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Systematic Literature Review

Measurement Instruments of Productivity Loss of Paid and Unpaid Work: A Systematic Review and Assessment of Suitability for Health Economic Evaluations From a Societal Perspective

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ABSTRACT

Objectives: This study aimed (1) to perform a systematic literature review of instruments for measuring productivity loss of paid and unpaid work and (2) to assess the suitability (in terms of identification, measurement, and valuation) of these instruments for use in health economic evaluations from a societal perspective.

Methods: Articles published from 2018 were sourced from PubMed/Medline, PsycInfo, Embase, and Econlit. Using 2 separate search strategies, eligible economic evaluations and validation studies were selected and unique measurement instruments identified. A data-extraction form was developed by studying previous literature and consulting an international panel of experts in the field of productivity costs. This data-extraction form was applied to assess the suitability of instruments for use in economic evaluations.

Results: A total of 5982 articles were retrieved from the databases, of which 99 economic evaluations and 9 validation studies were included in the review. A total of 42 unique measurement instruments were identified. Nine instruments provided quantified measures of absenteeism, presenteeism, and unpaid work. Five instruments supplied the necessary information to enable the use of at least 1 common valuation method. The Health and Labour Questionnaire-Short Form, Health and Labour Questionnaire, and Institute for Medical Technology Assessment Productivity Cost Questionnaire met both criteria. Nevertheless, the developers replaced the Health and Labour Questionnaire-Short Form and Health and Labour Questionnaire by the more recently developed Institute for Medical Technology Assessment Productivity Cost Questionnaire.

Conclusions: Although many instruments for measuring productivity loss were identified, most were not suitable for capturing productivity changes for economic evaluations from a societal perspective. Future research can benefit from this study by making an informed instrument choice for the measurement of productivity loss of paid and unpaid work.

Keywords: economic evaluation, indirect costs, measurement, measurement instruments, productivity costs, productivity loss, questionnaire, survey, systematic review.

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Introduction

Health economic evaluations aim to inform decision-makers about efficient resource allocation.[1] For these evaluations, a societal perspective has frequently been advocated.[2–5] In a societal perspective, all relevant costs and benefits should be included, regardless of who incurs these benefits or costs.[6] Costs can be categorized as healthcare costs, patient and family costs, costs in other sectors, and productivity costs.[7] The latter cost category includes costs related to paid and unpaid production loss due to illness, disability, or death of productive persons.[8]

Productivity costs may contribute to a large proportion of total direct and indirect costs of medical conditions.[9–11] Examples include: a cost-effectiveness study of expensive hospital drugs, which found that productivity costs comprised up to 83% of total costs[9]; a study of cancers in 27 countries in the European Union, which concluded that productivity loss due to early death and lost working days accounted for 41% of total economic burden in 2009 (ie, €52.03 billion)[10]; and a study of the costs of hand and wrist injuries of working age people in The Netherlands, which found that productivity costs represented approximately 75% of total costs.[11] In some instances, conclusions about the cost-effectiveness of interventions changed depending on the inclusion or exclusion of productivity costs.[9] Therefore, in an economic evaluation from a societal perspective, excluding these costs could lead to biased cost-effectiveness outcomes.[12] We do note that international consensus on appropriate perspectives to take in economic evaluations and their operationalization is lacking.

Given that obtaining information on productivity loss directly from work sites is usually not feasible,[4] self-report questionnaires are often used to measure this loss.[4,13–21] Although researchers can choose from a wide variety of instruments measuring productivity loss, a gold standard is lacking.[14] Country-specific methods guidelines provide different recommendations on the inclusion of productivity costs. For instance, when including productivity costs in economic evaluations, some guidelines state that only absence from work is of interest[22–24] whereas others also encourage including reduced productivity while at work[25] or unpaid work loss.[26] Additionally, the methods used to measure productivity loss need to comply with the anticipated valuation method. Recommended valuation methods vary across countries,[22–25,27,28] resulting in different requirements for measurement instruments.[8,16,29] It is essential that applied measurement instruments support the ultimate inclusion of the estimated costs in economic evaluations. For instance, many instruments focus primarily on absence from paid work,[12] while authors have encouraged including other components of productivity loss as well.[30–33] Moreover, some instruments do not provide the necessary information for monetary valuation of productivity loss.[14] Thus, not all measurement instruments may be suitable for including these costs in economic evaluations from a societal perspective.

Some systematic reviews have already been conducted on measurement instruments of productivity costs. For instance, Tang[16] identified 11 generic questionnaires. Mattke et al[21] found 20 survey instruments that assess the effect of health problems on productivity loss and related costs. Additionally, Ospina et al[13] identified 21 instruments for measuring reduced productivity while at work. Although these reviews provided insight into different instruments and their characteristics, these did not evaluate the suitability of these instruments for health economic evaluations. Additionally, the current review includes broader search terms, such as unpaid productivity loss. This review aims to add to current knowledge and recommendations by performing a more comprehensive review of the literature and a thorough evaluation of the identified instruments.

Thus, this study aimed to perform a systematic literature review of measurement instruments of productivity loss of paid and unpaid work and to assess their suitability in terms of identification, measurement, and valuation for use in health economic evaluations conducted from a societal perspective.

Methods

A systematic review was performed to identify measurement instruments of productivity loss of paid and unpaid work. This systematic review consisted of 2 search strategies. Measurement instruments were identified from economic evaluations and validation studies. The search of validation studies was added as a separate search since recently developed instruments might not have been applied in economic evaluations yet. This review adopted the transparent Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[34]

Search Strategy

Two search strategies were designed to identify relevant studies in PubMed/Medline, PsycInfo, Embase, and Econlit. Both were designed and optimized by an experienced biomedical information specialist (Wichor M. Bramer) at the Erasmus Medical Center, Rotterdam, The Netherlands.

The first search strategy was developed to identify economic evaluations that applied instruments to measure productivity loss. This strategy contained the following key elements: "productivity loss" and "economic evaluation." For the purpose of this study, economic evaluations and cost-of-illness studies were included.

The second search strategy was developed to identify validation studies of measurement instruments of productivity loss. This search strategy contained the following key elements: "productivity loss" and "validation study." For the purpose of this study, validation studies included studies that aimed to assess the measurement properties of 1 or more instrument. The elements of both strategies were extended with controlled vocabulary keywords (eg, MeSH terms in PubMed) and synonyms.

Both searches were restricted to publications from January 2018. This time frame was selected to focus on identifying instruments that were actually used in recent economic evaluations (first strategy). The second search strategy also allowed inclusion of new instruments with an insufficient research longevity to already be observed in the first search strategy. The full search strategies are presented in Appendices 1 and 2 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.05.002.

Study Selection

After applying the search strategies to the selected databases on February 14, 2019, duplicate studies were removed using Endnote[35] deduplication function. Subsequently, the eligibility of the remaining studies was assessed separately for the 2 searches by 2 researchers independently (K.H. and D.G.) according to the criteria presented in Table 1. First, a pilot screening was performed of 100 references. Then, all titles and abstracts were screened. After that, full texts of the included articles were screened. Discrepancies between the researchers were discussed until consensus was reached. In exceptional cases where consensus could not be reached, a third researcher was consulted (H.P.).

Data Extraction

After the selection of eligible studies, relevant data were extracted using a predesigned data-extraction form. This form was developed by studying previous literature and consulting an international expert panel in the field of productivity costs. Data from the first 20 studies were extracted by 2 researchers (K.H. and D.G.) collaboratively to ensure harmonization. After this pilot, the 2 researchers divided the references and extracted data independently. Any doubts were discussed between the researchers or with a third researcher (H.P.). If information could not be retrieved from the included studies, additional studies and websites were manually searched. If information on an instrument could still not be retrieved, the instrument was excluded from analysis.

The following data were extracted from the included studies from both searches using an Excel-based template: study characteristics (ie, country, study design, time horizon, disease area, diagnosis, age range, mean age, percentage of female respondents, percentage of respondents with paid work, productivity loss of patient/parent/caretaker/other) and measurement instrument (ie, instrument name, version, full or partial instrument used). Unique instruments were selected for analysis if they could be distinguished by their name or items and contained unique questions on productivity loss. If instruments were modified for use in specific studies by others instead of the original authors, only the original instrument was selected, because a preliminary search showed that many articles did not report the specific changes made to the original instruments.

In addition to general instrument characteristics (ie, instrument name and abbreviation, focus of application, mode of administration, number of items in total, number of items on productivity loss, recall period, languages available, online

Table 1. Eligibility criteria for identified studies from the literature search of economic evaluations and validation studies.

Category*	Criteria for economic evaluations	Criteria for validation studies
Population	Study subjects were humans	
Age	At least some study participants were between 18 and 70 years	
Language	Published in English	
Availability	Full text was available online	
Research methodology	Cost-effectiveness, cost-benefit, cost-utility, or cost-of-illness study	Validation study
Productivity loss	One or more components of productivity loss were measured using a specified self-report, proxy-report, or an interviewer-led instrument (ie, instrument name or items was reported)	Study aim was validating a measurement instrument of 1 or more components of productivity loss
Exclusion	Abstracts for presentations in meetings and conferences, literature reviews, editorials, corrections, book chapters, unpublished studies, and studies that predicted productivity loss using an instrument with a different outcome measure were excluded	

*The first 4 and last category contain criteria for both economic evaluations and validation studies.

availability, and conditions of use), other aspects were included to evaluate the suitability for use in health economic evaluations.

Because estimating productivity costs entails (1) identifying relevant costs components, (2) operationalizing the measurement, and (3) expressing production loss in monetary values using common valuation methods,[7] these steps formed the basis for this part of the data-extraction form.

Identification of relevant cost components

Relevant cost components of productivity loss of paid and unpaid work were identified from previous literature[8,13,14,16–21,36] and discussed with the expert panel during multiple meetings. The following components were recognized in the literature: absenteeism, presenteeism, unpaid work, compensation mechanisms, and multiplier effects. Although the relevance of the first 3 components was confirmed, the expert panel concluded that there was insufficient clarity about how compensation mechanisms and multiplier effects influence overall productivity costs and to what extent employees are capable of estimating compensation or multipliers during their work absence. Therefore, it was concluded that this review should focus on absenteeism, presenteeism, and unpaid production loss (hereafter referred to as unpaid work). This review assessed whether instruments included these 3 components.

Absenteeism was defined as time absent from work.[8,16,17,21,36] Although the specific description may vary between studies, instruments should provide information on absence from work, sick days, sick leave, missed work, lost work time, or similar situations.[16,19,20] This could also be measured by determining the difference between expected and actual work hours.[14,16] If a distinction was made between missed work because of illness and other reasons, only the first part was of interest for this study.[18,20]

Presenteeism was defined as reduced productivity while being ill at work.[8,36] Examples of questions that focus on presenteeism can refer to measuring quality or quantity of production or tasks performed.[8]

Unpaid work was defined as unpaid productive activities that can be replaced by a hired third person.[37] This rule of thumb has the purpose of differentiating between what is unpaid work and what is not. Using this definition, examples of unpaid work could be household tasks, taking care of children, and volunteer work. Nevertheless, leisure time, playing with grandchildren, and studying was not considered unpaid work, because this does not yield production and/or cannot be replaced by a third person.

Operationalizing measurement

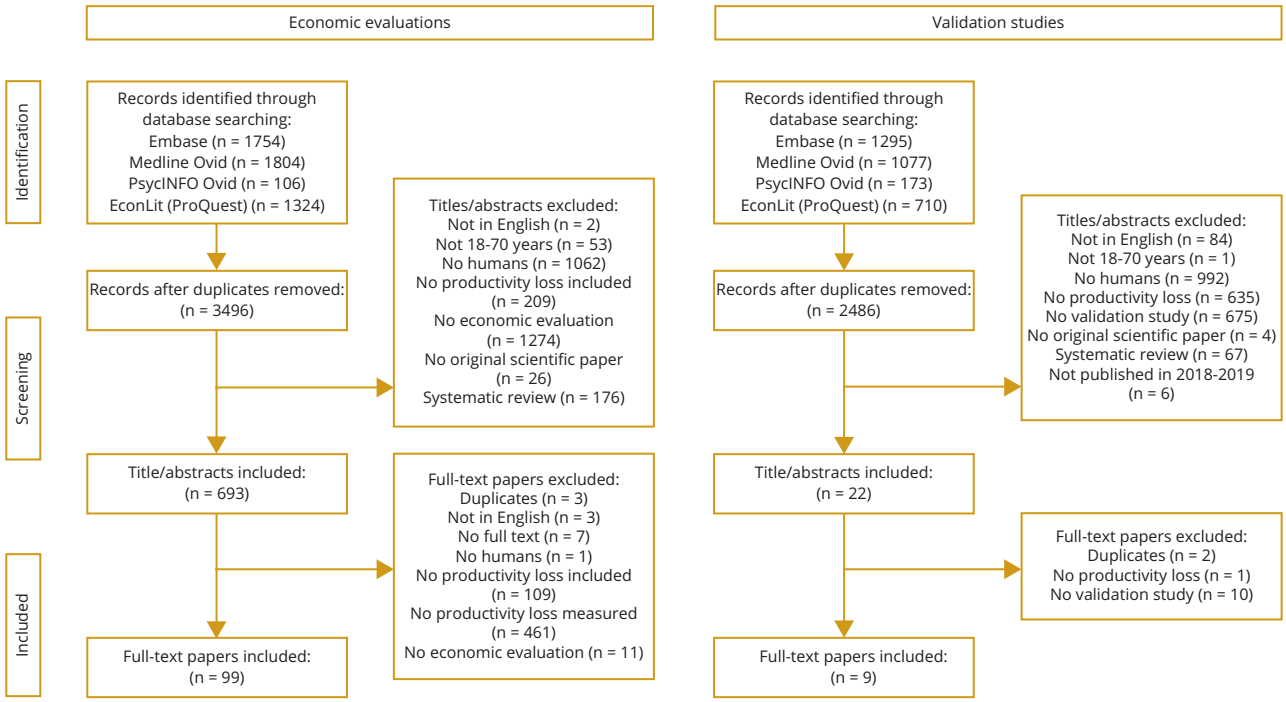
To enable valuation, instruments must provide quantified data for the respective components of productivity loss (eg, hours, days, percentages). This review evaluated whether instruments supplied quantified data for absenteeism, presenteeism, and/or unpaid work.

Monetary valuation

To express production loss owing to absenteeism in monetary values, measurement instruments should be suitable for using common valuation methods, namely the human capital method (HCM) and/or the friction cost method (FCM).[29,38,39]

To enable valuation using the HCM, next to data on direct information on absenteeism, data on long-term disability or premature death of patients, and national retirement age is necessary.[8,29] Given the availability of data on national retirement age and death of patients, measurement instruments only need to provide information on long-term disability to be suitable for monetary valuation using the HCM. Long-term disability refers to the often permanent, complete or partial inability to perform paid work. This commonly involves the (partial) loss of employment and, in that sense, is distinct from absenteeism where the inability to work is typically temporary and does not involve a loss of employment. Within the FCM, absence from work is only included in cost calculations for the period of time assumed required to replace the ill employee by a substitute; the so-called friction period. Therefore, this period needs to be specified, which can be estimated by using national or international data on vacancy durations. To be suitable for the FCM, a measurement instrument is required to assess absenteeism in more detail and also provide information on the number of periods and duration of absence from work (because new friction periods can start with new periods of absence).[16] This review assessed whether instruments provided the necessary information to apply these valuation methods.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagrams of literature searches of economic evaluations and validation studies.



Analysis

An overview of the identified instruments will be presented and their general characteristics and information on the suitability for use in economic evaluations from a societal perspective.

Results

The search of economic evaluations discovered 3496 articles of which 99 were included after title-and-abstract and full-text screening. The search on validation studies identified 2486 articles of which 9 were selected. The Preferred Reporting Items for

Table 2. Summary of study characteristics.

Item	Category	N = 108	%*
Country	The Netherlands	28	26
	United States	23	21
	United Kingdom	10	9
	Canada	8	7
	Spain	8	7
	Australia	7	6
	Germany	7	6
	Other	40	37
Type of study	Cost-effectiveness	49	45
	Cost-of-illness	47	44
	Cost-utility	42	39
	Validation	9	8
	Cost-benefit	1	1
Productivity loss of whom	Patients	98	91
	Caregivers	11	10
	Parents	1	1

*Total percentages may exceed 100 as certain studies were included in more than 1 category.

Table 3. Frequency of identified measurement instruments of productivity loss.

Measurement instrument (abbreviation, version)	Frequency in economic evaluations	Frequency in validation studies	Total frequency
Work Productivity and Activity Impairment Questionnaire-General health (WPAI-GH, version 2.0)	24	1	25
Work Productivity and Activity Impairment-Specific Health Problem (WPAI-SHP version 2.0)	9	1	10
iMTA questionnaire for Costs associated with Psychiatric Illness (TiC-P)*	9	0	9
Productivity and Disease Questionnaire (PRODISQ)	7	0	7
iMTA Productivity Cost Questionnaire (iPCQ)	5	1	6
Work Productivity and Activity Impairment (WPAI, no version specified)*	5	0	5
Health and Performance Questionnaire (HPQ, 7-day clinical trial version)	4	1	5
Client Service Receipt Inventory (CSRI)*	4	0	4
Health and Labour Questionnaire-Short Form (SF-HLQ)	3	0	3
Health and Labour Questionnaire (HLQ)	3	0	3
Migraine Disability Assessment (MIDAS)	3	0	3
Resource Utilization in Dementia (RUD)	3	0	3
Work Limitations Questionnaire (WLQ)	2	0	2
Quantity and Quality (Q-Q)	1	1	2
Stanford Presenteeism Scale (SPS-6)	1	1	2
Valuation of Lost Productivity Questionnaire (VOLP)	1	1	2
Health and Work Questionnaire (HWQ)	0	2	2
Client Sociodemographic and Service Receipt Inventory (CSSRI)*	1	0	1
Cost Interview	1	0	1
Family Cost Survey (FCS, version 1.0)	1	0	1
Health-Related Productivity Loss Instrument (HPLI)	1	0	1
MS Questionnaire	1	0	1
Patient Self-Assessment Questionnaire & Diary (SAQ)	1	0	1
Proforma for Cost of illness for Irritable Bowel Syndrome	1	0	1
Questionnaire by Agboola et al[46]	1	0	1
Questionnaire by Tanvejsilp et al[47]	1	0	1
Use of Services and Productivity Questionnaire (USPQ)*	1	0	1
Survey by Mumford et al[48]	1	0	1
The cost diary by Goossens et al[49]	1	0	1
Work and Health Interview (WHI)	1	0	1
Work Productivity and Activity Impairment plus Classroom Impairment (WPAI-CIQ-SHP, version 2)	1	0	1
Otago Cost and Consequences Questionnaire (OCC-Q)	1	0	1
Family Health Economic questionnaire*	1	0	1
Work absence question by Wynne-Jones et al[50]	1	0	0
Work Productivity and Activity Impairment Questionnaire-General Healthcare Giving V2.0 (WPAI:GH-CG)*	1	0	0
Endicott Work Productivity Scale (EWPS)	0	1	1
Headache-Attributed Lost Time Indices 30 (HALT-30 Index)	0	1	1
Headache-Attributed Lost Time Indices 7/30 (HALT-7/30 Index)	0	1	1
Headache-Attributed Lost Time Indices 90 (HALT-90 Index)	0	1	1
Health Productivity Scale (HPS)	0	1	1
Job-Stress-Related Presenteeism Scale (JSRPS)	0	1	1
Lam Employment Absence and Productivity Scale (LEAPS)	0	1	1
Nurses Work Functioning Questionnaire (NWFQ)	0	1	1

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Table 3. Continued

Measurement instrument (abbreviation, version)	Frequency in economic evaluations	Frequency in validation studies	Total frequency
Presenteeism Questions by Aronsson et al[51]	0	1	1
Question by Vänni et al[40]	0	1	1
Resource Use Questionnaire-Preschool (RUQ-P)	0	1	1
Single item presenteeism question (SIPQ)	0	1	1
Work Hoarse (VRS-8)	0	1	1
Work Productivity Short Inventory (WPSI)	0	1	1
Total	102	23	125

*Excluded from further analysis owing to identical productivity-loss questions, lack of information, or no original instrument.

Systematic Reviews and Meta-Analyses flow diagrams for the literature searches are presented in Figure 1. A full list of the included studies and their characteristics may be found in Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2021.05.002.

Study Characteristics

In total, 108 studies were included in this review, including 99 economic evaluations and 9 validation studies. Table 2 presents the summarized study characteristics. Most studies were performed in The Netherlands (28; 26%), the United States (23; 21%), and the United Kingdom (10; 9%). The most common study types were cost-effectiveness studies (49; 45%), cost-of-illness studies (47; 44%), and cost-utility studies (42; 39%) of which some applied more than 1 method. Almost all studies (98; 91%) measured productivity loss of patients, while others focused on caregivers and/or parents.

Included Measurement Instruments

Forty-nine measurement instruments of productivity loss were identified. The economic evaluations applied 34 instruments, and the validation studies reported on 22. Of these, 7 instruments were obtained through both searches.

Table 3 presents the identified instruments, ordered by frequency of use within the selected studies. The Work Productivity and Activity Impairment Questionnaire (WPAI)-General health (WPAI-GH, version 2.0), the WPAI-Specific Health Problem (version 2.0), and the Institute for Medical Technology Assessment (iMTA) questionnaire for Costs associated with Psychiatric Illness were applied most frequently in the included studies. More than half of the instruments (66.7%) were only applied once. From the 13 instruments that were only identified through the included validation studies, the question by Vänni et al,[40] the Resource Use Questionnaire-Preschool (RUQ-P), and the Work Hoarse were developed recently. Seven instruments were excluded from further analysis. The iMTA questionnaire for Costs associated with Psychiatric Illness was omitted because the iMTA Productivity Cost Questionnaire (iPCQ) was part of this instrument.[41] The Use of Services and Productivity Questionnaire was excluded because this instrument comprised a combination of the original quantity and quality method and the Health and Labour Questionnaire (HLQ).[42] The Client Service Receipt Inventory and the Client Sociodemographic and Service Receipt Inventory were removed from analysis because the component for measuring productivity loss is an exact copy of the WPAI-GH.[43] The Family Health Economic questionnaire[44] and the WPAI (no version specified) could not be included owing to a lack of information on the items used. Furthermore, the WPAI: GH-Care Giving version 2.0 could not be traced back to the original authors of the WPAI-GH.[45] Therefore, only the original WPAI-GH was selected. Thus, 42 unique instruments were included in the analysis.

General Instrument Characteristics

The general characteristics of the included instruments are presented in Table 4, sorted by the number of included components of productivity loss.

The number of both generic and disease-specific instruments was 21. Mode of administration was self-administered by patients for all but 7 instruments. The Cost Interview, the MS Questionnaire, and the Work and Health Interview involve interviews of patients. The Family Cost Survey, the Survey by Mumford et al,[48] and the RUQ-P consist of self-administration by the parent, and the Resource Utilization in Dementia (RUD) self-administration by the caregiver.

The number of items of the instruments ranged from 1 to 436, with an average of 39.8 and a median of 10 items. Notably, some of these instruments did not solely measure productivity loss and included other items as well, for instance the MS Questionnaire (436 items) and the RUQ-P (90 items). The number of items on productivity loss ranged from 1 to 50 items, with an average of 9.3 and a median of 6 items. Furthermore, recall periods of the instruments ranged from 1 day[87,47] to 2 years.[40] Most employed a recall period of less than 3 months. Additionally, 1 instrument covered the period from symptom onset until today,[69] and 1 used a variable period from admission date.[48] Notably, the instruments which were applied most frequently in the included studies had 6 items on productivity loss and a recall period of 7 days.

All but 3 instruments were available in English. The Cost Interview was only available in German,[72] the MS Questionnaire was only available in Spanish (Panama),[69] and the Productivity and Disease Questionnaire (PRODISQ) was only available in Dutch.[68] Seven instruments were available in more than 7 languages: the iPCQ,[55] the RUD,[80] the Valuation of Lost Productivity Questionnaire,[60] the Work Limitations Questionnaire,[70] and the 3 versions of the WPAI.[62]

From the 42 included instruments, 31 (73.8%) were available online. Eight (19.5%) were available online in only 1 or 2 of the existing translations. Notably, for most instruments, no information on conditions of use could be found online or in published studies. Instruments that did not require prior permission or

Table 4. General characteristics and suitability of measurement instruments of productivity loss for use in economic evaluations.

Instrument name and abbreviation	General characteristics				
	Focus of application	Mode of administration	Number of items (total)	Number of items (productivity loss)	Available online
Headache-Attributed Lost Time Indices 30 (HALT-30 Index)	Disease-specific	Self-report by patient	5	4	Yes, in English[52]
Headache-Attributed Lost Time Indices 90 (HALT-90 Index)	Disease-specific	Self-report by patient	5	4	Yes, in English[52]
Health and Labour Questionnaire-Short Form (SF-HLQ)	Generic	Self-report by patient	14	11	Yes, in English[54]
Health and Labour Questionnaire (HLQ)	Generic	Self-report by patient	23	11	Yes, in English[54]
iMTA Productivity Cost Questionnaire (iPCQ)	Generic	Self-report by patient	18	14	Not found
Migraine Disability Assessment (MIDAS)	Disease-specific	Self-report by patient	5	4	Yes[58]
Resource Use Questionnaire-Preschool (RUQ-P)	Disease-specific	Interview of parent	90	5	Not found
Questionnaire by Agboola et al[46]	Disease-specific	Self-report by patient	37	13	Yes[46]
Valuation of Lost Productivity Questionnaire (VOLP)	Generic	Self-report by patient	26	26	Not found
Work Productivity and Activity Impairment-Specific Health Problem (WPAI-SHP version 2.0)	Disease-specific	Self-report by patient	6	6	Yes[61]
Work Productivity and Activity Impairment plus Classroom Impairment (WPAI-CIQ-SHP, version 2)	Disease-specific	Self-report by patient	10	6	Yes[61]
Work Productivity and Activity Impairment Questionnaire-General health (WPAI-GH, version 2.0)	Generic	Self-report by patient	6	6	Yes[61]
Endicott Work Productivity Scale (EWPS)	Generic	Self-report by patient	25	Not found	Not found
Headache-Attributed Lost Time Indices 7/30 (HALT-7/30 Index)	Disease-specific	Self-report by patient	5	4	Yes, in English[52]
Health and Performance Questionnaire (HPQ, 7-day clinical trial version)	Generic	Self-report by patient	21	12	Yes[64]

NA indicates not applicable; NR, not reported.
*instrument meets full requirement (ie, includes all components, provides quantified measures for all components, or is suitable for use of both valuation methods).
†instrument does not meet the requirement (ie, only includes 1 component, does not provide quantified measures for any of the components, or is not suitable for use of any of the valuation methods).
‡instrument meets partial requirement (ie, includes 2 of 3 components, provides quantified measures for 1 or 2 components, or is suitable for use of 1 valuation method).

Table 4. Continued

			Identification	Measurement	Valuation
Conditions of use	**Languages**	**Recall period**	**Components included**	**Allows for quantification**	**Suitable for common valuation methods**
Can be freely used for clinical, research or other academic purposes[53]	English, Dutch, French, German, Italian, Portuguese, and Spanish[53]	30 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
Can be freely used for clinical, research or other academic purposes[53]	English, Dutch, French, German, Italian, Portuguese, and Spanish[53]	90 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism and presenteeism‡	No†
Not recommended for use since replacement with iPCQ,[55] should not be used without prior consent[56]	Dutch, English[57]	1 month	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	Yes, for HCM and FCM*
Not recommended for use since replacement with iPCQ,[55] should not be used without prior consent[56]	Dutch, English[57]	2 weeks	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	Yes, for HCM and FCM*
Available upon request,[55] no further information found	English, Dutch, Czech, Danish, Finnish, French, German, Hungarian, Italian, Korean, Norwegian, Polish, Portuguese, Romanian, Spanish, and Turkish[55]	4 weeks	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	Yes, for HCM and FCM*
Not found	English[58]	3 months	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
Permission needed,[59] no further information found	English, French (Canada)[59]	12 months	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism and unpaid work‡	No†
Not found	English[46]	NR	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism‡	No†
Available upon request,[60] no further information found	English (United Kingdom, Ireland), Dutch, French (Switzerland, France), German (Switzerland, Germany), Italian, Spanish, Arabic, Romanian, Polish, Hungarian, Norwegian, and Russian[60]	3 months, 7 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
No permission needed, no costs[62]	More than 40 languages, including English[62]	7 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
No permission needed, no costs[62]	More than 20 languages, including English[62]	7 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
No permission needed, no costs[62]	More than 20 languages, including English[62]	7 days	Absenteeism, presenteeism, and unpaid work*	Yes, for absenteeism, presenteeism, and unpaid work*	No†
Not found	English, and Turkish[63]	1 week	Absenteeism and presenteeism‡	Yes, for absenteeism‡	No†
Can be freely used for clinical, research or other academic purposes[53]	English, Dutch, French, German, Italian, Portuguese, and Spanish[53]	7 and 30 days	Absenteeism and presenteeism‡	Yes, for absenteeism and presenteeism‡	No†
Not found	English, Spanish[64]	7 days	Absenteeism and presenteeism‡	Yes, for absenteeism and presenteeism‡	No†

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Table 4. General characteristics and suitability of measurement instruments of productivity loss for use in economic evaluations.

Instrument name and abbreviation	General characteristics				
	Focus of application	Mode of administration	Number of items (total)	Number of items (productivity loss)	Available online
Health-Related Productivity Loss Instrument (HPLI)	Generic	Self-report by patient	6	5	Not found
Lam Employment Absence and Productivity Scale (LEAPS)	Generic	Self-report by patient	4	4	Yes[66]
Otago Costs and Consequences Questionnaire (OCC-Q)	Disease-specific	Self-report by patient	38	6	Not found
Productivity and Disease Questionnaire (PRODISQ)	Generic	Self-report by patient	50	46	Not found
Survey by Mumford et al[69]	Disease-specific	Self-report by parent	16	4	Yes[48]
The cost diary by Goossens et al[49]	Generic	Self-report by patient	11	1	Yes[49]
Work and Health Interview (WHI)	Generic	Interview of patient	15	Not found	Not found
Work Limitations Questionnaire (WLQ)	Generic	Self-report by patient	5	5	Not found
Work Productivity Short Inventory (WPSI)	Disease-specific	Self-report by patient	22	19	Yes[71]
Cost Interview	Disease-specific	Interview of patient	85	8	Not found
Family Cost Survey (FCS, version 1.0)	Disease-specific	Self-report by parent	6	1	Yes[73]
Health and Work Questionnaire (HWQ)	Generic	Self-report by patient	24	5	Yes[54]
Health Productivity Scale (HPS)	Generic	Self-report by patient	29	29	Yes[74]
Job-Stress-Related Presenteeism Scale (JSRPS)	Generic	Self-report by patient	6	6	Yes[75]
MS Questionnaire	Disease-specific	Interview of patient	436	5	Not found
Nurses Work Functioning Questionnaire (NWFQ)	Generic	Self-report by patient	50	50	Yes[76]
Patient Self-Assessment Questionnaire & Diary (SAQ)	Disease-specific	Self-report by patient	43	6	Yes[77]
Presenteeism Question by Aronsson et al[51]	Generic	Self-report by patient	1	1	Yes[40]
Proforma for Cost of illness for Irritable Bowel Syndrome	Disease-specific	Self-report by patient	37	10	Yes[78]
Quantity and Quality (Q-Q)	Generic	Self-report by patient	2	2	Yes[30]
Question by Vänni et al[40]	Generic	Self-report by patient	1	1	Yes[40]
Questionnaire by Tanvejsilp et al[47]	Disease-specific	Self-report by patient	22	9	Yes, in English[47]
Resource Utilization in Dementia (RUD)	Disease-specific	Self-report by caregiver	30	6	Yes, in English[80]
Single item presenteeism question (SIPQ)	Disease-specific	Self-report by patient	1	1	Yes[81]
Stanford Presenteeism Scale (SPS-6)	Generic	Self-report by patient	6	6	Yes, in English[82] and Dutch[83]
Work absence question by Wynne-Jones et al[50]	Disease-specific	Self-report by patient	1	1	Yes[50]
Work Hoarse (VRS-8)	Disease-specific	Self-report by patient	8	8	Yes[86]

registration were the 3 Headache-Attributed Lost Time (HALT) Indices, and the 3 versions of the WPAI. Additionally, items from the HLQ, Health and Labour Questionnaire-Short Form (SF-HLQ), PRODISQ, and quantity and quality method, were used to develop the more recently designed and validated iPCQ, which may therefore be seen as replacing and improving the previous instruments. The iPCQ was largely developed by the same research group involved in developing the instruments it replaces, and in doing so experiences with and evidence on the validity of the previous instruments was used.

Table 4. Continued

			Identification	Measurement	Valuation
Conditions of use	**Languages**	**Recall period**	**Components included**	**Allows for quantification**	**Suitable for common valuation methods**
Not found	English[65]	2 weeks	Absenteeism and presenteeism‡	Yes, for absenteeism‡	No†
Not found	English[66]	2 weeks	Absenteeism and presenteeism‡	Yes, for absenteeism and presenteeism‡	No†
Not found	English[67]	1 month	Absenteeism and presenteeism‡	Yes, for absenteeism‡	No†
Not recommended for use since replacement with iPCQ,[55] prior registration (no fee) is required[68]	Dutch[68]	3 months	Absenteeism and presenteeism‡	Yes, for absenteeism‡	Yes, for FCM‡
Not found	English[48]	Variable period from admission date	Absenteeism and unpaid work‡	Yes, for absenteeism and unpaid work‡	No†
Not found	English[49]	1 week	Absenteeism and unpaid work‡	Yes, for absenteeism and unpaid work‡	No†
Not found	English[16]	2 weeks	Absenteeism and presenteeism‡	Yes, for absenteeism and presenteeism‡	No†
Available upon request,[70] no further information found	28 languages, including English[70]	2 weeks	Absenteeism and presenteeism‡	Yes, for absenteeism‡	No†
Not found	English[71]	1 year/3 months/2 weeks	Absenteeism and presenteeism‡	Yes, for absenteeism and presenteeism‡	No†
Not found	German[72]	12 months	Absenteeism†	Yes, for absenteeism‡	Yes, for HCM‡
Not found	English[73]	NA	Absenteeism†	Yes, for absenteeism‡	No†
Not found	English[54]	1 week	Presenteeism†	Yes, for presenteeism‡	No†
Not found	English[74]	30 days	Presenteeism†	No†	No†
Not found	English[75]	NR	Presenteeism†	No†	No†
Not found	Spanish (Panama)[69]	From symptom onset until today	Absenteeism†	Yes, for absenteeism‡	No†
Not found	English[76]	4 weeks	Presenteeism†	No†	No†
Not found	English[77]	NR	Absenteeism†	Yes, for absenteeism‡	No†
Not found	English[40]	12 months	Presenteeism†	No†	No†
Not found	English[78]	NR	Absenteeism†	Yes, for absenteeism‡	No†
Not recommended for use since replacement with iPCQ[79]	English, Dutch[30]	1 day	Presenteeism†	No†	No†
Not found	English[40]	2 years	Presenteeism†	No†	No†
Not found	English, Thai[47]	1 day	Absenteeism†	Yes, for absenteeism‡	No†
Not found	43 languages, including English[80]	30 days	Absenteeism†	Yes, for absenteeism‡	No†
Not found	English, Persian[81]	30 days	Presenteeism†	Yes, for presenteeism‡	No†
Not found	English,[82] Dutch,[83] Italian,[84] Portuguese (Brazil)[85]	1 month	Presenteeism†	No†	No†
Not found	English[50]	4 months	Absenteeism†	Yes, for absenteeism‡	No†
Not found	English[86]	7 days	Presenteeism†	No†	No†

Suitability for Use in Economic Evaluations

Table 4 presents the assessment of the suitability of the included instruments for use in economic evaluations from a societal perspective in terms of identification, measurement, and valuation.

Identification of relevant cost components

From the 42 selected instruments, 32 (76.2%) contained questions on absenteeism, also 32 (76.2%) on presenteeism, and 14 (33.3%) on unpaid work. Eighteen instruments (42.9%) included 1 component (absenteeism, presenteeism, or unpaid work), 12

(28.6%) incorporated 2 components, and 12 (28.6%) contained all 3.

Operationalizing measurement

Thirty-four instruments provided data that allows for quantification of at least 1 component of productivity loss. Quantities of all 3 components were measured by the HALT-30 Index, SF-HLQ, HLQ, iPCQ, Migraine Disability Assessment (MIDAS), Valuation of Lost Productivity Questionnaire, WPAI-GH, WPAI-Specific Health Problem, and WPAI-CIQ-SHP.

Monetary valuation

Four instruments could be used for the monetary valuation of productivity loss using the HCM by also providing information on long-term disability: the SF-HLQ, HLQ, iPCQ, and the Cost Interview. The SF-HLQ, HLQ, iPCQ, and PRODISQ enabled the use of the FCM by providing additional information on periods of absence from work.

Considering the previous criteria of suitability for use in economic evaluations simultaneously, the SF-HLQ, HLQ, and iPCQ, 3 generic instruments, provided quantified measures of the relevant components of productivity loss and enable monetary valuation with the FCM and HCM. Nevertheless, as described in the section on general characteristics, among others, the SF-HLQ and HLQ were replaced by the more recently developed iPCQ.

Discussion

This study identified 42 unique measurement instruments of productivity loss. Previous studies have found 16 of these. For instance, the WPAI-GH and the HLQ were also found in previous systematic reviews.[13,14,16,18,20,21] In contrast, 26 of the included instruments in the current review were not identified in any of these previous reviews, for example the iPCQ, the HALT Indices, and the RUD.

Although many instruments were identified, our study found that most were not fully suitable for use in health economic evaluations from a societal perspective. This study aligns with previous studies finding that not all instruments include both absenteeism and presenteeism.[13,14,16,18,21] Our study adds to this finding by focusing on productivity costs from both paid and unpaid work and discovering that few instruments included unpaid work loss. Nevertheless, a small number of instruments did enable the quantification of productivity loss for all 3 components. Although some instruments deliberately focus on the measurement of only 1 or 2 components, the current study can inform researchers on the relevant components of productivity loss that might not be included when relying on these instruments. Furthermore, as with the earlier review by Tang,[16] the current study found that few instruments were compatible with the FCM. Supplementary to this observation, most instruments also did not provide information on long-term disability of respondents, therefore potentially causing a major underestimation of lifetime-productivity costs when applying the HCM. Importantly, some recent studies did not use the most recent instrument to measure productivity costs, but applied instruments that were replaced by newer instruments from the same developers. Thus, this review provides further evidence on the limited suitability of instruments to measure and value productivity loss for economic evaluations. Therefore, future research should focus on using or developing instruments that are valid and suitable for this use.

A noticeable difference between the identified instruments is the length of the recall periods, which vary from 1 day to 2 years. Previous studies have highlighted that recall of events is subject to error and bias.[88,89] Although longer recall periods generally result in less accurate estimates,[90–92] these might be necessary for capturing the impact on productivity loss due to infrequently occurring events or problems.[71] Few studies have investigated recall periods of productivity loss to improve accuracy of memory recall and thus limit recall bias. For instance, Severens et al[93] advised using a recall period of no more than 2 months, or rather 4 weeks, for precision in self-reported absence from work. In contrast, Goetzel et al[71] did not find different recall periods of absenteeism and presenteeism to have significantly different reliability. Hence, the literature about valid recall periods for questions absenteeism and presenteeism is inconclusive. Moreover, to our knowledge, no empirical evidence exists on the accuracy of recall periods for measuring unpaid production loss. As Stull et al[91] suggested in their article on optimal recall periods for patient-reported outcomes, no single standard recall period is appropriate for measuring all outcomes. Phenomena that are more constant over time have a higher chance of being recalled accurately.[91] In addition, salient events might allow for a longer recall period.[94] Therefore, differentiation between the recall periods of different components of productivity loss and medical costs might be necessary. Nevertheless, to our knowledge, no studies have investigated the effect of differing recall periods within 1 instrument on response accuracy. Additionally, recall period choices might depend on other factors as well, such as participant burden, costs, and measurement intervals,[17] which should be considered for individual studies. Factors influencing researchers' motivations for specific recall periods were not included in this study. This study provides insight into the different recall periods used and highlights the need to investigate (factors influencing) optimal recall periods of measurement instruments of productivity loss. The recall periods identified in this review may be used as a starting point in a comparative study on the accuracy of outcomes.

Most identified instruments were designed for data collection from the patients themselves. Nevertheless, this might not be feasible in-patient groups with severe mental or physical illness or with cognitive disabilities. Thus, in the absence of previous studies, patient-proxy agreement in the measurement of productivity loss should be studied to provide insight into the accuracy of self-report of for instance parents or caregivers.

Although this study can contribute to the well-informed choice of which instrument to use in economic evaluations, this could still be challenging.[8] The iPCQ appears to meet the criteria used in our current study and could therefore be recommended for use in economic evaluations. Nevertheless, specific economic evaluations might have specific needs for the measurement of productivity costs. This review may then be helpful in purposely selecting another instrument. The search for consensus on and harmonization of methods of including, measuring and valuing productivity costs should continue, within and across countries and within international studies. Transparency on the use of a specific instrument and motivations for this decision might contribute to the choice process.

Limitations and Strengths of the Study

Potential limitations must be considered when interpreting the results of this study. First, although a very thorough search strategy was applied, the exclusion criteria might have resulted in missing relevant studies. For instance, only English-language studies were included in this review. In contrast, a strength of this review is that instruments were not searched for in a direct way. By searching for economic evaluations that included either a societal perspective, indirect costs, or productivity costs, we were

able to include articles that did not mention productivity costs measurement instruments in their title or abstract.

Second, owing to feasibility reasons, economic evaluations and validation studies published before 2018 were excluded. Although a more elaborate review might have resulted in identifying additional measurement instruments, these instruments were, for some reason, then at least not applied in recent economic evaluations. Moreover, instruments that were only recently developed, or those that have had considerable research longevity, should have been found in the included validation studies.

Furthermore, in this review, measurement instruments were assessed using a predesigned data-extraction form to assess the suitability for use in economic evaluations. Although this elaborate form was composed with great care and with guidance from an international expert panel on productivity costs in economic evaluations, other aspects might be relevant for the instrument choice. Although validity and reliability were not assessed in the current study, which we think is an important issue to be addressed in future studies, we do provide information on whether the instruments could be used to measure and value the relevant components of productivity loss and thus were suitable for use in economic evaluations from a societal perspective. Furthermore, although this study was focused on absenteeism, presenteeism, and unpaid work, other components might also be relevant in the future. Some authors have suggested including compensation mechanisms and multiplier effects.[4,16,95] Nevertheless, measuring these might be difficult as little is known about their effect on productivity costs. To accurately include multiplier effects and compensation mechanisms, also in the valuation stage, further research is needed into their actual effect on productivity costs, the relationship between these components, and how to accurately measure these effects in different contexts. Such research would also facilitate developing instruments that could measure these aspects in a valid manner. Moreover, it might not always be necessary to include absenteeism, presenteeism, and unpaid work and to enable monetary valuation using both the HCM and the FCM (eg, if national guidelines state to use only 1). In contrast, applying an instrument that meets these criteria might promote comparability within and across (international) studies because this instrument could be suitable for a variety of patient groups and countries.

Conclusions

Although many instruments for measuring productivity loss were identified, most were not suitable for use in health economic evaluations from a societal perspective. There is a need for national and international guidelines on the choice of measurement instrument to promote the comprehensive inclusion of productivity costs and enhance comparability and transferability within and across countries.

Supplemental Materials

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.jval.2021.05.002.

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