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Published in:
Social Science & Medicine

DOI:
[10.1016/j.socscimed.2017.02.025](https://doi.org/10.1016/j.socscimed.2017.02.025)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2017

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

van den Berg, B., Gafni, A., & Portrait, F. (2017). Attributing a monetary value to patients' time: A contingent valuation approach. *Social Science & Medicine*, 179, 182-190.
<https://doi.org/10.1016/j.socscimed.2017.02.025>

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Attributing a monetary value to patients' time: A contingent valuation approach

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ARTICLE INFO

Article history:

Received 24 May 2016

Received in revised form

8 February 2017

Accepted 14 February 2017

Available online 20 February 2017

Keywords:

The Netherlands

Contingent valuation

Patients' time

Monetary valuation

Economic evaluations

Willingness to pay

Cost-effectiveness analysis

ABSTRACT

It is hard to ignore the importance of patient time investment in the production of health since the influential paper by Grossman (1972). Patients' time includes time to admission, travel time, waiting time, and treatment time and can be substantial. Patients' time is, however, often ignored in economic analyses. This may lead to biased results and inappropriate policy recommendations, which may eventually influence patients' health, wellbeing and welfare.

How to value patient time is not straightforward. Although there is some emerging literature on the monetary valuation of patient time, an important challenge remains to develop an approach that can be used to monetarily value time of patients not participating in the labour market. We aim to contribute to the health economics literature by describing and empirically illustrating how to monetarily value the time of patients not participating in the labour market comprehensively, using the contingent valuation method. It is worth noting that our method can also be applied to people participating in the labour market.

This paper describes the development of the contingent valuation survey. We apply our survey approach to a sample of 238 Dutch patients not participating in the labour market: $n = 107$ Radiotherapy department (data collected between November 2011 and January 2013); $n = 44$ Rehabilitation department (March 2012–May 2012); $n = 87$ Orthopaedics department (January to June 2013). Results show that those patients value waiting time the highest (€30.10 per hour) and value travel and treatment time equally with respectively €13.20 and €13.32 per hour.

This paper encourages future empirical research refining and applying the developed survey methodology to create more data on how other subgroups of individuals value their patients' time.

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1. Introduction

Time is a scarce resource and plays an important role in the economic literature, see for instance the seminal work of Becker (1965) and the paper of De Serpa (1971). Both authors emphasize that individuals use market goods and time to produce commodities that enter the utility function and that the level of utility that can be achieved depends on the time that is allocated to produce these commodities. They state that the available amount of time is a constraint for achieving higher utility levels. Consequently, individuals have to decide on the allocation of their own time to the

production and consumption of commodities (De Serpa, 1971).

The importance of time investment in the production of health was demonstrated by Grossman (1972). His theory of demand for health uses the production function model of consumer behaviour developed by Becker (1965) to describe the relationship between market goods and time (labeled as 'health inputs') and health as output. Clearly, medical care is one of the market goods that can be used to produce health. For instance consumers may use general practitioner (GP) visits and their own time for visiting the GP to improve their health.

Patient time uses related to medical care consumption include time to admission, travel time, waiting time and treatment time. Time to admission can be defined as the time between the first referral and the moment that the treatment actually starts. Travel time is defined as the time that a patient needs to travel between

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the place where the patient lives and the medical care centre where the patient is treated. Waiting time is defined as the time that the patient waits at the health centre before treatment. Treatment time is defined as the time spent receiving the active treatment e.g. by a doctor, nurse or technician. Time to admission differs from the other types of time. In principle when the patient is waiting to be invited for treatment he can use that time to do other things which is not true for the other types of time. Waiting for access to treatment might however involve various degrees of psychological burden for patients (Vermeulen et al., 2005; McCormick et al., 2006) or those who care for them (Claar et al., 2005).

In the area of economic evaluations of healthcare interventions, the valuation of patient time is a topic of debate; see Ernst (2006) for an overview of the conceptual issues involved in the valuation of patient time for economic evaluations. It has been argued that ignoring time in cost-effectiveness analysis (CEA) can bias the results, especially when time costs are substantial. For instance, Russell (2009) investigates the effects of patient time in smoking cessation interventions on CEA results. She shows that, for some interventions, taking into account patient time does not affect the results of CEA, whereas, for others, it invalidates the results. For instance, in the case of group intensive counseling without nicotine replacement for smoking cessation, costs per quality-adjusted life-year (QALY) were substantially higher after inclusion of patient time. In contrast, in the case of full counseling by a physician without nicotine replacement for smoking cessation, inclusion of patient time did not increase the costs per QALY as much. Also, inclusion of patient time substantially changed the cost per QALY of screening colonoscopy and self-monitoring of blood glucose (Russell, 2009). Whether or not as well as how to include and value patient time could therefore influence resource allocation decisions via the results of economic evaluations and may even ultimately influence patients' welfare.

How to value patient time is not straightforward (Russell, 2009). Various methods are available to value patient time monetarily. In the case of patients with paid jobs, one could use the opportunity cost methods and use patients' wage rate to value their time (e.g. Borisova and Goodman, 2003; Russell, 2009). In the case of patients not participating in the labour market, valuation of patient time is more complex. Patient groups not participating in the labour market include older (retired) individuals, housewives and -men, and people of working age who are not able to work because of health problems. These subgroups are a substantial part of the demand for care in the healthcare market. Although one could consider using patients' reservation wages to value their time, this seems an imperfect solution especially for the retired and people of working age who are not able to work because of health problems (Russell, 2009).

An important challenge is to develop an approach that can be used to monetarily value time consumed while undergoing medical treatment of people not participating in the labour market. Preferably the approach should not be too complex. We propose to use the contingent valuation method, as this method uses surveys to measure individuals' monetary valuation of hypothetical situations (O'Brien and Gafni, 1996). The advantage of this method is that it can be used to value welfare implications in the absence of a market (Propper, 1995), or via hypothetical situations in anticipation of medical innovations. The method is also less demanding for respondents than for instance discrete choice experiments (Van den Berg, 2005). It is worth noting that our method can also be applied to people participating in the labour market.

Ideally the developed methodology involves a comprehensive valuation of patient time. This means that it can be applied to various types of patient time, e.g. time to admission, travel time, waiting time and treatment time. So far other studies have focused

on a particular type of time and we aim to contribute to the health economics literature by developing a comprehensive method to monetarily value patient time.

In this paper we describe the development of the contingent valuation. The contingent valuation can be used to monetarily value hypothetical situations in the absence of a market. It does so by framing scenarios which respondents are asked to imagine. Subsequently, respondents are asked whether or not they are interested in a given scenario (hence indicating the individual preferences toward this scenario). If they indicate they are interested, they are asked to state their maximum willingness to pay for the preferred scenario or their minimum willingness to accept if they are forced to have a non preferred scenario (monetary values) (Mitchell and Carson, 1989; O'Brien and Gafni, 1996). This paper uses willingness to pay as it is about reductions in time (i.e., assumed to be a preferred scenario). The willingness to pay reflects the monetary value of patient time according to the contingent valuation method. As it is based on hypothetical willingness to pay it is followed up by a "certainty question" and respondents who are not certain about their willingness to pay are not counted which was found to reduce the effect of the situation being hypothetical (hypothetical bias) (Blumenschein et al., 2001, 2008).

This paper also presents the first empirical results of applying the developed survey methodology in a sample of patients not participating in the labour market. Data was collected in three departments of two Dutch hospitals: Radiotherapy, Orthopaedics, and Rehabilitation. They were chosen because the medical treatment of all subgroups involved a substantial amount of patient time and because a substantial number of patients were expected not to participate in the labour market.

2. Institutional context and the contingent valuation survey

The enactment of the Health Insurance Act in 2006 reformulated the Dutch health insurance system in a manner according to the principles of managed competition (Enthoven, 1978; Enthoven and Van de Ven, 2007). Under the Health Insurance Act, all citizens are required to be covered by private health insurance and all health insurers are required to accept all applicants during an annual open enrollment period. Coverage is financed by a combination of community-rated premiums, which are set by insurers, and income-related contributions set by the government. In addition, the new system includes a risk equalization mechanism to counteract incentives for risk selection (stemming from community rated premiums) with the goal of ensuring a level playing field for health insurers. Insurance products must cover a legally defined package of basic benefits, though the reform legislation gives insurers flexibility to design their products to better appeal to consumers and the ability to selectively contract with health care providers.

In this system, health insurers might be able to influence the length of different components of patients' time input. For instance, if health insurers believe that shorter waiting time for service in some providers is a reflection of consumers' preferences in favour of these providers, they could allocate extra money to these providers enabling them to increase capacity and therefore reduce waiting times. They might also contract health care providers with shorter waiting times (defined as time to admission and time spent in the waiting room). Also in case of travel time insurers could play a role. They seem increasingly supportive of, for example, hospitals which open specialized treatment centres in the community to facilitate access to treatment of older individuals. Another example relates to severely ill people as it is quite common that health insurers have contracts with taxi companies to reduce travel time and the discomfort associated with travel time. More generally, health

insurers within a system of managed competition have incentives to invest in reducing patient time inputs as long as citizens (and/or their employers) are willing to pay for these reductions. Since January 2006 all Dutch citizens are used to thinking in terms of health insurers having a role in potentially influencing healthcare providers as well as in terms of willingness to pay for health insurance and deductibles. It seems therefore reasonable to argue that because of the 2006 health care reform the contingent valuation method becomes a natural way to derive people's values regarding alternative potential treatments with varying amounts of patient time inputs.

3. Development of the contingent valuation survey

3.1. Development of scenarios to value patient time

The framing of the survey questions is an important component of a contingent valuation study. Contingent valuation questions are by definition about hypothetical situations. However, researchers should make a substantial effort to attempt to phrase questions realistically. In this respect, it is recommended to connect to respondents' perceptions (Schläpfer and Fischhoff, 2012). All scenarios included in the survey have therefore been developed in close collaboration with health care providers of the three included hospital departments. We also added some open-ended questions to check how realistic our scenarios were.

It is well known that patient time can have negative or positive effects on health status; see for instance Luce et al. (1996). One could argue that increasing variation in patient time is likely to result in increasing negative or positive effects on health status. A crucial part of phrasing the contingent valuation questions so that their values will be used for example in CEA, is trying to abstract from the impact of time changes on patients' health to avoid counting time as both a cost and an effect (Drummond et al., 2005).

In general terms we have developed similar scenarios to value patient time across the three patient groups (i.e. radiotherapy, rehabilitation and orthopaedics patients). There are, however, some slight differences between the patient groups that relate to the specific context of each patient group. The main difference is that, in the case of radiotherapy, we use the expected number of treatment of each patient in each scenario and therefore total time saved varies per patient.

The general **time to admission** scenario is:

Suppose it would be possible to reduce time to admission to the Department where you are treated (NAME) from M weeks to N weeks. This could for instance be done by employing more people. Suppose this reduction in time to admission would neither influence the effectiveness of your treatment nor the side effects of the treatment.

The general **treatment time** scenario is:

The total treatment time at the Department you are treated (NAME) takes typically M minutes. Most patients will be treated NUMBER of times per TIME PERIOD/IN TOTAL.

Suppose we could reduce the time necessary to undergo a treatment to T minutes instead of the typical M minutes, every treatment would now last Z minutes. Assume this reduction in treatment time would neither influence the effectiveness of your treatment nor the side effects. This has been scientifically proven.

The general **waiting time** scenario is:

The next questions are about the time you have to wait during the days you are undergoing TREATMENT at the NAME. You could consider waiting time in the waiting room.

Suppose it would be possible to reduce the waiting time in the NAME by half. The reduction of your waiting time does neither influence the effectiveness of your treatment nor the side effects.

The general **travel time** scenario is:

Suppose it would be possible to reduce your travel time from the place you are currently living and the treatment centre NAME during the total period of your treatment by half. This could for instance be done by opening a few small but specialized treatment centres in the community.

3.2. Development of the payment questions

Asking for willingness to pay in a health insurance system is not straightforward. This issue relates to the payment vehicle. One could ask for increased co-payments and/or supplementary health insurance. Slightly more complicated, but more realistic in our case, might be to ask respondents to choose from different health insurance companies offering packages that differ with respect to purchased care from affiliated care suppliers. This approach was successfully adopted by Van den Berg et al. (2008) and connects most closely to current developments within the Dutch health care system (Van der Star and Van den Berg, 2011). We opted for out of pocket payments by asking the respondents to assume that their health insurer would not be willing to pay the extra service. This was done to avoid the large sample size required when asking respondents how much extra insurance premium they would be willing to pay to get extra coverage including the new service. As the extra payments are likely to be small fractions of the existing premium, very large samples are required to be able to detect statistically significant differences between the values patients attach to various types of time difference.

There has been considerable debate on the answering formats of contingent valuation studies. Haab and McConnell (2002, chapter 5) give a comprehensive description of the trade-offs researchers have to consider when choosing between various answering formats in contingent valuation studies. They emphasize the importance of prior information to inform answering formats. The purpose of this paper is not to contribute to the debate about answering formats but to provide a way to assess the value of time. We opted for an alternative approach that has not been applied yet by proposing a number to the respondents and subsequently asking if they would or not be willing to pay this number as well as providing them the option to pay more or less as the stated number after they had answered respectively yes or no. The number was based on the mean net hourly wage in the Netherlands. In case of time reduction expressed in weeks, we did not use the mean net hourly wage as it resulted in very large amounts that patients would probably not be willing to pay. To make the scenarios more realistic, we decided to provide a smaller number as a starting point.

There is no agreement on how to choose the starting point for finding individuals WTP. Applying the opportunity cost method for people who work would involve sometime using the mean wage of similar people based on the labour-leisure theory. We therefore opted for using wages as a starting point because we considered this as a natural starting point. Therefore our numbers are according to Haab and McConnell (2002) based on prior information about wages and our results (based on small sample because our main aim is to develop the scenario and not to come up with the numbers based on representative sample) can be used as prior information for other researchers. We obviously encourage others to use our empirical findings to generate start bids or create payment cards in future patient valuation of time studies. We also give respondents a follow up question about the certainty of their stated willingness to pay answer. This approach was shown to produce valid willingness to pay answers (Blumenschein et al., 2008).

The general **payment questions scheme** for treatment time starts with the following questions:

Would you be willing to undergo this equally effective but shorter treatment?

O Yes, I would be willing to undergo this equally effective but shorter treatment.

O No, I would not be willing to undergo this equally effective but shorter treatment.

The willingness to shorten the patient time in medical consumption is not just helpful for respondents to get into the valuation tasks but it is also informative as it measures patients' preferences for shortening the time irrespective of their willingness to pay.

Subsequently we moved to the monetary valuation task:

This new technique which reduces your treatment time is more expensive than the normal treatment. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs out of your own pocket.

Please recall your net monthly income and your monthly expenses on rent/mortgage, food, clothes and so on, as well as other things you would like to spend your money on.

Suppose you have to undergo NUMBER treatments. Would you be willing to pay more than NUMBER euro to reduce your treatment time from NUMBER to NUMBER minutes during all planned NUMBER treatments?

O Yes, what would be the maximum amount you would be willing to pay? I would be willing to pay euro once to reduce my treatment time during all planned NUMBER treatments from NUMBER to NUMBER minutes.

O No, what would be the maximum amount you would be willing to pay? I would be willing to pay euro once to reduce my treatment time during all planned NUMBER treatments from NUMBER to NUMBER minutes.

How sure are you about your stated willingness to pay?

O Sure

O Not sure

The reduction in waiting time would cost money. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

The general payment question schemes for the time to admission, waiting time and travel time are identical to the one described under the general treatment time scenario. For more details on the exact survey questions per time category and per patient group respectively see [Van den Berg et al. \(2013\)](#).

3.3. Ethical approval

The Medical Ethics committee of the VU University Medical Centre Amsterdam and of the hospitals involved gave ethical approval for our contingent valuation survey. We asked patients first to give their informed consent and then to complete a written survey.

3.4. Hypotheses and econometric tests

We also consider if the contingent valuation responses are sensitive to three key elements: (1) patients' income, (2) patients' actual time use and (3) patients' health.

We hypothesised that willingness to pay increases with:

- the patients' income;
- the time actually spent on travelling; waiting and being treated;

and decreases with:

- health of the patients;

and correlates with other socio-demographics.

Within the contingent valuation literature, it is, however, not uncommon to test for sensitivity to income of stated willingness to pay questions, as such a relation exists in theory and an empirical association is considered as supportive for the validity of the stated preference method.

It would also help to confirm the validity of the developed contingent valuation questions if the patients consider the quantity of their current amount of time investments in medical care consumption in their stated willingness to pay. Although this relation is less strict in theory, it is worth testing.

The third hypothesis relates to patients' health. We assume this difference in willingness to pay is because of the difference in the initial health. Lower initial health involves lower utility than better initial health hence the same level of health gain (assumption changes in time do not affect effectiveness treatment) represents a relative greater improvement if initial health is lower. Therefore willingness to pay for shortening time is higher if initial health is lower.

The three hypothesis were tested using Probit and Tobit analyses. Firstly, we used Probit analyses to study the relationship between (1) the willingness to shorten patient time and (2) the willingness to pay for shortening patient time and log (income), self-assessed health, and self-reported time per time category. Secondly, we used Tobit models to study the relationship between the stated willingness to pay (1) for all respondents and (2) only for the respondents who were sure of their answers and, again, log (income), self-assessed health, and self-reported time per time category. We decided to use Tobit models instead of linear regression analyses to correct for the heaping at 0 (i.e. WTP = 0 for the respondents who do not want to pay for the reduction in patients' time). We also tried other characterizations of income (such as using income and using a dummy indicating high incomes). All analyses were controlled for gender, age, age squared, type of patient, marital status, and highest educational level attained. The analyses were performed for the various types of patient time.

In all analyses, a statistical significance level of 5% was used. All statistical analyses were performed using STATA 12 (StataCorp. 2011, Stata Statistical Software: Release 12. College Station, Texas: StataCorp., LP.).

4. Data

4.1. Study population

Student assistants distributed the written surveys in the waiting room of the Orthopaedics department. The patients could either complete the survey while waiting and hand it over back to the student assistant or complete the survey at home and return it by post (in a stamped envelope). In the case of the Radiotherapy and Rehabilitation departments, the medical doctors instead of the student assistants invited the patients to participate in the study.

Inclusion and exclusion criteria: All respondents had to be able to fill in the questionnaire, as was determined by the interviewer, able to understand the Dutch language and currently not participating in the labour market. An additional inclusion criterion at the Radiotherapy department was that the patients (with cancer) were not undergoing palliative radiotherapy. Therefore patients with very severe cancer (as a consequence of which they cannot be treated anymore) are excluded from our study.

4.2. Survey questions

4.2.1. Demographic and socio-economic characteristics

Involvement in the market force was measured using answering

categories (1 = retired; 2 = unemployed; 3 = disability pension/sickness leave; 4 = housewife/man; 5 = students; 6 = others). We also asked patients' gender and age, marital status and the highest level of education. Education level is measured using three categories: 1 = "Only elementary education completed or less, or only low professional education"; 2 = "Intermediate professional or secondary education", 3 = "High professional or university education". Net monthly household income was measured using a few answering categories.

4.2.2. Health

The patients were asked to complete a standard self-assessed health question and the EQ-5D-3L (Dolan, 1997). The Dutch population values were applied (Lamers et al., 2006).

4.2.3. Time use characteristics and contingent valuation questions

In addition to the scenarios presented above, we measure patients' self-reported time use. These questions had either open answering categories, asking for hours and/or minutes per treatment per day, or they had to opt for a listed option. To help the respondents to think about the time they spend on medical care consumption, especially in case of travel time, we asked them also about their residence before we asked about their usual one way travel time from their place of residence to get their treatment. The answering categories included home, hospital, care home, or nursing home.

Per department, we varied the order in the questionnaires of the contingent valuation questions on waiting time, travel time and treatment time as well as the order of the answering categories (Yes and No). This is to avoid response bias.

To make the valuations comparable across the scenario's, we computed the mean willingness to pay per hour shortening of patient time per department.

5. Results

5.1. Sample characteristics

Student assistants distributed surveys to 84 rehabilitation patients, to 229 radiotherapy patients and to 275 orthopaedics patients. 64 rehabilitation patients (76.0%), 142 radiotherapy patients (62.0%) and 153 orthopaedics patients (55.6%) completed our survey. 68.7% of the rehabilitation respondents, 75.3% of the radiotherapy respondents, and 56.8% of the orthopaedics respondents were not working which amounts to a total of 44 rehabilitation patients, 107 radiotherapy patients and 87 orthopaedics patients who are included in our study.

Table 1 gives the sample characteristics of the 238 patients by patient group as well as for the total sample.

The 238 patients are not participating in the labour market. A very small fraction of the respondents is unemployed and around 16% is a housewife/man. Not surprisingly, almost half of the rehabilitation patients have a disability pension or are on sickness leave. This holds for 26% of the radiotherapy and orthopaedics patients. A large fraction of the patients are retired ranging from over 34% in case of rehabilitation to almost 50% in case of radiotherapy. This relates obviously to the mean age of our sample of around 61 which is quite consistent over the patient groups. The majority of patients are married and almost all patients live at home and are not staying in a hospital or nursing home. In the case of radiotherapy patients this seems a consequence of our inclusion criteria: only patients who are likely to be cured are included. The net monthly household income of the sample is around €1900 and is quite similar over the patient groups. There are no striking differences in patients' general health between the subgroups.

The mean time to admission is 21 days. The mean and standard deviation for radiotherapy patients is smaller than for rehabilitation patients. The mean travel time is about 33 min, and is the highest for radiotherapy (equal to 41 min on average). This is not surprising as there are relatively less radiotherapy departments in the Netherlands compared with rehabilitation or orthopaedics departments. The average waiting time is considerably higher by orthopaedics than in other departments (34 min compared to about 13 min by rehabilitation and radiotherapy). Not surprisingly, the longest treatment time is by rehabilitation because the patients have to exercise during treatment. The treatment time equals about 30 min for radiotherapy and about 20 min for orthopaedics.

5.2. Patient time valuation

Table 2 gives the mean willingness to pay by patient time category. To avoid overestimations in stated preferences willingness to pay answers, we also present the frequencies of patients being certain/sure about their stated willingness to pay and the means conditional on being certain and excluding the willingness to pay equal to 0. Totals are presented in the last column of Table 2.

About 44% of the respondents are willing to shorten their time to admission (the percentage is substantially larger for radiotherapy patients). Over half of the patients prefer shortening in travel time except in the case of orthopaedics. This makes in total 46.9% of patients preferring shorter travel time. Almost half of the orthopaedics patients prefer shortening waiting time whereas less than 20% of radiotherapy and 15% of rehabilitation patients prefer shortening waiting time. The large majority of almost three quarter of patients prefers shortening in treatment time. This percentage is quite consistent over the patient groups with a slightly lower percentage in case of radiotherapy.

Almost half of the patients prefer to shorten their travel time, about 25% prefer to shorten waiting time and almost 75% prefer to shorten treatment time. This does not necessarily imply they would all be willing to pay for shortening. Table 2 shows that around 10% of the total sample would be willing to pay for shortening on average, except for waiting time in case of rehabilitation and radiotherapy patients (here around 3%). A few respondents give inconsistent answers in the sense that they report not willing to shorten their patient time and still indicate that they are willing to pay for a reduction in patient time.

The maximum willingness to pay for an hour time input reduction of our respondents is ranging from €0.19 per hour shortening in case of rehabilitation travel time to €4.00 per hour shortening in case of radiotherapy treatment time. The mean willingness to pay for a reduction of one week of the time to admission is low and equals €13.00. These averages are obviously deflated by the people who are not willing to pay and by a few people who stated they would be willing to pay but subsequently reported a zero when we asked for the amount they would be willing to pay.

About 25% of our respondents also report that they were not sure about the amount they stated. This is quite low compared with other studies. For instance 38% of respondents ($n = 84$) in Blumenschein et al. (2001) are willing to pay for an asthma management program provided by a pharmacist. On average, 14% of the patients are sure to be willing to pay. This percentage is similar to the percentage of patients actually purchasing the program in the intervention group of the experiment. After only accounting the patients who were sure about their willingness to pay, the willingness to pay for reduction in travel time by rehabilitation patients is still the lowest with €3.75 per hour and with €38.00 per hour the highest in case of radiotherapy treatment time. These figures are based on low numbers of respondents. The main reasons for this

Table 1
Characteristics sample and Patient time use.

		Rehabilitation	Radiotherapy	Orthopaedics	Total
Demographic and socioeconomic characteristics					
Employment status (%)	Disability insurance	47.7	26.0	25.3	29.9
	Retired	34.1	49.0	42.2	43.7
	Unemployed	/	2.9	2.4	2.2
	Housewife/man	15.9	16.4	16.9	16.4
Age:	Mean age (SD)	58.0 (16.2)	64.3 (12.7)	58.5 (17.5)	61.08 (15.4)
Gender (%):	Male	52.7	34.5	29.1	35.8
Marital status (%):	Married	63.6	70.1	70.1	68.9
	Widowed	11.3	14.9	10.3	12.2
Level of education (%)	Lower (professional) education	20.4	31.7	25.6	27.4
	Intermediate education	61.3	34.6	34.9	35.9
	Higher education	34.1	30.8	34.9	32.9
Residence (%):	Living at home	100	96.2	98.8	97.8
Income:	Mean net monthly household income (SD) (% Missing income)	€1970/£2275 (807)(9)	€2036/£2351 (1147)(7)	€1782/£2058 (1095) (12)	€1936/£2236 (1074)(9)
Health Characteristics					
Self Assessed Health (%)	Excellent	0	0.9	0	0.4
	Very good	0	12.2	11.6	9.8
	Good	44.2	41.5	53.5	46.4
	Average	48.8	40.6	34.9	40.0
	Bad	7.0	4.7	0	3.4
EQ5D:	Mobility (0 = 'no problems in walking about' to 2 = 'confined to bed')	0.50	0.36	0.67	0.50
	Self-care (0 = 'no pb with self-care' to 2 = 'unable to wash or dress myself')	0.27	0.13	0.15	0.16
	Usual act.(0 = 'no pb performing usual act.' to 2 = 'unable to perform usual act.')	0.75	0.61	0.62	0.64
	Pain/discomfort (0 = 'no pain or discomfort' to 2 = 'extreme pain or discomfort')	0.81	0.55	1.06	0.78
	Anxiety/Depression (0 = 'not anxious or depr.' to 2 = 'extremely anxious or depr.')	0.38	0.29	0.21	0.28
	TOTAL score EQ5D (0 = 'death' to 1 = 'full. health')	0.67	0.75	0.64	0.69
	Mean EQ5D (VAS): (0 = 'Worst health imag.' to 10 = 'Best health imag.')	6.22	5.86	6.68	6.22
Pain:	Mean score (0 = 'no pain' to 10 = 'the most intense pain imag.')	3.42	2.62	5.21	3.65
Characteristics of Patient Time					
Mean time to admission in days (SD)		27.9 (38.9)	17.6 (15.1)	25 (14.1)	20.8 (25.2)
Mean Travel time (one way) in minutes (SD)		26.2 (13.6)	41.1 (19.2)	34.2 (23.1)	32.7 (18.2)
Mean Waiting time in minutes (SD)		11.1 (12.1)	16.9 (16.2)	26.1 (19.0)	21.2 (20.1)
Mean Treatment time in minutes (SD)		73.9 (37.7)	30.1 (9.1)		33.0 (28.8)
Number of respondents		44	107	87	238

are that few people are willing to pay for a reduction of their patient time and only 75% of them are sure of their stated willingness to pay. Three radiotherapy respondents are willing to pay around €266.00 for one week reduction of their time to admission. Overall people seem to put the highest value on waiting time (€30.10 per hour) and value travel and treatment time equally with respectively €13.20 and €13.32 per hour.

5.3. Correlations between patient time valuations and individual characteristics

Table 3 presents for the various types of patient time the results of the regression analyses exploring if the valuations of patients' time vary across income groups, health status and self-reported patient time.

Regression results for willingness to shorten patient time are presented in the second column of Table 3. The results show that longer self-reported travel and waiting time are statistically significantly and positively associated with patients' stated willingness to shorten this type of time.

The third column of Table 3 gives the results of being willing to pay for shortening the various types of patient time. Mean travel time is positively associated with being willing to pay for

shortening travel time. Income is positively associated with being willing to pay for shortening waiting time.

The association between willingness to pay and being sure about willingness to pay are presented in respectively the fourth and fifth columns of Table 3. Income is positively associated with willingness to pay for shortening travel time and also with being sure about willingness to pay for shortening travel time. Worse self-assessed health is negatively associated with being sure about willingness to pay for shortening treatment time.

As income is usually positively associated with willingness to pay and because it was not often positively associated with the willingness to pay in Table 3, even after testing for various other specifications of income, we further explored the association between log income and willingness to pay for only people who stated a willingness to pay of more than zero. These results are presented in Table 4.

Although the estimates are based on very small samples, Table 4 shows that there is generally speaking a positive association between log income and willingness to pay.

6. Discussion and conclusion

We developed in this paper a comprehensive approach to

Table 2
Mean time valuation (first part).

	Rehabilitation	Radiotherapy	Orthopaedics	Total
Time to admission (TTA)	From 4 weeks to two weeks	From 4 weeks to three weeks		
Willing to shorten time to admission	37.5%	47.0%	^a	44.3%
Willing to pay for shortening time to admission	4.9%	11.8%		9.8%
Maximum amount per week shortening time to admission	€4.20/£4.85	€25.60/£29.56		€18.90/£21.83 (#135)
Certainty question	79.4%	66.2%		70.5%
Max. amount per week shortening TTA for resp. who are sure of answer ^a	€0.23/£0.27 (#21)	€19.50/£22.52 (#41)		€13.00/£15.01 (#62)
Max. amount per week shortening TTA for resp. who are willing to pay for shortening of their TTA & who are sure of their answer ^a	€5.00/£5.77 (#2)	€266/£307.19 (#3)		€201/£232.13 (#5)
Travel time (TT)	Four hours reduction	Own travel time divided in half	Two hours reduction	
Willing to shorten travel time	51.1%	59.2%	29.6%	46.9%
Willing to pay for shortening travel time	12.2%	11.0%	7.3%	9.8%
Maximum amount per hour shortening travel time	€1.53/£1.77	€1.66/£1.92	€3.44/£3.97	€2.21/£2.55 (#183)
Certainty question	73.5%	68.1%	86.3%	76.4%
Max. amount per hour shortening TT for resp. who are sure of answer ^a	€0.19/£0.22 (#20)	€0.56/£0.65 (#40)	€2.05/£2.37 (#45)	€1.13/£1.30 (#105)
Max. amount per hour shortening TT for resp. who are willing to pay for shortening of their TT & who are sure of their answer ^a	€3.75/£4.33 (#1)	€7.53/£8.70 (#3)	€18.05/£20.85 (#5)	€13.20/£15.24 (#9)
Waiting time (WT)	Four hours reduction	Own waiting time divided in half	40 min reduction	
Willing to shorten waiting time	13.5%	18.7%	45.1%	27.9%
Willing to pay for shortening waiting time	2.4%	3.1%	9.8%	5.5%
Maximum amount per hour shortening waiting time	€0.96/£1.11	€2.37/£2.74	€7.32/£8.45	€4.05/£4.68 (#174)
Certainty question	82.6%	72.9%	83.6%	79.2%
Max. amount per hour shortening WT for resp. who are sure of answer ^a	€0.92/£1.06 (#27)	€2.20/£2.54 (#40)	€2.60/£3.00 (#49)	€2.07/£2.39 (#116)
Max. amount per hour shortening WT for resp. who are willing to pay for shortening of their WT & who are sure of their answer ^a	€25.00/£28.87 (#1)	€29.40/£33.95 (#3)	€31.80/£36.72 (#4)	€30.10/£34.76 (#8)
Number of respondents	44	107	87	238

Table 2. Mean patient time valuation (second part)

	Rehabilitation	Radiotherapy	Orthopaedics	Total
Treatment time (TrT)	Four hours reduction	25 treatments 5 m instead of 20 m.	5 to 4 days treatment time	
Willing to shorten treatment time	79.1%	65.3%	77.0%	72.2%
Willing to pay for shortening treatment time	13.6%	9.8%	20.7%	14.6%
Maximum amount per hour shortening treatment time	€2.01/£2.32	€5.40/£6.24	€1.09/£1.26	€3.30/£3.81 (#207)
Certainty question	79.5%	62.5%	67.8%	67.9%
Max. amount per hour shortening TrT for resp. who are sure of answer ^b	€1.19/£1.37 (#23)	€4.00/£4.62 (#38)	€0.70/£0.81 (#48)	€1.95/£2.25 (#109)
Max. amount per hour shortening TrT for resp. who are willing to pay for shortening of their TrT & who are sure of their answer ^b	€9.16/£10.58 (#3)	€38.00/£43.88 (#4)	€3.75/£4.33 (#9)	€13.32/£15.38 (#16)
Number of respondents	44	107	87	238

^a In collaboration with health care providers, we decided to exclude from the survey the questions on time to admission. This was mainly to shorten the survey for Orthopaedics patients, such that we could add an additional part to the survey devoted to testing for differences in scope.

^b Respondents who were not sure of their answer as well as respondents who mention that they were willing to pay for a reduction of their patient time and who indicate that they are willing to pay €0/£0 and respondents who mention that they were not willing to pay for a reduction of their patient time and who indicate that they were willing to pay more than €0/£0 are excluded from the calculations.

monetarily value patient time distinguishing between various types of patient time: Time to admission, travel, waiting and treatment time.

As mentioned before, we opted for the contingent valuation method as it can be used to value hypothetical situations in the absence of a market or in anticipation of a market and because the method is also relatively easy to use.

In an attempt to be as realistic as possible, our scenarios have been developed in close collaboration with health care providers of the three hospital departments involved: Radiotherapy, Rehabilitation and Orthopaedics. Generally speaking, the contingent

valuation scenarios explained that patients normally (we purposely avoided terms like 'on average' as not everyone might understand this term) have to spend some time when consuming medical care and that there could be ways to reduce this time e.g. by organising things better, employing more people or via ICT or medical innovations. This obviously depends partly on the different types of time that were distinguished, time to admission, travel, waiting and treatment time. Therefore, the examples of how things could be done faster depended on the type of time, and the amounts of time related as much as possible to current practice according to the healthcare providers. We obviously also described and explained

Table 3

Does valuation of patient time vary across income groups, health status and experienced patient time? Estimation results.

Outcomes	Willing to shorten Patient time ^{a,e}		Willing to pay for shortening Patient time ^{b,e}		Willingness to pay (all respondents) ^{c,e}		Willingness to pay (only respondents who are sure of their answers) ^{d,e}	
	Coef.	T-st.	Coef.	T-st.	Coef.	T-st.	Coef.	T-st.
Time to admission								
Log income ^f	−0.21	−0.9	0.28	0.8	7.78	0.2	69.3	0.4
Self-Assessed health (1 = exc. 5 = bad)	0.12	0.7	0.12	0.5	2.32	0.1	−42.2	−0.3
Mean Time to admission in days	−0.00	−0.5	0.00	0.4	−1.26	−0.8	2.25	0.3
# respondents	121		124		111		57	
Travel time								
Log income ^f	0.17	0.9	0.36	1.2	2.02	0.8	5.13	0.5
Self-Assessed health (1 = exc. 5 = bad)	0.31	2.1	0.09	0.4	0.69	0.3	9.70	1.2
Mean Travel Time (one way) in min	0.03	4.2	0.02	2.9	0.02	0.3	0.72	1.5
# respondents	197		193		165		93	
Waiting time								
Log income ^f	0.03	0.1	0.75	1.9	22.5	1.7	72.9	2.1
Self-Assessed health (1 = exc. 5 = bad)	−0.14	−0.9	−0.11	−0.4	2.04	0.2	4.83	0.3
Mean Waiting time in min	0.01	2.3	0.01	1.5	0.30	0.0	0.79	1.1
# respondents	163		164		140		93	
Treatment time								
Log income ^f	−0.22	−1.0	−0.24	−1.0	−2.20	−0.6	−8.70	−0.7
Self-Assessed health (1 = exc. 5 = bad)	−0.16	−1.0	0.03	0.2	−3.60	−1.3	−18.7	−1.8
Mean Treatment Time in min	0.00	0.2	0.00	0.1	0.12	1.2	0.27	0.7
# respondents	163		160		156		77	

^a Results estimates Probit estimation (1 = willing to shorten Patient Time/0 = not willing to shorten Patient Time).^b Results estimates Probit estimation (1 = willing to pay for shortening Patient Time/0 = not willing to pay for shortening Patient Time).^c Results estimates Tobit estimation of Willingness to Pay for shortening Travel, Waiting, Treatment time by one hour and Time to admission by one week (All respondents).^d Results estimates Tobit estimation of Willingness to Pay for shortening Travel, Waiting, Treatment time by one hour and Time to admission by one week (Only respondents who are sure of their answers and who give coherent answers, namely those who are willing to pay and whose willingness to pay is positive en those who are not willing to pay and whose willingness to pay is equal to 0.).^e All models are corrected for gender, age, age squared, type of patients, marital status, highest educational level attained. Results of models that are not corrected for educational level are similar to the ones presented in Table 3. Estimation results are reported without correction for self-reported total patient time. This is because including this variable did not affect the main results. The results show some significant differences in valuation between the Orthopaedics patients and the other patient groups: Orthopaedics patients are less often willing to shorten travel time and more often willing to shorten treatment time and pay for shortening treatment time than others. There are also some age effects, showing that on average older individuals are less often willing to shorten travel time and are more often willing to shorten time to admission, but their willingness to pay is on average lower than the ones of younger individuals (Regarding travel time, waiting time and time to admission).^f We also try other characterizations of income (such as using income and using a dummy indicating high incomes) but this did not affect the results.**Table 4**

Does valuation of patient time increase with income? Estimation results for subgroup patients whose willingness to pay >0.

Outcomes	Willingness to pay>0 ^a	
	Coef.	T-st.
Time to admission		
Log income	60.2	2.2
# respondents	25	
Travel time		
Log income	8.9	1.6
# respondents	6	
Waiting time		
Log income	41.9	1.9
# respondents	8	
Treatment time		
Log income	7.9	1.7
# respondents	15	

^a Results estimates linear regression of willingness to pay for shortening travel, waiting, treatment time by one hour and time to admission by one week for respondents whose willingness to pay >0.

the meaning of the four types of time.

Despite the fact that we emphasised in the contingent valuation scenarios that respondents should assume that shortening time would not influence the effectiveness of the treatment or its side effects, it became clear from the qualitative responses that a few people seemed to believe that this was not the case. One respondent wrote for instance “travelling makes my health worse”.

Obviously there might have been a few more. We suggest for future research to add follow up question to explore quantitatively if people still considered impact on health. This information could be used in the regression analysis to potentially control for or similar to the certainty follow up questions could be used to exclude people from the sample who didn't understand the scenario. If the fraction of people would be very high this should be considered as a signal that the approach isn't feasible which could differ from country to country and would be an interesting area to further investigate. The phrasing of the time to admission scenario by suggesting the involved time reduction would be feasible by employing more people could also measure willingness to pay employing more people in health care instead of willingness to pay for reduction in time to admission (suggested by an anonymous reviewer but not supported by the quantitative responses). This could obviously be further explored in future work.

Please note that asking respondents that shortening time would not influence the effectiveness of the treatment or its side effects is only important in case one wishes to monetarily value patient time for use in CEA. In contingent valuation studies for other purposes, one could for instance also allow time to influence the effectiveness of the treatment or its side effects, and specify this relationship which might be a challenge for future research.

We opted to apply our developed method to patients because they have experience with medical care. This implies that we have adopted the ex-post perspective (Dolan et al., 2003). In principle the survey method could also be extended to elicit preferences of a representative or non-representative sample of the general

population to elicit ex-ante monetary valuations of time involved in consuming medical care. Obviously, the ex-ante and ex-post perspectives could also complement each other. In addition the survey methodology could also be generalised to other patient groups and potentially also to areas beyond medical care like prevention, public health or long-term care.

For illustration, this paper also presents the first empirical results of applying our developed survey methodology in a sample of patients not participating in the labour market. The results are mainly illustrative and suggest that around half of patients prefer to spend a shorter time in the four time categories but not all of them are willing to pay to reduce their time inputs. There also seems to be some minor differences between the three patient groups. Based on the patients who would be willing to pay, and are sure about their willingness to pay, it seems fair to conclude that patients seem to put the highest value on waiting time (€30.10 per hour) and value travel and treatment time equally with respectively €13.20 and €13.32 per hour; however, these numbers are based on very small samples and might also be influenced by the start bid which was based on the mean wages of the Dutch population. The stated preferences give a slightly different picture than these monetary values as patients preferred to shorten waiting time the least (27.9%) and to shorten treatment time the most (72.2%).

The regressions results should be interpreted with caution because of the relatively small sample size. They are clearly not the main purpose of our study and we have included them for illustration and to encourage others to further explore the hypotheses as well as potentially testing other hypotheses.

Although we distinguished various types of patients' time, we have not included time to recover. Future research could consider including this type of patients' time although the involved scenario could be challenging.

The empirical findings stemming from applying the contingent valuation method to value patient time in our study suggest a more heterogeneous picture of time values than using wages. We encourage more/additional empirical and conceptual work to explore the robustness and the consequences of this finding for how we value patient time.

Our survey methodology could universally be used to provide a comprehensive monetary value of patient time. However, every institutional context as well as every medical procedure might require to slightly rephrase the developed contingent valuation questions (obviously also depending on research objective and questions). This paper encourages future empirical research applying and refining the developed survey methodology to provide estimates for different subgroups like other medical conditions and/or prevention and long-term care as well as in other jurisdictions.

Acknowledgements

We gratefully acknowledge The Netherlands Organisation for Health Research and Development for their funding (ZonMw grant number 152002032); Ben Slotman, Marjolein Bakker, Marco Hoozemans and Adri Appeldorn for commenting on draft survey and recruitment of patients; Samira Baouchi, Mahfam Quammaqamy, Ninotsjka Scheuer, Mariëlle Heijns, Vera Root and Linda Hartman

for assisting with collecting the data and two anonymous reviewers for their comments.

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