ORIGINAL ARTICLES
Economic Evaluation

The iMTA Productivity Cost Questionnaire
A Standardized Instrument for Measuring and Valuing Health-Related Productivity Losses

Clazien Bouwmans, MSc1,2,* Marieke Krol, PhD1,2, Hans Severens, PhD1, Marc Koopmanschap, PhD1, Werner Brouwer, PhD2, Leona Hakkaart-van Roijen, PhD1,2

1Institute for Medical Technology Assessment, Erasmus University Rotterdam, Rotterdam, The Netherlands; 2Institute of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, The Netherlands

ABSTRACT

Background: Productivity losses often contribute significantly to the total costs in economic evaluations adopting a societal perspective. Currently, no consensus exists on the measurement and valuation of productivity losses.

Objective: We aimed to develop a standardized instrument for measuring and valuing productivity losses.

Methods: A group of researchers with extensive experience in measuring and valuing productivity losses designed an instrument suitable for self-completion, building on preknowledge and evidence on validity. The instrument was designed to cover all domains of productivity losses, thus allowing quantification and valuation of all productivity losses. A feasibility study was performed to check the questionnaire’s consistency and intelligibility.

Results: The iMTA Productivity Cost Questionnaire (iPCQ) includes three modules measuring productivity losses of paid work due to 1) absenteeism and 2) presenteeism and productivity losses related to 3) unpaid work. Questions for measuring absenteeism and presenteeism were derived from existing validated questionnaires. Because validated measures of losses of unpaid work are scarce, the questions of this module were newly developed. To enhance the instrument’s feasibility, simple language was used. The feasibility study included 195 respondents (response rate 80%) older than 18 years. Seven percent (n = 13) identified problems while filling in the iPCQ, including problems with the questionnaire’s instructions and routing (n = 6) and wording (n = 2). Five respondents experienced difficulties in estimating the time that would be needed for other people to make up for lost unpaid work. Conclusions: Most modules of the iPCQ are based on validated questions derived from previously available instruments. The instrument is understandable for most of the general public.

Keywords: absenteeism, presenteeism, productivity losses, unpaid work.

Copyright © 2015, International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc.

Introduction

Economic evaluations are increasingly performed to aid decision makers in allocating scarce health care resources. Such evaluations provide information on the relative cost-effectiveness of a (new) health care intervention compared with one or more (existing) alternatives [1]. Especially when decisions regarding the implementation or reimbursement of new interventions are (partly) based on economic evaluations, and these outcomes influence access of patients to interventions, it is essential that these economic evaluations be conducted consistently and uniformly. A fundamental methodological choice, typically strongly affecting cost-effectiveness outcomes, is the perspective from which an economic evaluation is performed [2].

Evaluations from a health care perspective normally aim to include only those costs that fall on the health care budget (and therefore may be seen as most relevant to health care decision makers). From a theoretical viewpoint, it can be argued that optimal (i.e., welfare maximizing) decision making is possible only by taking a societal perspective [3]. Evaluations conducted from the societal perspective aim to incorporate all relevant costs and effects, regardless of where these occur [1]. An important cost category relevant from this perspective (but not from the health care perspective) is that of productivity costs. The value of productivity changes owing to illness and treatment often reflects a large part of the total costs related to health and health care interventions [4] and may even exceed medical costs [2]. Consequently, the decision regarding the inclusion of
productivity costs in economic evaluations can have large implications for final outcomes. Some have argued that performing economic evaluations from both the societal and the health care perspective would be most informative [5–7]. Such a two-perspective approach is already recommended in several national health economic guidelines [8–11]. Despite the fact that some of the national health economic guidelines recommend a two-perspective approach and approximately half of the guidelines prescribe taking a societal perspective (http://www.ispor.org/peguidelines/index.asp), in practice productivity costs are ignored in the vast majority of economic evaluations [2,5,12,13].

It is unclear why productivity costs are ignored in economic evaluations so often. It has been suggested, however, that the exclusion of productivity costs in economic evaluations is related to a lack of guidance and standardization of measurement and valuation of health-related productivity losses [14,15]. Indeed, most health economic guidelines provide little or no guidance on how to estimate productivity costs. Moreover, golden standards regarding the measurement and valuation of productivity losses do not exist. Specific guidance as to the types of productivity costs that should be included in economic evaluations is generally limited as well [16]. In addition, validated questionnaires for measuring productivity losses are scarce and not systematically applied [19].

Costs associated with health-related productivity changes are commonly referred to as productivity costs and can be defined as “Costs associated with production loss and replacement costs due to illness, disability and death of productive persons, both paid and unpaid” [17]. Currently, the importance of inclusion of productivity costs related to paid work in economic evaluations taking a societal perspective is generally acknowledged. This is not (yet) the case for unpaid work [18]. Nonetheless, unpaid work clearly is an important source of economic value contributing to overall welfare. Given that health care interventions are often aimed at elderly populations who do engage in unpaid work but not in paid work, inclusion of these costs can be highly relevant in many studies. Three types of unpaid activities can be distinguished: household work (e.g., cooking and cleaning), care work (e.g., taking care of children, helping friends or family with cleaning and personal care), and volunteer work (e.g., helping out in a commodity center or a sports club). Despite unpaid work’s recognized importance, it is omitted from the vast majority of economic evaluations, even those that claim to take a societal perspective [4,18,19]. In addition, complete and validated measurement instruments for unpaid work are lacking. For instance, the measurement of unpaid work in the Health and Labor Questionnaire was limited to household tasks taken over by others [20]. The Work Productivity and Activity Impairment questionnaire asks about the ability to perform these tasks, with no opportunity to value in monetary terms [21].

Productivity changes in paid work may occur because of absence from work (absenteeism) or because of reduced productivity while at work (presenteeism). Information on absence from work (absenteeism) or because of reduced productivity while at work (presenteeism) can be included in economic evaluations is generally limited as well [16]. In addition, validated questionnaires for measuring productivity losses are scarce and not systematically applied [19].

This article reports on the development of a standardized instrument suitable for self-completion for measuring and valuing all relevant productivity losses: the iMTA Productivity Cost Questionnaire (iPCQ). For this purpose, we optimized the features of existing instruments. Our underlying aim was to enhance the generalizability and comparability of outcomes of economic evaluations.

### Methods

#### Development

A group of well-experienced researchers in the field of measuring and valuing productivity losses for use in economic evaluations of health care interventions was empanelled for the development of a standardized instrument for measuring and valuing productivity losses. This group of researchers (all working at the Erasmus University Rotterdam) consisted of four health economists (L.H.R., M. Koopmanschap, M. Krol, and W.B.) and two health scientists (C. B. and H.S.). During three interactive brainstorming sessions of 2 hours, the approach for the development of the questionnaire was discussed and the main quality criteria the instrument should meet were drawn up. These criteria were based on up-to-date scientific knowledge and practical experience of the researchers involved. The criteria are summarized in Table 1.

It was decided to base the standardized instrument on preexisting questionnaires by optimizing the features of these instruments developed within or in cooperation with Erasmus

### Table 1 - Summary of main criteria applied for the development of the iMTA Productivity Cost Questionnaire.

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization: Generalizability and comparability</td>
</tr>
<tr>
<td>Building on preknowledge and evidence on reliability and validity of existing questionnaires</td>
</tr>
<tr>
<td>Including absenteeism, presenteeism, and losses of unpaid work</td>
</tr>
<tr>
<td>Allowing to quantify productivity losses in descriptive and monetary terms</td>
</tr>
<tr>
<td>Suitable for valuations based on the human capital approach and the friction cost approach</td>
</tr>
<tr>
<td>Feasible to use for adults in a broad general population</td>
</tr>
<tr>
<td>Applicable in economic evaluations of health care interventions, independent of the disease area</td>
</tr>
</tbody>
</table>

---

---
University: the (Short-Form) Health & Labor Questionnaire (SF-HLQ) [20] and the PROductivity and DISease Questionnaire (PRODISQ) [33]. A number of items included in these questionnaires had already proved their usefulness in practice and had been validated. The primary criterion for the selection of appropriate questions for measuring different types of productivity losses was evidence regarding the validity of the measurements.

In general, consensus exists on the relevance of productivity losses of paid work for evaluations adopting a societal perspective. Nevertheless, productivity losses at work due to health problems (presenteeism) are frequently omitted. Another important area that is generally ignored concerns productivity losses of unpaid work. Still, given the aging of Western populations, a growing proportion of patients is retired. These patients, however, may still play an active role in society by performing nonpaid jobs or volunteer activities and by providing informal care [34]. The instrument needed to be able to capture all these aspects.

Another important prerequisite was that the questionnaire allowed for the quantification of productivity losses in descriptive terms (e.g., the number of days of absenteeism and presenteeism, the amount of losses of due to unpaid work) and in monetary terms. Given the ongoing debate on whether productivity losses are best valued with the friction cost approach or the human capital approach [25–32,35] and the lack of practical consensus [2,5,12,13], it was considered important that the questionnaire was suitable for both approaches. To do so, questions about the frequency and length of spells of absenteeism needed to be included.

The instrument should be suitable for patient self-completion to ensure efficient data collection. It was discussed whether the phrasing of the questions in the existing productivity cost instruments used as the foundation for the iPQ were sufficiently easily understandable for most of the general public. Difficulty of language could affect the validity and feasibility of the instrument. Therefore, after completion of the design of the iPQ instrument, it was sent to a specialized agency (http://www.bureautaal.nl) that rephrased the questions to language level B1. This language level is based on the Common European Framework of Reference for Languages, which plays a central role in language and education policy worldwide. The Common European Framework of Reference for Languages describes language ability on a scale of levels from A1 for beginners up to C2 for those who have mastered a language. Most levels are empirically validated (www.coe.int/lang-CERF). Language level B1 implies that the text can be comprehended by 95% of the general population, including lower educated persons [36]. To enhance the feasibility of the questionnaire, we kept the length of the questionnaires as short as possible.

The questionnaire has been translated into English, and in the future should be made available in multiple languages, allowing its use in national and international studies.

Results

General Structure of the Questionnaire

The iPQ consists of 18 questions, of which 9 are general questions to collect demographic information, such as age, sex, and respondents’ work status (e.g., number of hours per week of paid work and number of working days a week). Productivity losses are measured in three separate modules, allowing the option of leaving out specific types of productivity losses when these are not relevant for a specific population. The questionnaire adopts a recall period of 4 weeks. This period is based on research indicating that longer recall periods negatively affect the accuracy of self-reported presenteeism [41]. Evidence regarding the appropriate recall period for presenteeism, however, is indecisive [19]. In addition, the questionnaire provides an easily understandable general instruction for the respondent and routing instructions, allowing the respondent to easily skip questions that are not applicable to individual responders.

Absenteeism

The iPQ includes three questions for measuring productivity losses due to absence from work. The questions originate from the PRODISQ and the SF-HLQ and identify the occurrence of absenteeism from paid work and the length of absenteeism. In addition, the module includes a specific question to assess the starting date of long-term absence from work. Long-term absence in this context is defined as absence starting before the recall period. The validity of these questions was shown in a number of studies [20,38,41].

Presenteeism

Three questions are included to identify health-related diminished productivity at work. The questions are a combination of questions of the PRODISQ and the SF-HLQ. Respondents are asked whether they suffered from health problems at work and if so, for how many days (question originating from the SF-HLQ). Next, respondents are asked to rate their work performance on these days in comparison to their functioning on normal working days using a 10-point rating scale. The latter question is derived from the PRODISQ and based on the earlier developed Quantity and Quality (QQ) method [37]. Brouwer et al. [39] examined the construct and convergent validity of the alternative methods applied in the SF-HLQ and the PRODISQ. They concluded that estimates of productivity losses using the Quantity scale from the PRODISQ resulted in a better cost estimation than from the so-called Osterhaus method applied in the SF-HLQ. The Quantity scale estimate was “considered to better indicate the real quantity of lost productivity.” Reliability of presenteeism questions was previously examined using a test-retest design [38]. A satisfactory agreement was found on the reported efficiency rates (intraclass correlation coefficient of 0.729). In addition, moderate agreement was found on the reported number of days at work while impaired (intraclass correlation coefficient 0.556).

Productivity Losses of Unpaid Work

The questions in the unpaid work module were developed during two brainstorming sessions of the working group members. Measurement and valuation of losses of unpaid work in the SF-HLQ are limited to losses that are actually taken over by other persons, hence ignoring lost production. The members of the working group were of the opinion that all losses should be measured, whether production was taken over or not, to avoid underestimation.

To increase the measurements’ validity, unpaid tasks were defined. Respondents are asked whether they could perform less unpaid work, such as household work and volunteer work, as a result of health problems. Next, they are asked to state how many hours it would take someone else to replace this unperformed unpaid work. The latter approach was chosen for several reasons: 1) it ensures that all lost unpaid work is measured and not only the work that is actually replaced by others; 2) it ensures a reasonable estimate of required time of someone else (not hampered by health problems); and 3) it applies a “third-person criterion” distinguishing unpaid work from leisure time. To clarify, the third-person criterion denotes that all benefits from activities outside paid work that are replaceable by a third person are considered unpaid labor [40].
Valuation
To be able to produce productivity cost estimates with the human capital approach and the friction cost approach, the absenteeism questions were constructed in such a way that they allow for determining the length of individual absenteeism periods. This is necessary because with the friction cost approach productivity losses related to absenteeism are assumed to be restored after a “friction period,” that is, the period required to replace an ill worker.

Manual
A manual was developed to provide practical support for applying the instrument and for measuring and valuing productivity losses. The manual includes examples and instructions for estimating costs of productivity losses of (long-term) absence from work using the friction cost approach. In addition, the manual provides a codebook for the registration of data.

In some cases, the basic questions of the iPCQ relating to absence from work may not be feasible or appropriate, for instance, when the health problems are characterized by episodic exacerbations (e.g., migraine), which can cause strong fluctuations in patients’ productivity and frequent, short episodes of absenteeism [20]. Such fluctuating productivity patterns may ask for a more intense monitoring of productivity changes. Therefore, the iPCQ provides an alternative version for measuring these short episodes of absenteeism, which was derived from the Health and Labor Questionnaire. This version consists of daily log reporting on presence or absence from work. The validity of the daily log reports was assessed previously [20]. These alternative questions are included in the manual.

The questionnaire and the manual are available in Dutch and in English. The questionnaire is suitable for interview administration, traditional self-completion in writing, and Web-based applications.

Validation
The validity of several elements of the iPCQ originating from the preexisting instruments was previously investigated. As explained, the questions regarding unpaid work were newly developed. Although all modules need further validation, consequently, this implies that especially for the unpaid work module additional research is necessary to assess its reliability and validity.

All questions were rephrased by a specialized agency to make the questionnaire suitable for a broad general population. A feasibility study was conducted as the first step in the validation process of the iPCQ. This study was designed to test the consistency and intelligibility of the questionnaire. For this purpose, a convenience sample from the general population was asked to complete the iPCQ and to indicate whether it considered certain questions unclear. In addition, respondents were able to comment on the questionnaire’s instructions and its routing. Two students each randomly invited 100 adults from public places (e.g., shops, marketplaces, and passengers in public local transport) and relatives to participate in the study. An additional number of respondents was recruited by colleagues from our institute. The questionnaire was completed in writing. Respondents were asked to mark questions that were difficult to understand. The reason why the question was considered difficult to answer had to be reported in a separate document. Finally, respondents were asked to comment on the questionnaire and its structure. Questionnaires were returned by mail. Participation in the study was encouraged by allotting three vouchers of €50 among respondents. Responsiveness and ease of administration were also evaluated by measuring the questionnaire’s completion time of 30 participants by each of the students.

The feasibility study included a total of 195 respondents 18 years and older (response rate 80%). As can be seen in Table 2, 36% of the respondents were men; 25% reported a middle-level education, and 50% reported a higher level of education. A total of 62% were in paid profession. Ten percent of the respondents in paid profession reported having experienced absenteeism in the preceding 4 weeks, and 30% had experienced health problems at work affecting their level of productivity. The number of respondents experiencing problems in completing the iPCQ was small (n = 13). Two respondents reported that the routing from short-term absence from work to long-term absence was unclear. This routing between these questions was subsequently revised. Two respondents mentioned that explanatory statements preceding specific questions were overlooked because of routing instructions. In response to these comments, the placement of these instructions was revised. In addition, two respondents pointed out that the routing to the end of the questionnaire was unclear at some points. These routing instructions were revised. Two respondents indicated that the wording of the question on absence from work was confusing. Consequently, the wording was revised.

Five respondents experienced difficulties in estimating the amount of time that would be needed for other people to make up for lost unpaid work. Although we acknowledge the relative difficulty of this question, an easier yet (theoretically) correct alternative for this question is currently unavailable. For 60 respondents, the time to complete the iPCQ was measured. On average, the time to complete the iPCQ was 4.8 (± 2.6) minutes.

Discussion
This article reports on the development of the iPCQ, a standardized instrument for measuring and valuing productivity losses for use in economic evaluations of health care. Where possible, the development of the instrument was based on previously available instruments. The iPCQ is a short and concise instrument suitable for quantifying presenteeism at and absenteeism from paid work as well as productivity losses related to unpaid labor. The iPCQ has a modular structure that allows selecting relevant components of productivity losses for individual studies. The instrument is suitable for self-reporting, online use, and face-to-face interviewing. To enhance feasibility and responsiveness, the questions in the iPCQ are phrased in such a way that the questions are easily understandable for most of the general public, including low-educated people. In addition, to increase its feasibility, also in the context of patient self-reported measurements, the number of questions of the instrument is limited. On average, it took our convenience sample less than 5 minutes to complete the questionnaire.

| Table 2 – Characteristics of respondents in the feasibility study (N = 195). |
|----------------|------------------|
| Characteristic | Value            |
| Age (y), mean ± SD | 51.4 ± 17.7     |
| Sex: male, n (%)  | 70 (36)          |
| Education, n (%)  |                 |
| Low              | 20 (10)          |
| Secondary        | 71 (37)          |
| High             | 97 (40)          |
| Living with partner, n (%) | 130 (67) |
| Paid work (%)    | 121 (62)         |
Some aspects regarding the content of the iPCQ need to be noted. First, the iPCQ adopts a 4-week recall period, on the basis of previous research indicating less accurate reporting for longer recall periods [41]. This period is normally shorter than the interval of follow-up measurements in evaluation studies, in which measurements every 4 weeks are rare for practical reasons. This implies that interpolation and extrapolation of the measured productivity losses are necessary to cover the full evaluation period. Evidence regarding the appropriate length of recall periods for presenteeism is indecisive [19]. This topic therefore deserves more attention in the literature. For clarity and convenience of respondents, the recall period for presenteeism was set equal to that of absenteeism (i.e., 4 weeks). For reasons of reliability and comparability, we strongly advise to align with this recall period when using the iPCQ. It is important to realize that the validity of the measurements is influenced by three important aspects: recall bias, measurement quantity, and measurement gaps. Recall bias is likely to increase with longer recall periods. Shorter recall periods will result in an increase in either measurement moments or measurement gaps, needing interpolation between measurement moments. Consequently, decisions regarding recall periods should be taken with caution. Acceptable duration of measurement gaps depends on the fluctuation of productivity losses within the population of interest.

Second, the iPCQ does not include questions regarding compensation of lost productivity or regarding the effects of diminished productivity on coworkers (so-called multiplier effects). Empirical research has shown that coworkers often compensate productivity losses during regular hours [42–44] and that absenteeism and presenteeism can negatively affect the productivity of coworkers in cases of team dependency [45–47]. To what extent such mechanisms affect final production and actual costs, however, remains largely unclear. Therefore, adjusting productivity costs for compensation mechanisms or multiplier effects is premature. If future research provides insight into how to properly cope with compensation mechanisms and multiplier effects, in terms of not only their measurement but also their effect on actual costs, the iPCQ may need to be updated.

Third, regarding the measurement of unpaid work, the working group did not support current ways of including this in available instruments. Moreover, the limited amount of available scientific studies discussing unpaid labor offered little guidance regarding appropriate measurement approaches. Consequently, the questions in the unpaid work module were based on experience of the working group members. This implies that especially this module needs additional validation. We also emphasize that unpaid work deserves more attention in the scientific literature in general because it is often ignored while it may be influential especially in groups such as elderly, who often form a large part of treated patients.

Fourth, the iPCQ was developed using a modular structure that facilitates excluding irrelevant modules. We do advise, however, to exclude modules only after careful consideration and clear justification for doing so if one aims to conduct an economic evaluation from the societal perspective.

Finally, it is important to realize that the iPCQ is an instrument to quantify productivity losses (especially for use in economic evaluations). It does not measure workability or role functioning.

Although these aspects are important, they are commonly included in quality-of-life measures. They are therefore not seen as part of productivity per se, but as health effects and valued as part of quality of life.

Despite critical notes, the development of the iPCQ offers a valuable comprehensive tool to enhance the comparability and generalizability of outcomes in economic evaluations adopting a societal perspective. The application of standardized instruments is an important prerequisite for increasing the comparability of outcomes of economic evaluations. To test and to maintain the quality of instruments, however, it is essential to extensively validate instruments, to regularly assess the content on the basis of (new) scientific developments, and to adjust the instrument when necessary. Also, in that context, the validation of the iPCQ is an ongoing process. It is currently applied in several economic evaluations of interventions in different disease areas. The results of these studies are expected in the near future, allowing further assessment of the properties of the iPCQ and, where possible and required, improvement based on new scientific insights.

Conclusions

The iPCQ is a concise generic instrument developed to quantify health-related productivity losses of paid and unpaid work for use in economic evaluations. It is largely based on previously available instruments and builds on the current scientific state of play in productivity cost measurement and valuation. The instrument is unique in its language use because it has been especially developed to be understandable for the vast majority of the general public including low-educated people. Although many of the items of the iPCQ have been previously validated, further validation of the instrument is foreseen and encouraged. iPCQ is currently available in Dutch and English. Translations in other languages, for example, German, French and Spanish, is expected in the near future.

Source of financial support: The authors have no other financial relationships to disclose.

R E F E R E N C E S
