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Economic evaluations of occupational health interventions from a company's perspective: a systematic review of methods to estimate the cost of health-related productivity loss

K. Uegaki, M.C. de Bruijne, A.J. van der Beek, W. van Mechelen, M.W. van Tulder. *Submitted.*

Abstract

Objectives

To evaluate how changes in health-related productivity have been measured and valued in economic evaluations from a company's perspective.

Methods

The primary literature search was conducted in Medline and Embase. Supplemental searches were conducted in the Cochrane NHS Economic Evaluation Database, the National Institute for Occupational Safety and Health database, the Ryerson International Labour, Occupational Safety and Health Index database, scans of reference lists and researcher's own literature database. Article selection was conducted independently by two researchers based on title, keywords, and abstract, and if needed, full text. Differences were resolved by a consensus procedure. Articles were selected based on seven criteria addressing study population, type of intervention, comparative intervention, outcome, costs, language and perspective, respectively. Characteristics of the measurement and valuation of health-related productivity changes were extracted and analyzed descriptively.

Results

A total of 34 studies were included. Changes in health-related productivity were estimated using (a combination of) data related to sick leave, compensated sick leave, light or modified duty or work presenteeism. Data were collected from different sources (e.g. administrative databases, worker self-report, supervisors) and by different methods (e.g. questionnaires, interviews). Valuation varied in terms of reported time units, composition and source of the corresponding price weights, and whether additional elements, such as replacement costs, were included.

Conclusion

Methods for measuring and valuing changes in health-related productivity vary widely, hindering comparability of results and decision-making. We provide suggestions for improvement.

Economic evaluations are a tool to help inform decision makers about how to best allocate limited resources. In occupational health, the interest in economic evaluations has steadily grown as stakeholders realize that resources for occupational health interventions are limited and health problems in the working population are paired with significant socioeconomic burden¹⁻³. For example, the cost of lost productive time by workers with depression has been estimated to be \$44 billion per year⁴, and from a US survey of over 28,000 workers, productivity loss costs for companies due to workers' personal or family health problems was estimated \$226 billion per year⁵. In The Netherlands, companies are obligated to continue to pay 70-100% of the salary of employees during the first two years of sick leave, regardless of work-relatedness⁶.

For results of economic evaluations to be informative, they must contain relevant and comparable data on costs and consequences. The choice of which costs and consequences are included in an economic evaluation is influenced by the perspective taken. Traditionally, a societal perspective is recommended, and in principle, all costs and consequences regardless of who pays or gains are included⁷. However, results from this broad approach may be difficult to apply for decision making at the local (workplace) level, warranting evaluations from a more specific stakeholder perspective, such as the company⁸⁻¹⁰. Indeed, in addition to growing interest, there is increasing awareness that company decision makers have a need for relevant and comparable information so that they can prioritize their budget in order to attain the greatest (health) gains for their workforce^{11,12}.

In economic evaluations conducted from a company's perspective, the benefit of occupational health interventions is commonly expressed in terms of changes in health-related productivity, which are translated into a monetary value¹³. However, how this key variable is measured and valued may vary widely. Variability in costing methods used in cost-effectiveness analysis was recently reported by Adams et al.¹⁴. While most of the included studies did not include changes in productivity, the authors identified three potential reasons for the observed variation in how changes in productivity are handled: disagreements between existing economic evaluation guidelines on whether to include these costs, lack of practical guidance on how to comply with recommendations, and a simple omission of this cost in the guidelines themselves.

Variability in how changes in health-related productivity are measured and valued can hinder the comparability of studies addressing the same health problem and across health problems, thereby limiting the usefulness of the results for decision-making. In order to identify avenues for standardization, insight into the exact nature of the variability is needed. Thus, the objective of our systematic review was to map out how changes in health-related productivity have been measured and valued in economic evaluations of occupational health interventions from a company's perspective.

Methods

Study design and search strategy

A systematic review was conducted of economic evaluations from a company's perspective and based on primary research. We conducted our primary search in EMBASE.com, a database combining the recorded journal entries of Medline from 1966 to present and Embase from 1974 to present. An experienced search specialist from our

institute developed the search strategy (table 1), which covered the period from 1966 to April 2007. Supplemental searches were conducted in the Cochrane NHS Economic Evaluation Database (NHS EED), the National Institute for Occupational Safety and Health (NIOSH) database, and the Ryerson International Labour, Occupational Safety and Health Index (RILOSH) database. Additional articles were identified from reference lists and the researchers' own literature databases.

Table 1. Search strategy in EMBASE.com.

Set	Search terms
1	(economic-evaluation/exp) AND (employee/exp OR employee* OR employer/exp OR employer* OR industrial-worker/exp OR worker* OR work-site OR worksite OR workman-compensation/de OR workplace/de OR workplace OR work-capacity/de)
2	Set 1 AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [systematic review]/lim OR comparative-study/de OR intermethod-comparison/de OR clinical-study/exp OR controlled-study/exp)
3	Set 1 AND (health-program/exp OR health-maintenance-organization/exp OR occupational-health-service/exp OR preventive-health-service/exp)
4	Set 1 AND (productivity/exp OR absenteeism/exp OR return-to-work OR sick-leave OR job-performance/de OR work-resumption/de)
5	(Measur* OR valuing* OR valuation OR value* OR significance OR analys* OR estimat* OR assess* OR determinat* OR methodology/de OR accuracy/de)
6	(Set 3 OR set 4) AND set 5
Final set	Set 2 OR set 6

Study selection

Two reviewers (KU and MdB) independently determined the eligibility of studies on the basis of title, keywords and abstract, and if needed, a review of the full text. Differences in judgement were resolved through a consensus procedure. We selected studies based on seven criteria: (i) the study population consisted of working-age individuals at risk for health problems or with health problems interfering with their ability to work; (ii) the intervention in question was a workplace or primary care service, technology or program to prevent work disability; (iii) the intervention was compared to an alternative; (iv) an outcome that reflected a worker's health-related production capacity was measured and valued; (v) at minimum, costs of intervention-related resource use were included; (vi) the study was reported in either Dutch or English; and (vii) the economic analysis was conducted from a company's perspective. We excluded editorials, letters, articles describing the design of economic evaluations but not reporting any results, congress abstracts, reviews and modelling studies.

Data extraction

To guide our data extraction procedure, we identified key aspects of measurement and valuation from existing guidelines and texts on economic evaluations^{7,15}. With respect to the measurement, we extracted data on the type of time losses that were used to quantify the changes in health-related productivity, data collection method and data source used. With regards to valuation, we extracted data on the time units and corresponding price weight used, and the composition and source of the price weight. In cases where information could not be found in the articles, we used the notation, "not specified".

One researcher (KU) extracted the data and a second researcher (MdB) checked 10% for accuracy. No disagreements were identified. We synthesized the data descriptively.

Applied terminology

We labelled the economic evaluations using the conceptual matrix proposed by Drummond et al.⁷. The type of economic evaluation is determined by the number of alternatives compared, if both costs and consequences are included, and how the consequences are expressed. In a cost-effectiveness analysis (CEA), the consequences are expressed in terms of a unit of effect, such as pain, function or symptom severity. A cost-utility analysis (CUA) is a variant in which the unit of effect is quality-adjusted life years. In a cost-benefit analysis (CBA), all health consequences (i.e. benefits due to improved health, future health care costs avoided and increased productive output due to improved health status) are translated into a monetary value using principles of willingness-to-pay⁷. The label, financial appraisal, was used to denote economic evaluations in which the costs and consequences of two or more alternatives are compared, but where the monetary consequences were limited to changes in health care use and/or productivity valued using market prices.

Results

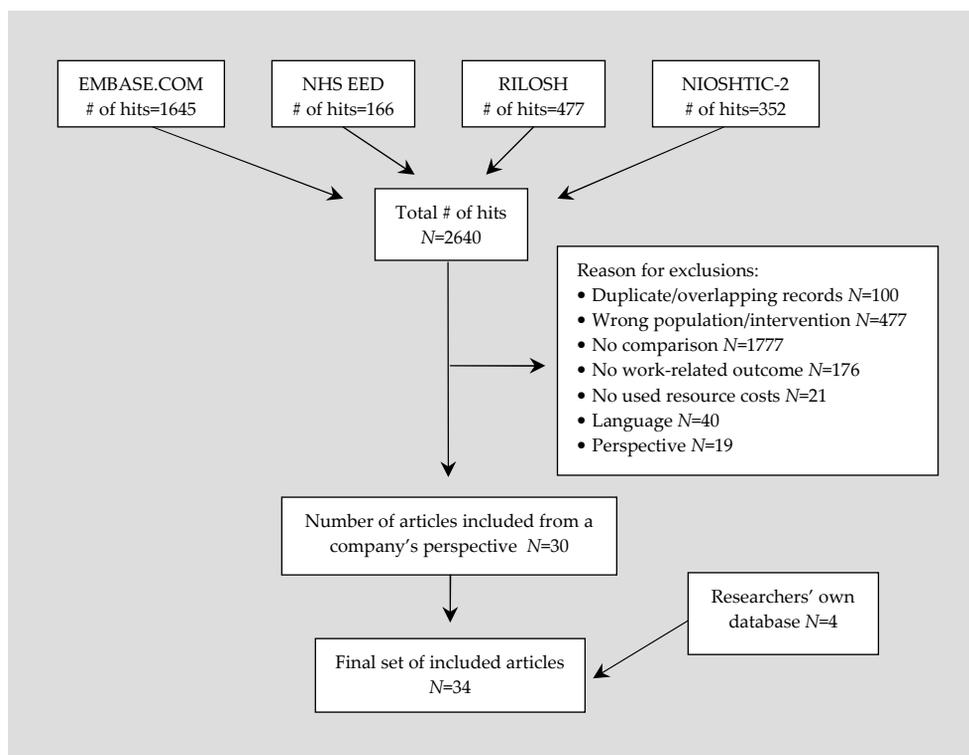
Study selection

Our primary search in EMBASE.com generated 1645 hits. We obtained an additional 166, 477 and 352 hits from our searches in NHS EED, NIOSHTIC-2 and RILOSH, respectively. From this total of 2640 hits, 100 duplicates were removed, resulting in set of 2540 articles. Of these, 2422 were excluded based on title, keywords and abstract, and the full texts of the remaining 118 articles were assessed. Thirty studies were included based on our selection criteria. Thirty of the included studies were identified in EMBASE.com, and one from RILOSH. The searches in NHS EED and NIOSHTIC-2 did not result in any additional studies. Four additional articles were identified from the researchers' own literature database, resulting in a total of 34 studies for this review (figure 1).

General description of the studies

Physical health issues, such as back injury or pain, lacerations and musculoskeletal injuries or pain, were targeted in half of the studies¹⁶⁻³². Six studies evaluated health promotion/lifestyle and wellness interventions³³⁻³⁸, and seven investigated the cost-effectiveness of influenza vaccines³⁹⁻⁴⁵. Mental health problems^{46,47} and migraine^{48,49} were addressed by two studies each. The studies originated in eight countries: Australia^{34,40,45}, Canada^{19,27,37}, Colombia⁴³, Italy⁴¹, Malaysia⁴⁴, The Netherlands^{17,20,28,35}, Sweden^{22,29}, and USA^{16,18,21,23-26,30-33,36,38,39,42,46-49}.

Thirty-two studies conducted a financial appraisal^{16-34,36-48}, and two studies performed both a financial appraisal and cost-effectiveness analysis^{35,49}. None of the studies conducted a cost-utility analysis. On the cost-side of the economic evaluations, all studies included costs related to the programs in the question. Examples of program cost items were capital expenditures for equipment, labour costs for the staff to provide the interventions or run the programs, and operational, maintenance or material costs. Eight (24%) studies included the time that employees take from work to undergo the intervention in the calculation of the program costs^{16,39-45}. Data on health care use for the

Figure 1. Selection process scheme from search results through to identification of the final set of articles.

health problem, such as physician contacts, were included by four (12%) studies^{20 24 39 49}. Proper et al.³⁵ included the cost of health-related productivity loss on the cost-side of the equation in their cost-effectiveness analysis.

On the consequence-side of the equation, all of the financial appraisals included the monetary value of changes in productivity. Savings from health care costs were included by fourteen (41%) analyses^{16 18 19 21 23 25-27 30 32-34 37 42}. None of the appraisals included a monetary valuation of improved health. Of the two studies that conducted a cost-effectiveness analysis, Proper et al.³⁵ determined the incremental costs per unit of energy expenditure, submaximal heart rate, proportion meeting the public health recommendation for physical activity, and upper-extremity symptoms. Lofland et al.⁴⁹ analysed costs per disability day averted. In their economic analysis, Mitchell et al.²⁴ considered the difference in total costs per injured worker. Four studies presented separate data on a health effect such as musculoskeletal pain, discomfort or fatigue^{17 19 29 35}, function²⁹, or mental health complaints such as anxiety, helplessness or depression²⁹.

Measuring changes in health-related productivity

We identified four expressions of lost work time that were used to estimate the changes in health-related productivity: (i) lost work time due to the worker being absent from work due to a non-compensable health problem; (ii) lost time work that is compensable because it is due to a “work-related” health problem; (iii) lost time work due to workers being present in the workplace but still unable to perform all their duties because of incomplete recovery; and (iv) lost time work due to workers are at work in their original

functions, however, perform their tasks less effectively due to their health problem. To facilitate further reporting, we used the following four labels to denote each proxy measure: (i) sick leave; (ii) compensated sick leave; (iii) limited or modified duty; and (iv) work presenteeism.

Absenteeism, whether sick leave or compensated sick leave, formed the basis of estimates of health-related productivity changes in all of the included studies. Four studies included both measures^{25 26 32 34}. Limited or modified duty and work presenteeism were considered by four^{20 24 25 32} and six^{17 43 44 46 48 49} studies, respectively.

An overview of data sources for each proxy measure are presented in table 2. Data on sick leave was collected either from administrative databases^{20-22 26 28 29 33-36 38 41 45}, self-report^{17 24 31 39 40 42-44 46 48 49}, report by others^{16 22 25 32 47} or else not specified³⁷. Company databases^{20 21 26 28 33-36 38 41 45} and non-standardized questionnaires^{24 31 39 40 42-44 46} were the two most commonly used methods at 32% and 24%, respectively. Of the ten studies using compensated sick leave to estimate changes in productivity, data was collected from either the company's own workers' compensation database^{23 25 30 32 34}, that of the insurer^{18 19 26 27}, or not specified¹⁶. In terms of limited or modified duty, each of the four studies^{20 24 25 32} collected data in a different manner. Work presenteeism was measured by either a non-standardized^{43 44 46} or standardized questionnaire^{17 48 49}.

Table 2. Data sources for each proxy measure of change in health-related productivity along with respective references.

Data source	Description	Number of studies ^{References}
Sick leave		
Administrative database	Company	11 ^{20 21 26 28 33-36 38 41 45}
	National Insurance	2 ^{22 29}
Self-report	Non-standardized questionnaire (written or telephone)	8 ^{24 31 39 40 42-44 46}
	Standardized questionnaire (written or telephone)	3 ^{17 48 49}
Report by others	Interview	1 ²²
	OSHA log	1 ³²
	Monthly injury report or log	3 ^{16 25 47}
Not specified	Method of data collection not reported	1 ³⁷
Compensated sick leave		
Administrative database	Company	5 ^{23 25 30 32 34}
	Workers compensation	4 ^{18 19 26 27}
Limited or modified duty		
Administrative database	Company	1 ²⁰
Self-report	Non-standardized questionnaire	1 ²⁴
Report by others	OSHA log	1 ³²
	Monthly injury report or log	1 ²⁵
Work presenteeism		
Self report	Non-standardized questionnaire (written or telephone)	3 ^{43 44 46}
	Standardized questionnaire (written or telephone)	3 ^{17 48 49}

Valuing changes in health-related productivity

Studies that measured changes in health-related productivity by sick leave, limited or modified duty or work presenteeism calculated the costs by using the basic human capital formula: time lost units multiplied by the price weight per time unit. Nine of the 10 studies using a measure of compensated sick leave determined the costs by the actual compensation payments. In these studies, aggregated totals were reported^{16 18 19 23 25-27 30 32}. Monetary award payments from litigation were included by only one study³⁰. The remaining study using a measure of compensated sick leave estimated costs via the human capital formula³⁴.

In the studies valuing sick leave by the human capital approach, five sources of variation in the methodology were observed: the time units used to quantify the changes in health-related productivity; the type of price weight used, the composition of the price weight, the source of the price weight, and additional elements in the calculation (table 3).

First, the time units used to quantify changes in health-related productivity differed in terms of being either hours or days. While the majority of studies reported the number of work days, two additional variations were observed: accounting for partial days and quantifying calendar days.

Second, the corresponding price weights varied in terms of whether a worker-specific price weight was used, or a job-specific, job- and gender-specific, or generic price weight. Three studies did not provide information about the type of price weight^{26 37 44}. Of the three studies that used a job-specific price weight, two used a mean for the job category^{33 41} and the remaining study did not include a specification¹⁷. Of the 16 studies that used a generic price weight, either the mean of the study or company population was used^{20 31 35 36 38 42 43 45 46}, a national mean⁴⁹, a mean from the literature²⁹, the median of the study population⁴⁷, or not specified^{28 39}.

Third, the composition of the price weight differed between studies in terms of whether or not secondary benefits were included in addition to the wage. Fifteen of the 28 studies included secondary benefits in their price weight, six did not and seven studies did not report this information.

Fourth, in a majority (20 of 28) of the studies, the price weight was obtained from the company. Published literature and participant self-report were the sources of price weights in one study each. Two studies obtained price weights from a national database. Four studies did not report the source of their price weight.

Last, the valuation of sick leave-based productivity costs differed among the studies in terms of whether or not additional elements were included in the calculation, and if included, the type of additional element. Of the 11 studies that included additional elements, one study³⁵ adjusted the estimation of sick leave-based productivity costs based on the assumption of elasticity, which states that the productivity loss is less than proportional to the time lost. In contrast, the additional elements considered in the remaining 10 studies represent extra costs, indicating that the cost of health-related productivity loss was more than that based on sick leave time alone^{19 27 33 34 40 43 44 46 47}.

Similar sources of variation were observed in the valuation methodology of limited or modified duty and work presenteeism (table 4).

Table 3. Summary of the time units, price weight characteristics and additional elements used in the valuation of health-related productivity changes measured by sick leave.

Valuation component	Description	Number of studies ^{References}
Time units		
Hours	Changes in health-related productivity quantified in hours of work time missed.	5 ^{17 33 45-47}
Days	Not otherwise specified: changes in health-related productivity quantified in days of work time missed not otherwise specified. That is, no differentiation was made between whole and partial days of time loss.	20 ^{21 22 24-26 28 29 31 35-44 48 49}
	Net or adjusted days: changes in health-related productivity quantified in which a differentiation was made between whole and partial days of time loss.	3 ^{16 20 34}
	Gross or unadjusted days: although partial days were measured, partial days were quantified as whole days of time loss.	1 ²⁰
	Calendar days: changes in health-related productivity quantified in terms of calendar days. Note that price weight correspondingly reflected a calendar day as opposed to a work day.	2 ^{20 35}
Price weights		
Worker-specific	The specific salary or wage of a worker is used.	5 ^{21 22 25 34 40}
Job-specific	A uniform price weight is used for all workers in the same job function.	3 ^{17 33 41}
Job- and gender-specific	A uniform price weight is used for all workers in the same job function but further differentiated for gender.	1 ⁴⁸
Generic	One uniform price weight is used with no differentiation for job function, gender or age.	16 ^{16 20 24 28 29 31 35 36 38 39 42 43 45-47 49}
Not specified	No description of the price weight was provided.	3 ^{26 37 44}
Composition of price weights		
Wage plus benefits	The price weight encompasses wages plus secondary benefits.	15 ^{17 20 22 25 31 35 40-47 49}
Wage only	The price weight consisted only of the wage rate.	6 ^{16 26 28 34 38 48}
Not specified	No description of the composition was provided.	7 ^{21 24 29 33 36 37 39}
Source of price weight		
Company	Administrative databases.	20 ^{17 20-22 25 26 28 31 33-36 38-43 45 47}
Literature	Published literature.	1 ²⁹
National	National databases such as the U.S. Bureau of Labor.	2 ^{48 49}
Participants	Participant self-report.	1 ⁴⁶
Not specified	Source not specified.	4 ^{16 24 37 44}
Additional elements		
Elasticity	This represents the less than proportional decrease in productivity loss to worked hours.	1 ³⁵

Table 3 continued.

Valuation component	Description	Number of studies ^{References}
Loss of operating income	This represents the average contribution to the company's global productivity that is lost when a worker is absent due to a health problem. This was determined from company data.	3 ^{40 43 44}
Turnover	This represents the costs associated with having to recruit, hire and train a new employee. It should be noted that there was variation in how these costs were estimated.	2 ^{34 47}
Replacement	This represents the costs related to replacing a worker temporarily. The calculation method of these costs varied or not specified in each study.	3 ^{33 40 44}
"Indirect costs"	A general rule of thumb of 2x the direct savings were used to account for savings from "indirect" spill over effects such as overtime, turnover, recruiting and training, increased employee morale and/or non-worker's compensation related absenteeism.	2 ^{19 27}
Wage multipliers	These represent weights based on the theoretical model of Pauly et al. that the cost of health-related productivity loss due to a worker's complete absence is more than full wage plus benefits per day worked.	1 ⁴⁶

Discussion

We conducted a systematic review to gain insight into the variation in how changes in health-related productivity are measured and valued in economic evaluations from a company's perspective. Thirty-four studies were included. With respect to measurement, we identified considerable variation in the type and number of proxy measures used as well as the data collection methods for each specific measure. With regards to valuation, we observed variation in terms of the reported physical units of change, type, composition and source of the unit price weights, and whether additional elements, such as replacement costs, were included.

To our knowledge, this is the first study to systematically evaluate the variation in how changes in health-related productivity were measured and valued in economic evaluations from a company's perspective. Although we searched four databases as well as the reference lists of included studies and our own database, we cannot guarantee that we captured all eligible studies. We do not believe, however, that additional studies would significantly alter our findings or recommendations.

In absence of objective productivity measures, estimates have been based on lost work time due to sick leave. A gold standard for collecting sick leave data does not exist. Both databases and questionnaires have their advantages and disadvantages, which need to be weighed per research question. However, using insurance databases have a particular disadvantage in that the data reflects what has been compensated; what has been compensated does not necessarily equate to the actual time a worker has been unable to work. If lost work time is collected from insurance-related databases, the amount of time lost during the waiting period before insurance coverage actually comes into effect also needed to be measured⁵⁰. Productivity changes related to sick leave should be supplemented by the productivity changes due to decreased work performance to avoid

Table 4. Summary of the time units, price weight characteristics and additional elements used in the valuation of health-related productivity changes measured by limited or modified duty and work presenteeism.

Valuation component	Description	Number of studies ^{References}	
		Limited or modified duty	Work presenteeism
Time units			
Days	Days.	3 ^{24 25 32}	4 ^{17 43 48 49}
Not specified	Units not specified.	.	2 ^{44 46}
Price weights			
Worker-specific	The specific salary or wage of a worker is used.	1 ²⁵	.
Job-specific	A uniform price weight is used for all workers in the same job function.	.	1 ¹⁷
Job- & gender-specific	A uniform price weight is used for all workers in the same job function but further differentiated for gender.	.	1 ⁴⁸
Generic	One uniform price weight is used with no differentiation for job function, gender or age.	2 ^{24 32}	3 ^{43 46 49}
Not specified	No description of the price weight was provided.	.	1 ⁴⁴
Composition of price weights			
Wage + benefits	The price weight encompasses wages plus secondary benefits. Note that we interpreted the term "salary" to mean wage plus benefits.	1 ²⁵	5 ^{17 25 43 44 46 49}
Wage only	The price weight consisted only of the wage rate.	.	1 ⁴⁸
Not specified	No description of the composition was provided.	2 ^{24 32}	.
Source of price weight			
Company	Administrative databases.	1 ³²	3 ^{17 43 44}
National	National databases such as the U.S. Bureau of Labor.	.	2 ^{48 49}
Participants	Participant self-report.	1 ²⁵	1 ⁴⁶
Not specified	Source not specified.	1 ²⁴	.
Additional elements			
Loss of operating income	This represents the average contribution to the company's global productivity that is lost when a worker functions less efficiently due to a health problem. This was determined from company data.	.	2 ^{43 44}
Wage multipliers	These represent weights based on the theoretical model of Pauly et al. that the cost of health-related productivity loss due to work presenteeism is more than its full wage equivalent.	.	1 ⁴⁶

underestimation⁵¹. For comparability, a standardized questionnaire should be used. In the past decade, a number have been developed for this purpose⁵²⁻⁵⁴.

Valuating the changes of health-related productivity into a financial metric makes these changes more interpretable for company managers. In an economic evaluation, the purpose is to determine if one intervention is more cost-effective than another. The cost of health-related productivity loss is a main cost driver. Therefore, it is critical that time units are valued properly. In particular, one common price weight should be used for all subjects. This is because the difference in the effect of the intervention is on the difference in change in productivity. The use of worker-specific wages can distort the actual difference⁵⁵. Currently, there is no gold standard for valuing the changes in productivity. As such, key assumptions of different methods should be tested in a sensitivity analysis.

A certain extent of the variation may reflect the socio-political context in which the study takes place. In particular, studies conducted in countries that have a workers' compensation system (e.g. Canada and United States) often used data from workers' compensation databases. In such jurisdictions, there is a differentiation between work-related and non-work related time loss. In contrast, in countries such as The Netherlands, such a differentiation does not exist and all work time loss due to a health problem is measured as sick leave. Given the variation arising from context, it is not realistic to think that one exact method for measurement and valuation can be prescribed. Nevertheless, a future endeavour for the field of occupational health should be to establish best practice guidelines for economic evaluations of occupational health interventions. These guidelines should provide explicit recommendations for reporting key aspects of methodology underlying the measurement and valuation of changes in health-related productivity. Such transparency and improvements in reporting will simplify the process of determining the comparability of studies. In addition, it will also facilitate the transferability of results.

In sum, the variation in the measurement and valuation methods to determine the changes in the costs of health-related productivity limits comparability of economic evaluations for the same health problem as well as between health problems. To help improve the comparability and interpretability of economic evaluations of occupational health interventions from a company's perspective, a future endeavour may be to establish an international task force to develop standardized guidelines. In the meantime, the following five points deserve attention:

- (i) Use of standardized questionnaires to measure changes in health-related productivity.
- (ii) Explicit presentation of measurement methods and time units of health-related productivity changes. This will mean disaggregating the amount of work loss from administrative databases. This may be a challenge when using workers' compensation data, however, just the costs can be misleading as the pay-outs are dependent on the local jurisdictions and insurance companies.
- (iii) Explicit presentation of the composition and source of corresponding price weights used to value the health-related productivity changes.
- (iv) Explicit presentation of the additional effects included in the analysis as well as the rationale for including these effects.
- (v) Clear description of the socio-political context in which the study takes place. This is so that readers from other jurisdictions can see how the distribution of burden is similar or different to theirs.

Conclusion

The methods to measure and value changes in health-related productivity vary widely among economic evaluations of occupational health interventions conducted from a company's perspective. This hinders the comparability and usability of results by occupational health professionals and company decision makers. We provide suggestions for improvement in future studies.

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