analysis. Third, they automatically apply mathematical procedures to transform the complex data into useful formats and displayed for rapid consumption by decision makers.

Dashboards are useful because they provide automated outcomes particularly relevant to tracking and evaluating health management initiatives. For instance, dashboards can:

- Provide data on the magnitude of association between poor health and productivity loss,
- Cross-refer productivity loss to specific factors such as smoking status, chronic conditions, stress level, weight, depression, physical activity, and nutrition,
- Determine how much a health improvement initiative might influence absenteeism and presenteeism,
- Track change over time so that users can act on selected outcomes, assess effect over time, and make adjustments to strategies or tactics to meet organizational objectives, and
- Provide a benchmarking system for employers to assess their own employee productivity levels against other comparison groups.

Riedel[25] has outlined an example for how a "health productivity dashboard" can add practical meaning to productivity data. Dashboards allow program stakeholders to quickly see the state of complex systems. The concept of a dashboard in employee health management is straightforward—when data are presented in a clear and concise manner, business leaders can understand the relationship of a variety of issues like health status, health conditions, occupation, compensation, absence, and on-the-job performance.

SUMMARY AND CONCLUSION

A paradigm shift is underway. Businesses are beginning to realize that employee health and wellness can no longer be treated conceptually or functionally as simply capital expenditures to begrudgingly tolerate as part of the cost of doing business. Progressive companies are recognizing the opportunity to reconceptualize their employees' health and well-being as capital investments. Furthermore, those companies that invest wisely in the well-being of their employees are seeing returns that make sense within the overall strategic vision of their organization.[26] We believe that this fuels an increasing need for practical and inexpensive measures of productivity, resulting in expanded use of self-report productivity instruments. Because these assessment measures rely heavily on the individual's subjective estimation of productivity loss related to health status (and other factors), they have been subjected to the classic criticism of response bias, errors of memory, social desirability, etc,[27,28] which has undermined both the adoption of these tools and acceptance of the data generated.

These tools, however, have several important advantages compared with other methodologies. They are relatively inexpensive and easy to administer, allowing the employer to gather a large amount of data at low cost. These data can then be associated with other key constructs in the work environment (including but not limited to health status and risk, such as department reorganizations and team-based function, unexpected events, such as equipment malfunction, etc). Cost and ease of administration allow for such assessments to be routine aspects of an employer's standard evaluation procedures.

This article supports the IBI consensus statements[6] in underscoring the importance of developing the conceptual framework of productivity measurement that guides the maturation of a variety of high utility instruments and provides a framework for their application. It is in the application to real world settings that allows stakeholders to 1) assess the degree of the problem, 2) appropriately allocate resources to meet the need, and 3) evaluate outcomes associated with the application of resources that foster the health and well-being of the workforce.

Productivity impairment and interventions to optimize productivity are increasingly important aspects of competitive business strategy. Identifying key drivers of impairment, monetizing impairment losses, and establishing realistic expectations for recapturing productivity are basic elements of that strategy. The physical and psychological well-being of employees is a clear source of enhanced performance that is imminently actionable through strategic population health management programming. If this type of programming is to meet its potential, the establishment of a rigorous evidence base and an accepted approach to measurement are necessary conditions that must contend with the real-world settings within which they will ultimately be tested and valued.

So, where does the field of health and productivity management go from here? We believe there are several essential directions that must shape future work in the area. Below is a nonexhaustive list of some key foci for the field.

1. Avoid the parochial quest for a single gold standard instrument but rather seek to develop a sound family of instruments with characteristics that meet specific measurement ends.
2. Develop and rigorously test interventions for health and productivity that include both clinical and business endpoints.
3. Continue to develop and improve models for monetizing losses and gains associated with health status and productivity.
4. Build and refine models of impairment that take into account comorbidities and multiple risks.
5. Build and refine models of impairment that take into account the interdependencies of job function.

In this article, we have set forth some of our thoughts, ideas, and experiences for consideration, not as definitive answers to a fledgling field of study but rather as points of consideration for employers seeking to use self-report measures of productivity and as a springboard for researchers and other thought leaders in generating a constructive dialogue for moving this field of study forward.

REFERENCES

1. Boles M, Pelletier B, Lynch W. The relationship between health risks and work productivity. *J Occup Environ Med.* 2004;46:737–745.
2. Sullivan S. Making the business case for health and productivity management. *J Occup Environ Med*. 2004;46:S56–S61.
3. Mattke S, Balakrishnan A, Bergamo G, Newberry SJ. A review of methods to measure health-related productivity loss. *Am J Manag Care*. 2007;13: 211–217.
4. Loeppke R, Taitel M, Richling D, et al. Health and productivity as a business strategy. *J Occp Environ Med*. 2007;49:712–721.
5. Towers Perrin. Annual health care cost survey, 2008, 1–32. Available at: http://www.towersperrin.com/tp/getwebcachedoc?webc=HRS/USA/2008/200801/hccs_2008.pdf. Accessed February 1, 2010.
6. ACOEM/IBI. *Improving the Health and Productivity of the American Workforce: A Blueprint for Action, 2008*. Santa Ana Pueblo, NM: Workforce Health and Productivity Summit; 2008.
7. Aldana SG, Pronk NP. Health promotion programs, modifiable health risks and employee absenteeism. *J Occup Environ Med*. 2001;43:36–46.
8. Lofland JH, Pizzi L, Frick KD. A review of health-related workplace productivity loss instruments. *Pharmacoeconomics.* 2004;22:165–184.
9. O'Donnell MP. Forces shaping the future of health promotion. *Am J Health Promot*. 2001;15:3–4.
10. Prasad M, Wahlqvist P, Shikiar R, Shih YT. A review of self-report instruments measuring health-related work productivity: a patient-reported outcomes perspective. *Pharmacoeconomics*. 2004;22:225–244.

11. Schultz, AB, Edington DW. Employee health and presenteeism: a systematic review. *J Occup Rehabil*. 2007;17:547–579.
12. Kessler RC, Barber C, Beck A, et al. The World Health Organization Health and Work Performance Questionnaire. *J Occup Environ Med*. 2003;45:156–174.
13. Lerner D, Amick BC III, Rogers WH, Malspeis S, Bungay K, Cynn D. The Work Limitations Questionnaire. *Med Care*. 2001;39:72–85.
14. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a work productivity and activity impairment instrument. *Pharmacoeconomics*. 1993;4:353–65.
15. Berger ML, Howell R, Nicholson S, Sharda C. Investing in healthy human capital. *J Occup Environ Med*. 2003;45:1213–1225.
16. Goetzel RZ, Shechter D, Ozminkowski RJ, Marmet PF, Tabrizi MJ, Roemer EC. Promising practices in employer health and productivity management efforts: findings from a benchmarking study. *J Occup Environ Med*. 2007; 49:111–130.
17. Davis K, Collins SR, Doty MM, Ho A, Holmgren AL. *Health and Productivity Among U.S. Workers*. Publication 856. New York, NY: The Commonwealth Fund; 2005.
18. Burton WN, Chen CY, Conti DJ, Schultz AB, Edington DW. The association between self-reported health risks and presenteesim. *JHP*. 2006;9–15.
19. Collins JJ, Baase CM, Sharda CE. The assessment of chronic health conditions on work performance, absence, and total economic impact for employers. *J Occup Environ Med*. 2005;47:547–557.
20. McDavid JC, Hawthorn LRL. *Program Evaluation & Performance Measurement.* London: Sage Publications; 2006.
21. Pelletier B, Boles M, Lynch W. Change in health risks and work productivity over time. *J Occup Environ Med*. 2004;46:746–754.
22. Riedel JE, Grossmeier J, Haglund-Howieson L, Buraglio C, Anderson DR, Terry PE. Use of normal impairment factor in quantifying avoidable productivity loss because of poor health. *J Occup Environ Med*. 2009;51:283–295.
23. Health and Productivity Management Center, American College of Occupational and Environmental Health. *Blueprint for Health*. Available at: http://blueprint.acoem.org. Accessed January 1, 2010.
24. Integrated Benefits Institute (IBI) *Health & Productivity Snapshot Calculator*. San Francisco, CA: IBI. Available at: http://www.ibiweb.org. Accessed February 1, 2010.
25. Riedel JE. Using a health and productivity dashboard: a case example. *Am J Health Promot*. 2007;1–10.
26. Watson-Wyatt. *The Health and Productivity Advantage. North American staying@work report: 2009–2010*. New York, NY: Watson-Wyatt; 2009.
27. Allen HM, Bunn WB. Validating self-reported measures of productivity at work: a case for their credibility in a heavy manufacturing setting. *J Occup Environ Med*. 2003;45:926–940.
28. Donaldson SI, Grant-Vallone EJ. Understanding self-report bias in organizational behavior research. *J Bus Psychol*. 2002;17:245–260.

