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Attributing a Monetary Value to Patients' Time: A Contingent Valuation Approach

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

[1]Bernard van den Berg
[2]Amiram Gafni
[3]France Portrait

[1]Centre for Health Economics, University of York, UK
[2] Centre for Health Economics and Policy Analysis and Department of Clinical Epidemiology and Biostatistics, McMaster University, Canada
[3] Department of Health Sciences, VU University Amsterdam, the Netherlands

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Centre for Health Economics
Alcuin College
University of York
York, UK
www.york.ac.uk/che

Abstract

It is hard to ignore the importance of patient time investment in the production of health since the influential paper by Grossman (1972). Patient time includes time to admission, travel time, waiting time, and treatment time and can be substantial. Time to admission is the time between the first referral and the moment that the treatment actually starts. Travel time is the time that a patient needs to travel between the place where the patient lives and the medical care centre where the patient is treated. Waiting time is the time that the patient waits at the medical care centre before treatment. Treatment time is the time spent getting active treatment for example by a doctor or a nurse. Patient 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. It is even less straightforward for patients who are not participating in the labour market. 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 patients' time comprehensively, using the contingent valuation method. Comprehensively means including various types of patient time (time to admission, travel time, waiting time, and treatment time) as the previous literature focused mainly on valuing a particular type of patient time, for instance waiting time.

This paper describes the development of the contingent valuation survey. The survey is added as an appendix to this paper. This paper also presents the first empirical results of applying our survey approach in a sample of patients in the Netherlands not participating in the labour market. These results show that the monetary value of waiting time was the highest (€30.10/£34.76 per hour) and travel and treatment time were equally valued (respectively €13.20/£11.43 and €13.32/£11.54 per hour).

1. Introduction and background

Time is a scarce resource and plays a significant role in the economics literature, see for instance the seminal work of Becker in 1965 and the paper of DeSerpa in 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 (DeSerpa, 1971).

The importance of time investment in the production of health was demonstrated in the influential paper by Grossman (1972). Grossman's 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 (labelled 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.

It should be noted that the type and importance of time in the health production function of Grossman (1972) might differ between preventive care, long-term care, and acute medical care. The prevention literature emphasizes the significance of, for example, time devoted to leisure activities to prevent coronary heart diseases (Sofi et al, 2008) and cancer (Anzuni et al, 2011) as a health input. Also the time investments associated with screening colonoscopy have been recognized as a relevant input (Jonas et al, 2010). The importance of time in long-term care relates mainly to informal care time and to professional care time as inputs in the production function; see for instance Norton (2000) and Van den Berg et al. (2005). The consumption of medical care obviously also involves time investments. The time investments of patients having cancer (Yabroff et al, 2007), diabetes (Russell et al, 2005), or all kinds of chronic diseases (Jowsey et al, 2012) have been shown to be substantial.

Sources of patient time 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 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 getting 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 they can use that time to do other things which is not true for the other categories 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 their carers (Claar et al, 2005).

The monetary valuation of patient time is a significant topic in the health economics literature. For instance, neglecting the value of time when calculating the elasticity of demand for medical care may lead to biased estimates (Phelps & Newhouse, 1974) and to inappropriate policy recommendations (Cauley, 1987). To predict healthcare use, it is crucial to value patient time in monetary terms, especially as the price of medical care is often zero or close to zero at the point of consumption because of insurance (Phelps & Newhouse, 1974), or because of tax-financing of healthcare. This is true in most OECD countries, as guaranteeing universal access to healthcare is considered a key element of health policy (Cutler, 2002).

The valuation of patient time is also crucial in order to calculate the welfare implications of waiting lists (Propper, 1995). Another reason is to be able to better compare health care costs between countries, as they could be distorted by non-budgetary costs, such as differences in waiting lists (Danzon, 1992).

In the area of economic evaluations of healthcare interventions, the valuation of patient time is a topic of debate. 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. The costs per QALY were equal to $3,446 when patient time was included versus $1,108 when patient time was not included. 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: $1,975 with patient time included versus $1,515 without patient time included. 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, and how patient time is included 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 & Goodman (2003) or 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).

The Washington panel encouraged research to value the time of people not participating in the labour market given the potential importance of the costs of patient time in these groups (Luce et al., 1996). Apart from studies applying wages of similar people or averages in costing studies or economic evaluations (e.g. Yabroff et al. 2007 and Russell, 2009) there is a small number of papers in the health economics literature on the monetary valuation of patient time that use different approaches. Propper (1995) developed a methodology to value the disutility of time spent on a waiting list for non-urgent medical treatment. Although there was a private market for getting around queuing, analysing these choices is problematic as it is unknown how long the waiting time of these people would have been if they had stayed in the queue. Similarly, it is not known if the people who stay on the waiting list had information on their waiting time. These reasons motivated Propper to use the contingent valuation method. She opted for a random sample of the English population of age 25-70 instead of people on a waiting list as she argued that the ex-ante perspective was more appropriate for use in cost-benefit analysis than the ex-post perspective. In the ex-ante perspective, also called insurance perspective, people at risk (in Propper's example (1995) for joining a waiting list) are asked about their preferences. In the ex-post perspective, also called the user perspective, people with experience (in Propper's example (1995) the people who are or have been on a waiting list) are asked for their preferences

(O'Brien & Gafni, 1996).[1] Johannesson et al. (1998) measured the willingness to pay for private insurance of a random sample of Swedes. The additional private insurance premium allows them to get surgery in private hospitals with shorter waiting times if they need it. Building on the work of Johannesson et al. (1998), Bishai & Lang (2000) measured patients' willingness to pay to reduce their waiting time for cataract surgery to less than one month in Canada, Denmark and Spain. Jonas et al. (2010) measured patients' willingness to pay to avoid the time and discomfort of the colonoscopy screening process. As this study was in the context of screening colonoscopy, which is preventive care, the results might not be applicable for acute medical care.

Although progress has been made, an important challenge remains 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 the contingent valuation method, as this method uses surveys to measure individuals' monetary valuation of hypothetical situations (O'Brien & 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).

Ideally the developed methodology will involve 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 a survey to value patient time in monetary terms of individuals not participating in the labour market, using the contingent valuation method. It is worth noting that our method can also be applied to people participating in the labour market. As we wish to monetarily value patients' time, we are by definition interested in the ex-post and not in the ex-ante perspective. This paper also presents the first empirical results of applying the survey methodology in a sample of patients not participating in the labour market. Data was collected in three departments of two Dutch hospitals: Radiotherapy, Orthopedics, 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. As research also indicates that contingent valuation answers could be sensitive to individual characteristics (Mitchell & Carson, 1989), we also investigate the relationships between the contingent valuation questions and various individual characteristics.

There have been concerns about using the contingent valuation method, especially with respect to its insensitivity to scope. This means that the expressed willingness to pay value is not sensitive to the magnitude of the commodity to be valued. In the environmental economics context, it has, for instance, been argued that respondents' willingness to pay to save 100,000 birds should be at least 100 times larger than respondents' willingness to pay to save 1000 birds (Smith & Osborne, 1996). Smith and Osborne (1996) reviewed the contingent valuation literature and showed that sometimes studies fail to satisfy scope validity but others not. The review of Smith and Osborne (1996) included mainly environmental economics studies. Olsen et al. (2004) gave two health economics examples of scope invalidity. As a consequence of this mixed evidence, it is worth including a test for scope validity when developing a contingent valuation survey. We include a scope validity test.

[1] Dolan et al. (2003) provide a framework on the various perspectives that can be employed in healthcare contingent valuation studies as well as alternative health economics valuation studies.

2. Institutional context and the contingent valuation method

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; and Enthoven & 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. The popular press even report about taxi's not being on time as a consequence of which patients miss their medical treatment. In this system health insurers might also be able to influence the length of time of treatment by means of financing, for example, innovative interventions.

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 and reflect respondents' perceptions (Schläpfer & 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.

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.[2]

> 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.*

[2] 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 **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 specialised 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 & 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 for 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 answer formats of contingent valuation studies. We follow Johannesson et al. (1993). In this approach respondents get a follow up question about the certainty of their stated willingness to pay answer. This approach was shown to produce valid answers (Blumenschein et al, 2008). The remaining issue is whether to provide respondents with a payment card, dichotomous questions or open answer categories. There is considerable debate on the pros and cons of these various approaches in the contingent valuation literature with respect to applying answer formats. We opted for an alternative approach that has not been previously applied, 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.[3] We encourage others to use our empirical findings to generate start bids or create payment cards in future patient valuation of time studies.

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?

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

❒ *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.

[3] 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.

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?

❒ *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.*

❒ *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?
❒ *Sure*
❒ *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 precise survey questions per time category and per patient group respectively see Appendix A (Radiotherapy), B (Rehabilitation), and C (Orthopaedics).

3.3. Hypotheses

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-demographic variables.

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. Suppose there are two patients with the same disease, all other things equal, except their initial health status: Patient 1's health status > patient 2's health status. We assume that patient 1's willingness to pay < patient 2's willingness to pay. This is not because time is associated with treatment outcomes or side effects, as we asked respondents to assume reductions in time would not influence the effect of treatment or side effects. We assume this difference in willingness to pay is because of the difference in the relative improvement in health. In other words the same absolute treatment effect differs in relative terms because of the difference in initial health status.

3.4. Test for scope validity

We also follow the recommendation to test for scope validity when developing a contingent valuation study (Smith & Osborne, 1996). This was done in case of Orthopaedic patients by testing whether or not there is a difference in willingness to pay for shortening treatment time. We varied the treatment time for a knee-prosthesis from five to four days hospital stay versus from five to two days hospital stay.

4. Data

4.1. Study population

After getting the approval of the Medical Ethics committee of the VU University Medical Centre Amsterdam and of the hospitals involved, we asked patients first to give their informed consent and then to complete a written survey. As already mentioned, the patients were approached in three departments of two Dutch hospitals: Department of Radiotherapy of one hospital and departments of Rehabilitation and Orthopaedics in the second hospital. 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 have the mental capacity to fill in the questionnaire (determined by the interviewer), be able to understand the Dutch language and currently not be 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

Patients first answer the demographic and socio-economic questions followed by their health characteristics. After these sections the contingent valuation questions were asked. Measures of the self-reported time patients spent undergoing treatment as well as travel time and waiting time were included before the contingent valuation questions.

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 for patients' gender and age, marital status and the highest level of education. Education level is measured using four 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 the following: 1= less than €460/£531; 2 = between €461/£532 and €1100/£1270; 3 = between €1101/£1271 and €1700/£1963, …; 9 = between €4801/£5544 and €5400/£6236; and 10 = more that €5400/£6236.

Health characteristics

The patients were asked to classify their health status using a standard self assessed health question with five answering categories: excellent; very good; good; average; bad. We measure patients' health-related quality of life using the EQ-5D (Dolan, 1997) and the Dutch population values developed by Lamers et al. (2006).

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 tick a box where the answering categories ranged from 1-10 minutes up to 51-60 minutes and including a box more than 60 minutes, namely..... minutes. 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 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.

As mentioned above, the scenarios vary slightly over the departments with respect to the amount of time involved. To make the valuations comparable across the scenarios, we computed the mean WTP per hour shortening of patient time per department.

5. Results

5.1. Sample characteristics

We distributed surveys to 84 rehabilitation patients, to 229 radiotherapy patients and to 275 orthopaedics patients. 64 rehabilitation patients (76%), 142 radiotherapy patients (62%) 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. The key characteristics are presented in the first column starting with the demographics and socio-economics, followed by the health characteristics. The last part of Table 1 presents the self-reported time the patients spend on accessing treatment, travelling, waiting and being treated. The mean and standard deviations of the continuous variables and the percentages of the categorical variables are presented 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 percent 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 percent of the radiotherapy and orthopaedics patients. A large fraction of the patients are retired ranging from over 34 percent in case of rehabilitation to almost 50 percent 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/£2194 and is quite similar over the patient groups. There are no striking differences in patients' general health between the subgroups. However, the EQ-5D dimensions show less mobility problems for radiotherapy patients and differences in pain.

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 minutes, and is the highest for radiotherapy (equal to 41 minutes 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 minutes compared to about 13 minutes by rehabilitation and radiotherapy). Not surprisingly, the longest treatment time is by rehabilitation because the patients have to exercise during treatment. The mean treatment time equals 26.3 minutes for radiotherapy and 20 minutes for orthopaedics.

Table 1: Characteristics sample and patients' 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)		20.8 (25.2)
Mean Travel time (one way) in minutes (SD)		26.2 (13.6)	41.1 (19.2)	25 (14.1)	32.7 (18.2)
Mean Waiting time in minutes (SD)		11.1 (12.1)	16.9 (16.2)	34.2 (23.1)	21.2 (20.1)
Mean Treatment time in minutes (SD)		73.9 (37.7)	26.3 (9.1)	26.1(19.0)	33.0(28.8)
Number of respondents		44	107	87	238

5.2. Patient time valuation

Table 2 gives the mean willingness to pay per patient time category. We first present patients' preferences with respect to shortening the patient time. Subsequently we report whether they would be willing to pay for shortening the patient time input and then we report the mean willingness to pay (WTP). 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 WTP equal to 0. The second to fourth columns of Table 2 give respectively the time for rehabilitation patients, radiotherapy patients and orthopaedics patients. Totals are presented in the last column of Table 2.

About 44 percent 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 percent of patients preferring shorter travel time.[4] Almost half of the orthopaedics patients prefer shortening waiting time whereas less than twenty percent of radiotherapy and fifteen percent 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 percent prefer to shorten waiting time and almost 75 percent 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 percent 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%).[5]

The maximum willingness to pay for an hour time input reduction of our respondents ranges from €0.19/£0.22 per hour shortening in case of rehabilitation travel time, to €4.00/£4.62 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/£15.01. 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.[6]

[4] Main reasons for preferring shortening travel time are "travel time too long", "could come by bicycle", "bad weather", and "high costs for petrol". Two respondents mention that travelling makes their health complaints worse. Main reasons for preferring shortening waiting time are "Waiting time is a waste of time", "waiting is annoying and tiring", "high car park costs". Main reasons for preferring shortening treatment time are "Gain of time", "No effects on success of treatment", "Treatment is unpleasant, tiring, and/or painful", and "more time for other patients".

[5] Some 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: 1 out of the 33 respondents who are willing to pay for shortening their treatment time, is not willing to shorten it. 3 out of the 22 patients who are willing to pay for the shortening of their travel time are not willing to shorten it, and 3 out of the 12 respondents who are willing to pay for the shortening of their waiting time 3 are not willing to shorten it.

[6] Other respondents also give inconsistent answers in the sense that they report willingness to pay for a reduction of their patient time but indicate a WTP equal to zero: 34 respondents (22 and 12, respectively) indicate that they are willing to pay for a reduction in treatment time (travel time and waiting time, respectively) and 5 (1 and 1, respectively) respondent(s) report a WTP equal to zero.

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%	/*	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*	€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*	€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*	€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*	€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*	€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*	€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

* 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.

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*	€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*	€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

*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.

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 percent 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 percent of the patients are sure (12 of the 32 willing to pay) 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 accounting only for 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/£4.33 per hour and with €38.00/£43.88 per hour the highest in case of radiotherapy treatment time.[7] Three radiotherapy respondents are willing to pay around €266.00/£307.19 for one week reduction of their time to admission. Overall people seem to put the highest value on waiting time (€30.10/£34.76 per hour) and they value travel and treatment time equally with respectively €13.20/£15.24 and €13.32/£15.38 per hour.

5.3. Testing the hypotheses for correlation of patient time valuations and individual characteristics

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

The first column of Table 3 gives the estimation results of three key variables: log income, self-assessed health and self-reported time per time category. Please note that the presented estimation results are controlled for gender, age, age squared, type of patient, marital status, and highest educational level attained. The results are presented for the various types of 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.

[7] These figures are based on low numbers of respondents. The main reasons for this 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.

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[1,5]		Willing to pay for shortening Patient time[2,5]		Willingness to pay (all respondents) [3,5]		Willingness to pay (only respondents who are sure of their answers) [4,5]	
Time to admission	Coef.	T-st.	Coef.	T-st.	Coef.	T-st.	Coef.	T-st.
Log income[6]	-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[6]	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[6]	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[6]	-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	

[1]Results estimates Probit estimation (1= willing to shorten Patient Time / 0 = not willing to shorten Patient Time)

[2]Results estimates Probit estimation (1= willing to pay for shortening Patient Time / 0 = not willing to pay for shortening Patient Time)

[3]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)

[4]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 WTP is positive en those who are not willing to pay and whose WTP is equal to 0.)

[5] 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).

[6] 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	WTP>0[1]	
Time to admission	Coef.	T-st.
Log income[6]	60.2	2.2
# respondents	25	
Travel time		
Log income[6]	8.9	1.6
# respondents	6	
Waiting time		
Log income[6]	41.9	1.9
# respondents	8	
Treatment time		
Log income[6]	7.9	1.7
# respondents	15	

[1]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

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.

5.4. Testing for scope validity

Table 5 presents the results of the test for scope validity. We calculated the willingness to pay for a shorter hospital stay for two scenarios. The hospital stay differed between the two scenarios: five versus four days compared with five versus two days. The results show that there are only minor differences between the mean willingness to pay but the differences are not statistically significant. These results support the hypothesis of scope validity.

Table 5: Does valuation of patient time vary with the scope of the reduction in treatment time? Estimation results orthopedics patients

Treatment time (TrT)	5 to 4 days treatment time	5 to 2 days treatment time	P-values mean differences
Willing to shorten treatment time	77.0%	77.0%	
Willing to pay for shortening treatment time	20.7%	20.7%	
Maximum amount per day short. treatment time	€26.16/£30.21	€18.24/£32.61	0.1023
Certainty question	67.8%	60.9%	0.2584
Max. amount per day short. TrT for resp. who are sure of answer	€16.80/£19.40(#48)	€15.12/£17.46(#47)	0.4387
Max. amount per day shortening TrT for resp. who are willing to pay for shortening of their TrT & who are sure of their answer	€90.00/£103.94(#9)	€72.51/£83.74(#10)	0.7004
Number of respondents	87		

6. Discussion and conclusion

This paper describes an approach to monetarily value patient time. Unlike existing studies that often focus on a particular type of patient time, we developed a more comprehensive approach distinguishing between various types of patient time: time to admission, travel, waiting and treatment time.

We opted to use the contingent valuation method as it enables us to derive monetary values of patient time, 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 less demanding for respondents than, for instance, a discrete choice experiment (Van den Berg, 2005). An important motivation for developing the survey methodology was the perceived problem of using wage rates to proxy the monetary value of patient time, particularly for a very substantial proportion of health care consumers, i.e. patients not participating in the labour market. However the proposed methodology could also be used to value the time of patients who are participating in the labour market. In this respect we also encourage further research in line with Borisova and Goodman (2003) comparing the contingent valuation survey results with valuation studies based on the wages of patients with paid jobs.

Although the contingent valuation scenarios are by definition hypothetical, researchers should make an effort to make them as realistic as possible to avoid item non-respondents or answers that do not make sense. 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 also described and explained 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 very few people seemed to believe that this was not the case. One respondent wrote for instance "travelling makes my health worse". Obviously there may have been other similar cases. However telling respondents that shortening time would not influence the effectiveness of the treatment or its side effects is only important in cases where 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.

As we used the ex-post perspective it was quite natural to phrase the payment questions in terms of out-of own pocket expenses. Our survey methodology could be applied universally but contingent valuation questions are quite natural in the Dutch health insurance context. As citizens are compulsorily insured they are familiar with paying health insurance premiums. We asked them to assume that the various hypothetical innovations to reduce time would not be covered by their health insurance. Consequently, if they would prefer to reduce their time to admission, travel, waiting and/or treatment time, they would have to pay the extra costs out of their own pockets. As opposed to the existing studies in this area, we followed Johannesson et al. (1993) by adding a follow up question about the

certainty of their stated willingness to pay answer. Generally speaking the answers seem to make sense. For instance the mean willingness to pay before sub-sampling on sure respondents is higher which is consistent with Blumenschein et al. (2008). Please note that there were a few inconsistencies in answers: a few responded that they were not willing to pay but then stated numbers, indicating that not everybody might have understood the questions.

We opted to apply our method to patients because they have experience with medical care. This implies that we have adopted the ex-post perspective. 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. Data were collected in three departments of two Dutch hospitals: Radiotherapy, Orthopedics, and Rehabilitation. They were chosen because 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. 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/£34.76 per hour) and value travel and treatment time equally with respectively €13.20/£15.24 and €13.32/£15.38 per hour; however, these numbers are based on very small samples. 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%). Although we have not checked the representativeness of our study samples because the purpose of the analyses are mainly illustrative, one should clearly check the sample representativeness if wishing to use our results.

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. This is also true for the scope validity test included in our paper. It seems fair, however, to conclude that the regression results and the scope test results are supportive for the validity of the developed contingent valuation survey questions to monetarily value patient time.

Although we are more comprehensive than the existing literature in terms of types of patient time, we have not included time to recover. Future research could consider including this type of patient time.

Two normative arguments against using the contingent valuation method are worth discussing. First one could argue that this method conflicts with equity. As trying to guarantee equal access to health care has dominated health policy in Western countries (Cutler, 2002) and therefore healthcare should be rationed irrespective of peoples' income, viz. their ability to pay.[8] But it is technically possible to correct for these differences in ability to pay. However this will require making some normative assumptions (Harberger, 1978). Second, one could argue that because the contingent valuation survey questions we

[8] Please note that this is true for all monetary valuation methods and also for non-monetary valuation methods (Donaldson et al., 2002).

have developed do not involve a trade-off between health and wealth, especially as we explicitly asked respondents to assume that the reduced time inputs that would be required would not affect the effectiveness of the treatment nor the side effects or recovery, it cannot be applied to inform resource allocation decisions in a fixed budget context. Even in this context, we believe that the preference questions (without the willingness to pay) can be informative within this context. In other words, it is informative to know that about half of the sample would be willing to shorten patient time. The remaining question is would they be willing to give up something else (like other types of care or quicker but less effective care) in order to get shortening of their patient time. This is a potential area for future research.

Although every institutional context, as well as every medical procedure, could require slight rephrasing of the contingent valuation questions (obviously also depending on research objective and questions), our survey methodology could universally be used to provide a comprehensive monetary value of patient time. This paper encourages future empirical research, applying and refining the survey methodology to provide estimates for different subgroups such as other medical conditions and/or prevention and long-term care, as well as use in other jurisdictions. Based on the results, future researchers can decide whether or not it is necessary to always run new surveys or whether averages will be sufficient to inform policy. All together this will provide the health economics community with better estimates for a wide range of problems which, although recognised for some time, have not yet been solved comprehensively.

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Appendix A: Survey questions radiotherapy

Time to admission

The next questions are about time to admission. Usually it takes some time before you are medically ready to start treatment. The time to admission is the time between the moment that you are medically ready and the moment that the radiotherapy treatment starts.

How long did you have to wait between the moment you were medically ready for treatment and the first radiotherapy treatment?

..... days

What was the most important reason you had to wait?

☐ I had to recover from surgery
☐ Lack of capacity
☐ Other, viz.....

Suppose it would be possible to reduce the time you had to wait between the moment you were medically ready for treatment and the first radiotherapy treatment. Instead of 4 weeks you would now for example have to wait 3 weeks. This reduced time to admission does not have any impact on the effectiveness of your treatment. Reducing your time to admission would involve extra costs.

The extra costs of reducing your admission to treatment time would not be reimbursed by your health insurer. As a consequence you would have to pay the extra costs out of your own pocket.

Would you be willing to reduce the admission to treatment time, the moment between you are medically ready for treatment and the actual start of the radiotherapy treatment (reduction from 4 to 3 weeks)?

☐ Yes, I would be willing to reduce the admission to treatment time from 4 weeks to 3 weeks.
☐ No, I would not be willing to reduce the admission to treatment time from 4 weeks to 3 weeks.

Would you be willing to pay for this reduced time to admission? Please recall that reduced time to admission does not have any impact on the effectiveness of your treatment.

☐ Yes, I would be willing to pay for this reduced time to admission from 4 weeks to 3 weeks.
☐ No, I would not be willing to pay for this reduced time to admission from 4 weeks to 3 weeks.

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 your time to admission would be 4 weeks. Would you be willing to pay more than 300 euro for a time to admission of 3 weeks instead of 4 weeks?

☐ Yes, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my time to admission from 4 weeks to 3 weeks.

❒ No, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my time to admission from 4 weeks to 3 weeks.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Treatment time

As was explained by the medical specialist during intake, the Radiotherapy treatment will usually last approximately 20 minutes. The radiotherapy itself takes only a few minutes and the other time is necessary for preparations. Because of ICT innovations, we are able to do things faster. This is also true in healthcare.

Suppose we could reduce the time necessary to undergo Radiotherapy. Instead of the usual 20 minutes, every treatment would now last 5 minutes. Assume this reduction in treatment time would neither influence the effectiveness of your treatment nor the side effects. This has been scientifically proven.

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

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

This new and equally effective but shorter treatment of 5 minutes is more expensive than the longer treatment which will last 20 minutes. Your health insurer will not reimburse the additional costs.

Would you be willing to pay for this reduction in treatment time? Please recall that this treatment is equally effective.

❒ Yes, I would be willing to pay for this equally effective but shorter treatment.
❒ No, I would not be willing to pay for this equally effective but shorter treatment.

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 25 radiotherapy treatments. Would you be willing to pay more than 50 euro to reduce your treatment time from 20 to 5 minutes during all planned 25 treatments?

❒ Yes, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro at once to reduce my treatment time during all planned 25 treatments from 20 to 5 minutes.

❒ No, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro at once to reduce my treatment time during all planned 25 treatments from 20 to 5 minutes.

How sure are you about your stated willingness to pay?

- ❒ Not sure at all
- ❒ Quite sure
- ❒ Very sure

Travel time

Where do you currently live?

- ❒ At home
- ❒ In the VU Medical Centre Amsterdam
- ❒ In another hospital than the VU Medical Centre Amsterdam
- ❒ In a care home
- ❒ In a nursing home
- ❒ Elsewhere, viz.....

How do you usually travel between the VU Medical Centre Amsterdam and the place you are living?

- ❒ Ambulance
- ❒ Taxi paid by my health insurer
- ❒ Taxi paid by myself
- ❒ Car
- ❒ Public transport
- ❒ I do not have to travel
- ❒ Else, viz.....

How much time does it usually take to travel from the VU Medical Centre Amsterdam and the place you are living (one way)?

- ❒ 1-10 minutes
- ❒ 11-20 minutes
- ❒ 21-30 minutes
- ❒ 31-40 minutes
- ❒ 41-50 minutes
- ❒ 51-60 minutes
- ❒ More than 60 minutes, viz.....
- ❒ Not applicable

Suppose it would be possible to reduce your travel time from the place you are currently living and the VU Medical Centre Amsterdam during the total period of your treatment with half. This could for instance be done by opening a few small but specialised radiotherapy clinics in the community. This reduction in travel time would cost money as it would involve building the new clinics. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

Would you be willing to reduce your travel time by half?

- ❒ Yes
- ❒ No

Would you be willing to pay for this reduction in your travel time?

❒ Yes
❒ No

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.

Would you be willing to pay more than 100 euro?

❒ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my travel time during the total treatment period by half.
❒ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my travel time during the total treatment period by half.

How sure are you about your stated willingness to pay?

❒ Not sure at all
❒ Quite sure
Very sure

Do you usually travel alone to the VU University Medical Centre?

❒ Yes, I usually travel alone.
❒ No, my partner usually accompanies me.
❒ No, somebody else than my partner usually accompanies me, viz.....

Waiting time

The next questions are about the time you have to wait during the days you are undergoing radiotherapy at the VU Medical Centre Amsterdam. You could consider waiting time related to transportation before or after treatment or waiting due to a technical problem with the radiotherapy technology.

How much time does it usually last between the moment you arrive at the VU University Medical Centre to undergo radiotherapy and the moment you are leaving the VU University Medical Centre?

❒ ..... hours and ..... minutes per radiotherapy treatment per day of which ..... minutes waiting time.

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

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.

Would you be willing to reduce your waiting time during all scheduled radiotherapy treatments by half?

❒ Yes, I would be willing to reduce the waiting time during all scheduled radiotherapy treatments by half.

❒ No, I would not be willing to reduce the waiting time during all scheduled radiotherapy treatments by half.

Would you be willing to pay for this reduction in your waiting time?

❒ Yes, I would be willing to pay for this reduction in waiting time.

❒ No, I would not be willing to pay for this reduction in waiting time.

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.

Would you be willing to pay more than 100 euro for this reduction of waiting time during all scheduled radiotherapy treatments?

❒ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my waiting time by half during all scheduled radiotherapy treatments.

❒ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my waiting time by half during all scheduled radiotherapy treatments.

How sure are you about your stated willingness to pay?

❒ Not sure at all

❒ Quite sure (Min of meer zeker)

❒ Very sure

What was the most important reason you had to wait?

❒ I did not have to wait.

❒ Due to lack of capacity.

❒ I had to wait for the medical doctor.

❒ Other, ...

Appendix B: Survey questions rehabilitation

Time to admission

The next questions are about time to admission. The time to admission is the time between the date you made the appointment with the Rehabilitation Specialist and the date your treatment actually starts.

How long did you have to wait between the first contact with the Rehabilitation Department and the start of your treatment?

..... weeks ..... days

What was the most important reason you had to wait?
- ☐ I had to recover from surgery
- ☐ I was on a waiting list
- ☐ Other, viz.....

Suppose it would be possible to reduce time to admission from 4 weeks to 2 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 your recovery.

Would you be willing to reduce you access to treatment by half?

- ☐ Yes
- ☐ No

The reduction of time to admission would involve extra costs of e.g. employing extra people. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

Would you be willing to pay for this reduced time to admission? Please recall that reduced time to admission does not have any impact on the effectiveness of your treatment.

- ☐ Yes, I would be willing to pay for this reduced time to admission.
- ☐ No, I would not be willing to pay for this reduced time to admission.

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 your time to admission would be reduced from 4 weeks to 2 weeks. Would you be willing to pay more than 120 euro for this reduction in time to admission by half?

- ☐ Yes, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my time to admission by half.
- ☐ No, what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my time to admission by half.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Treatment time

The total treatment time at the Rehabilitation Department takes usually one hour. Most patients will be treated eight times per month.

Suppose new more efficient rehabilitation treatment techniques would be developed. Because of this the treatment time for each treatment would be reduced by half. As a consequence the total monthly treatment time will reduce from eight to four hours. Suppose this reduction in treatment time would neither influence the effectiveness of your treatment nor the side effects.

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

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

This new techniques enabling to reduce your treatment time with half, are more expensive than normal treatments. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

Would you be willing to pay for this treatment? Please recall that this treatment is equally effective.

❒ Yes, I would be willing to pay for this treatment.
❒ No, I would not be willing to pay for this treatment.

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 your treatment time per month reduces from eight to four hours. Would you be willing to pay more than 30 euro for this reduction in treatment time with four hours?

❒ 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 per month.
❒ 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 per month.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Travel time

Where do you currently live?

- ❒ At home
- ❒ In a nursing home
- ❒ In a care home
- ❒ With family/friends
- ❒ Elsewhere, viz.....

How do you usually travel between the rehabilitation centre and the place you are living?

- ❒ Bike
- ❒ Taxi paid by my health insurer
- ❒ Taxi paid by myself
- ❒ Car
- ❒ Public transport
- ❒ I do not have to travel
- ❒ Else, viz.....

How much time does it usually take to travel between the rehabilitation centre and the place you are living (one way)?

- ❒ 1-10 minutes
- ❒ 11-20 minutes
- ❒ 21-30 minutes
- ❒ 31-40 minutes
- ❒ 41-50 minutes
- ❒ 51-60 minutes
- ❒ More than 60 minutes, viz.....
- ❒ Not applicable

Suppose it would be possible to reduce your travel time from the place you are currently living and the rehabilitation centre during the total period of your treatment with half. This could for instance be done by opening a few small but specialised rehabilitation centres in the community. Please consider in the next questions only your own travel time and not the travel time of people who might accompany you.

Would you be willing to reduce your travel time by half?

- ❒ Yes
- ❒ No

This reduction in travel time would costs money as it would involve building the new centres. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

Would you be willing to pay for this reduction in your travel time?

❒ Yes
❒ No

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 your monthly travel time would be reduced from 8 to 4 hours. Would you be willing to pay more than 30 euro for this reduction of 4 hours?

❒ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro once to reduce my monthly travel time d by half.
❒ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro once to reduce my monthly travel time d by half.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Do you usually travel alone to the rehabilitation centre?

❒ Yes, I usually travel alone.
❒ No, my partner usually accompanies me.
❒ No, somebody else than my partner usually accompanies me, viz.....

Waiting time

The next questions are about the time you have to wait during the days you are at the rehabilitation centre, apart from being treated. You could consider waiting time in the waiting room before the treatment starts or in between the various treatments.

Would you be willing to reduce your waiting time by half?

❒ Yes, I would be willing to reduce my waiting time by half.
❒ No, I would not be willing to reduce my waiting time by half.

Suppose your waiting time per visit in the rehabilitation centre usually lasts 1 hour. It would be possible to reduce this waiting time to 30 minutes by means of more efficient scheduling or employing extra people. The reduction of your waiting time does neither influence the effectiveness of your treatment nor the recovery.

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.

Would you be willing to pay for this reduction in your waiting time?

❒ Yes, I would be willing to pay for this reduction in waiting time.
❒ No, I would not be willing to pay for this reduction in waiting time.

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 the usual waiting time would be reduced by half. As a consequence your total monthly waiting time at the rehabilitation centre would be reduced from 8 hours to 4 hours. Would you be willing to pay more than 30 euro for this reduction in waiting time?

❒ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my monthly waiting time by half.
❒ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my monthly waiting time by half.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Appendix C: Survey questions orthopaedics

Treatment time

The next questions are about your treatment at the Orthopaedics department. Treatment time is the time it takes to treat you. Travel time is the time it takes you to travel to and from the department. Waiting time is the time you spend at the Orthopaedics department apart from the appointment.

If you are treated at the Orthopaedics department, how much time does it usually take you on the day of the treatment: please consider travel time, treatment time and waiting time.

..... hours and ..... minutes
of which
..... hours and ..... minutes travel time
..... hours and ..... minutes treatment time
..... hours and ..... minutes waiting time

Suppose you need a total knee prosthesis. Most patients will spend five days in the hospital to get this total knee prosthesis.

Suppose a new and more efficient treatment techniques would be developed. Because of this the treatment time in the hospital of most patients will be reduced. As a consequence, they will now have to stay two days in the hospital. The total treatment time will reduce from five to two days. Suppose this reduction in treatment time would neither influence the effectiveness of your treatment nor the side effects.

Would you be willing to undergo this new treatment?

☐ Yes, I would be willing to undergo this new treatment.
☐ No, I would not be willing to undergo this new treatment.

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 yourself.

Would you be willing to pay for this treatment? Please recall that this treatment is equally effective.

☐ Yes, I would be willing to pay for this treatment.
☐ No, I would not be willing to pay for this treatment.

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 your hospital stay reduces from five to two days. Would you be willing to pay more than 200 euro for this reduction of three days?

☐ Yes: what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my hospital stay with three days.

❒ No: what would be the maximum amount you would be willing to pay? I would be willing to pay ..... euro once to reduce my hospital stay with three days.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Travel time

Where do you currently live?

❒ At home
❒ In a care home
❒ In a nursing home
❒ With family/friends
❒ Elsewhere, viz.....

How do you usually travel between the Orthopaedics department and the place you are living?

❒ By bike
❒ Taxi paid by my health insurer
❒ Taxi paid by myself
❒ Car
❒ Public transport
❒ I do not have to travel
❒ Else, viz.....

How much time does it usually take to travel between the Orthopaedics department and the place you are living (one way)?

❒ 1-10 minutes
❒ 11-20 minutes
❒ 21-30 minutes
❒ 31-40 minutes
❒ 41-50 minutes
❒ 51-60 minutes
❒ More than 60 minutes, viz.....
❒ Not applicable

Suppose it would be possible to reduce your travel time from the place you are currently living and the Orthopaedics department per visit by half. This could for instance be done by opening a few small but specialised orthopaedics centres in the community. Please consider in the next questions only your own travel time and not the travel time of people who might accompany you.

Would you be willing to reduce your travel time by half?

❒ Yes
❒ No

This reduction in travel time would costs money as it would involve building the new centres. Your health insurer will not reimburse the additional costs. As a consequence you would have to pay the extra costs yourself.

Would you be willing to pay for this reduction in your travel time?

❒ Yes
❒ No

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 your travel time per visit would be reduced from 4 to 2 hours. Would you be willing to pay more than 30 euro for this reduction of 2 hours?

❒ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my travel time per visit by half.
❒ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my travel time per visit by half.

How sure are you about your stated willingness to pay?

❒ Sure
❒ Not sure

Do you usually travel alone to the Orthopaedics department?

❒ Yes, I usually travel alone.
❒ No, my partner usually accompanies me.
❒ No, somebody else than my partner usually accompanies me, viz.....

Waiting time

The next questions are about waiting time. Waiting time is the time you are spending at the Orthopaedics department, apart from the scheduled appointment time. You could consider waiting time in the waiting room before the treatment starts.

Would you be willing to reduce your waiting time by half?

❒ Yes, I would be willing to reduce my waiting time by half.
❒ No, I would not be willing to reduce my waiting time by half.

Suppose your waiting time per visit in the Orthopaedics department usually lasts 1 hour. It would be possible to reduce this waiting time to 20 minutes by means of more efficient scheduling or employing extra people. The reduction of your waiting time does neither influence the effectiveness of your treatment nor the recovery.

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.

Would you be willing to pay for this reduction in your waiting time?

☐ Yes, I would be willing to pay for this reduction in waiting time.
☐ No, I would not be willing to pay for this reduction in waiting time.

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 the usual waiting time would be reduced from 1 hour to 20 minutes. Would you be willing to pay more than 30 euro for this reduction in waiting time?

☐ Yes: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my waiting time with 40 minutes.
☐ No: what is the maximum amount of money you would be willing to pay? I would be willing to pay ..... euro at once to reduce my waiting time with 40 minutes.

How sure are you about your stated willingness to pay?

☐ Sure
☐ Not sure