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WAITING TIME SOCIOECONOMIC STATUS -AN INDIVIDUAL-LEVEL ANALYSIS

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Waiting time and socioeconomic status
- an individual–level analysis

by

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Abstract

Waiting time is a rationing mechanism that is used in publicly funded healthcare systems. From an equity viewpoint, it is regarded as preferable to co-payments. However, long waits are an indication of poor quality of service. To our knowledge, this analysis is the first to benefit from individual-level data from administrative registers to investigate the distribution of waiting time with respect to socioeconomic status. Furthermore, it makes use of an extensive set of medical information that serves as indicators of patient need. Differences in waiting time by socioeconomic status are detected. For men there is a statistically highly significant negative association between income and waiting time. More educated women, i.e., having an education above compulsory schooling, experience lower waiting time than their fellow sisters with the lowest level of education.

1. Introduction

Waiting time is a rationing mechanism that is used in many health care systems to establish equilibrium between the supply of and demand for health care services. From an equity viewpoint, it is regarded as preferable to co-payments, because the latter will exclude patients in need of treatment if they cannot afford it. However, waiting time causes pain, discomfort and anxiety to the individual patient, and prolonged waits are an indication of poor quality of service. Despite the great political interest in avoiding waiting time and the concern for equity, little is known about the distribution of waiting time with respect to socioeconomic status (SES). The scarcity of empirical evidence on this topic is due to lack of high quality data. In a recent paper, Siciliani and Verzulli (2009) apply survey data from nine countries to investigate the matter. For non-emergency surgery they find a negative and significant association between education and waiting times in Sweden, The Netherlands and Denmark, while the estimated effect of income was generally small. However, the drawbacks of survey data, such as small sample size and recall bias, have been pointed out in several yet unpublished analyses which employ administrative data in stead (Laudicella, Cookson, and Siciliani (2010), Carlsen and Kaarboe (2010), Tinghög et al.(2010)).

The contribution of this analysis is its unique data set of individual-level data from reliable sources, which enables us to explore the distribution of waiting time in great detail. The individual-level data stem from administrative registers. In that respect, our paper is closest to the work of Tinghög et al.(2010), but our data set is larger, it has information on supply side factors and ,notably, on education as well as income. Our analysis focuses on one patient group, thus enabling us to control extensively for patient severity. This is crucial as health care policy in many countries mandates shorter waiting times for more severely ill patients (Siciliani and Hurst, 2005). The patient population studied is patients who had a primary hip replacement in Norway during the years 2000-2003.

The paper is organised as follows. Section 2 provides a short description of the Norwegian health care system. Section 3 presents the data used, while the empirical method is explained in section 4. Results are reported and discussed in section 5. Section 6 concludes the paper.

2. Institutional background

Economic theory points to many pathways through which socioeconomic status can influence waiting time. According to human capital theory, productivity and wages are increasing in education, so is foregone labour income while waiting. Education may enhance individuals' knowledge of the functioning of the health care system. Furthermore, having more schooling may facilitate communication with medical personnel (Ishikawa and Yano, 2008). There may also be unobserved factors at play which are correlated both with education and waiting time. If individuals' educational choice is credit-constrained, these characteristics could be picked up by the income variable in stead. It is commonly assumed that health improvement is a normal good, i.e., well-off individuals have, cet.par., a higher willingness-to-pay for reducing waiting time. Monetary travel costs to distant providers or high copayments may not be prohibitive to them.

Norway's health system is largely financed by general taxes. Most services are nearly free of charge at the point of usage, and this applies for elective hip operations. The large majority of in-patient treatment takes place at public hospitals. The private commercial involvement in this sector is negligible, and private health insurance was non-existing during the study period. For historic reasons there are quite a few not-for-profit private hospitals operating, some of which have specialized in elective operations.

As of 1 January 2001, Norwegian patients have been granted a legal right to choose a provider for elective treatment[1]. Patients may have to travel long distances to hospital. However, copayment for transportation is negligible, the equivalent of 27 Euros one way if the patient goes to a hospital in another health region, and about 16 Euros otherwise (payment data are for 2005). Information on waiting times has been made available via a free telephone service, which started when the reform was implemented in 2001.[2] Despite the free choice of provider, only one percent of the patients in 2003 and 2004 actually opt for elective treatment at hospitals outside their own health region, according to Christensen and Hem (2004).

The patient is usually referred to a hospital by a GP. In order to assess whether a hip replacement, for example, is necessary, an examination is typically conducted by an orthopaedic surgeon at an outpatient clinic. The referral entails the patient being placed on a waiting list at a particular hospital. While waiting, the patient may choose to switch to another hospital, but will then be treated as a newcomer to the latter hospital's waiting list, so there is, in effect, a certain lock-in mechanism at play. Waiting time is defined as the time elapsed between referral and the date of hospitalisation.

[1] The right extends to all public hospitals in the country. It was taken as granted that "public hospitals" included non-commercial hospitals that had an agreement with hospital authorities (Ot.prp. no. 63 (2002-2003)). Hospitals affected by the law have a duty to "accept all patients who choose the hospital" (Ot.prp. no 63, 2002–2003) but have a formal right to reject patients from another health region if they need to prioritize their own patients for reasons of capacity (Directorate for Health and Social Affairs, circular IS-12/2004).

[2] In May 2003, the Government launched an information service on the Internet. This study uses data for patients who entered onto the waiting list no later than June 2003.

The GP is likely to be better informed than the patient about the overall quality of different hospitals. As a result of the reform introduced on 1 June 2001, every Norwegian citizen is entitled to a specified GP, who is allocated a key role as advisor when patients choose a hospital. Most GPs are self-employed and they are financed partly by list patient capitation and partly by fee-for-service. It is difficult to see what self-interest a GP should have in making referrals to a specific hospital, except for possible loyalty and personal relations. Gathering information is time-consuming and therefore costly to him (Vrangbæk *et al.*, 2007). The GP gets no direct compensation for such services, but the competition for patients introduced by a list patient system may give stronger incentives to engage in the matter (Carlsen, Iversen and Lurås, 2005). Nonetheless, patients may differ in their search cost. If the GP does not provide information about hospital choice, differences in patients' search costs may be decisive for observed patient behaviour.

Total hip replacements are carried out by the majority of Norwegian hospitals, but the number of operations per year varies significantly among them. Prior to 2002, public hospitals were owned by 19 different counties. Pursuant to the hospital reform implemented on 1 January 2002, the specialized health care sector was organized as state owned enterprises within five regional health authorities, which are responsible for patients within the region. The government allocates its budget to regional health authorities, which are then free to decide how much to allocate to individual hospitals under their jurisdiction. Since 1997, hospital owners have been given economic incentives to attract patients, since part of their funding is based on activity level. The rest is given as a block grant. The proportion that is paid based on activity was 50% of the stipulated cost per diagnosis-related group (DRG) in 1999-2001, 55% in 2002 and 60% in 2003.

The difference between activity-based remuneration and marginal cost varies significantly both between and within DRGs. Until 2003, all hip replacements were defined in one category, DRG 209, with a stipulated average cost of about 13,700 euros. In 2003, a subcategory was introduced for complicated cases, for which the compensation per treatment was about 2,000 euros higher. This subcategory is scarcely present in our sample. Elective surgery, including hip replacements, is considered to be an economically and organizationally attractive activity for an orthopaedics department.[3]

[3] According to an internal report from one of the regional health authorities (also called "health regions"), elective orthopaedics is profitable to the orthopaedics department. Performing a high volume of operations gives status and attracts candidates for specialization (Helse Nord, 2003).

3. Data

3.1. Construction of the data set

The data set is a pooled cross-section obtained by merging data from four different sources. Details on these data sets and the exclusion criteria follow below.

The source data are from *The Norwegian Arthroplasty Register* (hereafter NAR). Registrations in NAR are voluntary and based on registration forms that the surgeon completes immediately after an operation. Both public and private hospitals report to the register, which had a reporting rate of 98% of all hip replacements in 1999-2002 (Espehaug *et al.*, 2006). This analysis uses data on primary hip replacement operations performed at Norwegian hospitals during the period 2000–2003 on patients 25 years of age or older. If an individual has had several primary hip operations during the study period (i.e., on both hips), only the first one is included. Thus, 22,771 operations performed on the same number of individuals are relevant for this analysis. NAR provides data on the date of operation, the hospital used, patients' age and gender, and extensive medical information specifically related to the hip replacement. In addition to main diagnosis and number of secondary diagnosis, we include variables that reflect the patient's history of hip operations over a long period; indicators for having had any hip operation prior to the hip replacement and for having another primary hip replacement after the one in question. Furthermore, there are indicators representing the medical reason for the primary hip replacement observed.

Data on the individual's level of education, income, number of children and marital status have been gathered from the registers of *Statistics Norway*. These two registers can be perfectly merged by means of the unique personal identification code. Waiting time data are provided by *The Norwegian Patient Register* (hereafter NPR), and we utilize only observations that had NSCP codes relevant for primary hip replacements within DRG 209. For each hospital stay there are data on the patient's waiting time and home municipality, the name of the hospital, whether the stay was an emergency case or not, procedures executed, main diagnosis, secondary diagnosis etc. A *Matrix of distances* between all Norwegian municipalities provides information on driving distance by car in minutes, and makes it possible to identify the closest and next closest hospital in relation to the patient's home municipality.

An overview of the sample selection process is given in table 1. Data from the NPR are merged with the NAR data using the following variables; patient's year of birth, gender, date of operation, and hospital number. After matching, the combined data set consists of 17,871 observations, which is 79% of the relevant part of the NAR data set.[4] Among these, 1,434 observations lacked information on waiting time, and 112 on level of education. For fear of measurement errors, we have dropped observations that are outliers with respect to waiting time (in total 497 observations[5]. After inspecting seasonal variations in entry onto waiting lists, we excluded observations where entry took place before November 1999 or later than June 2003, confer figure 1. Further details are provided in table 1. The procedure described above generates a data set of 13,348 individuals aged 25 and above.

3.2 Descriptive statistics

Table 2 presents an overview of key variables and summary statistics by gender (for more comprehensive information on the data set, see appendix table 1, which reports for the mean individual). Waiting time varies substantially, with a mean of 173 days for men and 167 days for women. The dependent variable is defined as the log of waiting time and its distribution is shown in figure 2.

The key explanatory variables are education and income. Education is represented by three binary indicators for levels of completed education: compulsory schooling, having some education after compulsory schooling and having completed three years of upper secondary schooling or more.[6] Income is measured by yearly gross income, which comprises all income from labour, private enterprise, pensions, sickness allowance as well as financial income. Yearly nominal income, on which we have data for the years 2000-2003, is deflated to year 2000 price level. The data set makes it possible to explore several income concepts. Transitory income is represented by income the year prior to hip replacement, thus reducing the potential influence on income of inactivity during rehabilitation. Average income over several years serves as a proxy for permanent income. As waiting time observed is the result of supply and demand, it is important to control for supply factors as well. These and other controls are presented in the empirical analysis section below.

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[4] How well the two registers match varies among the institutions. Interest lies in whether some institututions are strongly under-represented or over-represented after the match compared to their share of operations in the NAR. Differences are traced, without any obvious explanation. The data set after matching is very similar to the pre-matching NAR set with respect to mean and variation of sex, age and date of operation. One source of mismatch stems from the fact that bilateral hip replacements made during one hospital stay are counted as two observations with the NAR, but only one with the NPR.

[5] Outliers are defined in accordance with several other studies of waiting times in Norway (The Office of the Auditor General of Norway, 2003).

[6] For the younger part of the sample, compulsory school lasted nine years. The definition of levels of secondary schooling takes into account the fact that the length of compulsory schooling has increased over time. Thus it may be regarded as a measure of an individual's level of education *relative to* his cohort.

The reference individual is a never-married woman (man) under the age of 50, who entered onto the waiting list in 1999, and whose highest level of education is compulsory schooling. Seventy per cent of the patients are women and their average age is 70 years, while men are on average 2,5 years younger. Women earned only 55 percent of men's average income, and had a lower level of education as well: 58 percent had completed some education after compulsory schooling compared to 67 percent for men and only 19 percent (35 percent) had completed three years of upper secondary education or higher education. Because of restrictions made during data selection, only four percent of the sample entered onto the list in 1999, about twenty-seven per cent in each of the years 2000, 2001, and 2002, and about fourteen per cent in 2003. Twenty-three (twenty-one) percent had their operation at a non-profit, private hospital and about eight percent at a university hospital. The average distance to the hospital used was 1,24 (1,08) hours by car. Travel distances within Norway may be substantial; the maximum travel distance to the closest hospital is 7,7 hours in this data set.

4. Empirical analysis

In order to investigate the relationship between SES and waiting time, we estimate an ordinary least squares model as follows.

$$WT_i = \beta_0 + \beta_1^{'} DEM_i + \beta_2^{'} MED_i + \beta_3^{'} SUPPLY_i + \beta_4^{'} SES_i + \beta_5^{'} MARITAL_i + \varepsilon_i$$

where WT is the log of waiting time of individual *i*, and the parameter vector of prime interest is β_4, connected to SES which represents level of completed education and income. In the main specification, we include a dummy for having completed any education above compulsory schooling. Income is expressed as the log of gross income the year prior to entry at waiting list. DEM represents age and gender, and MED is a comprehensive vector of medical information, described in section 3. The SUPPLY vector contains data on the year in which the patient was placed on the list[7] as well as geographical information on county, regional health authority and the patient's distance to the closest hospital which offers hip replacements. If a hospital is located in the municipality where the patient lives, the distance will be zero. In order to further reflect cost of access, we include distance to closest-next

[7] Year dummies cover several aspects that are potentially important for waiting time and that have changed over time, e.g., health care sector reforms, hospitals' total budget and the share assigned to activity based financing. We choose to include the year of *entry* to reflect the conditions at the point in time when the choice of hospital is possibly made, keeping in mind that there is a lock-in mechanism. Alternatively, one may include the year of *operation.*

hospital, defined as the closest hospital outside of the patient's municipality of residence. An indicator for university hospital is included to reflect that the more complicated cases are typically treated there, as well as an indicator for (non-commercial) private hospitals. As an indicator of patient choice we generate a dummy for bypassing the closest hospital. Patient's opportunity set is mirrored by the distance to the next closest municipality hosting a hospital. Trends in waiting time are captured by time dummies. MARITAL represents the patient's marital status and parenthood to children under the age of eighteen.

Our choice of estimator is facilitated by our waiting time measure being a continuous variable (see the discussion in Siciliani and Verzulli, 2009). However, waiting is a duration and the distribution of days on the waiting list is heavily skewed to the left. Taking into account the fact that there are no zero values and no peaks in this distribution, we define the dependent variable to be the logarithm of days waited and apply an OLS specification. Having done this transformation, applying an OLS model is approximately equivalent to running a basic duration model (Carlsen and Kaarboe, 2010). Figure 2 displays the distribution of the dependent variable.

Note that our data is at the individual level, which is very rare in the analysis of how waiting time varies by SES. Data on key variables are from administrative registers, thus reducing the risks of measurement error and avoiding small sample size which is a concern in surveys.

5. Results and discussion

Our interest lies in the association between waiting time and SES, and the data available allow us to investigate whether this relationship differs by gender. Control variables were added stepwise, and results from two of the most comprehensive specifications are reported in table 3. We started with a very simple regression of waiting time on income, marital status and parenthood to young children. Then controls were included to reflect education, age, patient medical information, and time of entry onto waiting list, i.e., the specification labelled (I) in the table. Specification (II) takes into account supply side factors as well, such as hospital ownership (public versus private, non-commercial hospital), university hospital status, patient's health region and county of residence, and distance to hospital.

Separating the sample by gender renders interesting results. For key variables, the magnitude of the coefficients differs across specifications (some of which are not reported in table 3), but the statistical significance and sign remain the same: for women, there is clear negative association between level of education and waiting time, whereas the income variable is insignificant. For men, the picture is nearly the opposite. Well-off men wait shorter for treatment, while the coefficient for male education, although negative as expected, is statistically insignificant once supply side factors are controlled for. Furthermore, inclusion of supply side covariates causes a sharp decrease in the magnitude of the coefficients for the income variable for men and the education variable for women. It should be noted that an estimation on the whole sample, with control for gender, will disguise the gender difference in the association between SES and waiting time, and thus lead to a misinterpretation of the results.[8]

Other things equal, an increase in income of NOK 10000 (1250 Euros) is associated with a shortening of waits of 48 days among men. Women who have completed some education above compulsory schooling experience on average 10 days shorter waits than their fellow sisters with compulsory schooling only. We have checked the robustness of this estimate in a number of ways, and results are reported in Appendix table 2. The following aspects have been examined:

a) Whether the results are driven by very long waits. In the columns labelled A, the quintile with the highest waiting time, i.e., with waits above 245 days, was excluded. The coefficients of interest have the same sign but are of lower magnitude than with the full sample (-0.065 versus -0,078 for male income and -0.049 versus -0.062 for female education level). However, despite the sample being smaller, the statistical significance remains the same.

b) whether results are driven by patients at the upper end of the SES distribution. This aspect was investigated by excluding men in the highest income quintile and women having completed some higher education; i.e., 13 percent of all women in the sample. Results are reported in columns B and C of Appendix table 2. The income variable becomes less significant, otherwise, the qualitative results are unchanged.

c) whether results depend on the definition of the SES variables. The indicator for educational level was redefined to reflect a level of at least 3 years of secondary education, in stead of any education above secondary schooling. This redefinition gave a small decrease in the absolute value of the coefficient for women (from 0,062 to 0,051). Furthermore, we replaced income the year prior to entry at the waiting list with average income. As could be expected, this gave

[8] We have estimated table 3 specifications for the whole sample as well. For the mean individual, income is statistically significant at 5 % level in specification (I) but not in (II), while education remains statistically significant, even at 1 % level, across all specifications.

a moderate increase in the coefficient for male income (-0,086 versus -0,078). In sum, the qualitative results appear robust to these different definitions of the SES variables.

Additionally, we have checked whether characteristics of the supply side may alter results. Previous research has shown that patients, given the right to choose hospital in 2001, make a trade-off between waiting time and distance to hospital (Monstad, Engesæter and Espehaug, 2007). In order to capture the patient's opportunity set, we replaced actual distance to hospital with the distance to next-closest hospital, and even an indicator for bypassing the closest hospital. None of the changes made to supply side variables alter the results for income and education estimated in the main specification.

Overall, we find the results for control variables to be reasonable. As shown in table 3, patients who travel one extra hour get a reduction in waiting time of 4.8 %. University hospital patient wait longer, and patients at private, non-commercial hospitals wait much shorter, perhaps because some of these hospitals specialize in elective surgery. There is a clear falling trend in waiting times, as can be seen from the year dummies. Inspecting patient characteristics, we find that older patients wait less, *cet.par.* For instance, a woman aged 80 and above wait approximately 8 % less than her fellow sister aged 70. Patients who have a primary hip replacement on both hips during the study period constitute a special group, who experience considerably shorter waits for the first of the two operations, irrespective of gender. Some findings are gender-specific: men who have had a hip operation before the hip replacement (eight percent of all men) wait 15 percent longer. Among women, waiting time increases in comorbidites, which is somewhat surprising. For both genders, main diagnosis and medical reason for hip replacement is a major determinant of waiting times. While controlling for these variables, we do not report their coefficients to keep the presentation simple. Results not reported in the paper are available from the authors upon request.

Our results contrast the findings in Siciliani and Verzulli (2009), who conclude that "Surprisingly, an increase in income of 10,000 Euro increases waits by 11% in Sweden." There are many differences between the two studies. Nevertheless, in many respects, the Norwegian health care system bears similarities to the Swedish, and the average age is not very different in the two analyses (sixty-five versus sixty-nine years). With more detailed and reliable data and a larger sample, we find a *negative* relationship between waiting time and SES in Norwegian data. Furthermore, our study shows that this relationship is gender-specific. It should be noted that within the cohorts which dominate our sample, many individuals, particularly women, were financially restricted in their choice of educational level. Consequently, women who got some education are a more selected group than men at the same (low) level of education. It also appears reasonable that income is a better marker of SES for men than for women, given traditional gender roles and men's much higher labour market participation. Furthermore, women with some education are much more concentrated in the health care sector than men, which may improve their access to relevant health market information.

The exact mechanisms behind the negative association between SES and waiting time are difficult to trace. However, in this case it does not seem likely that patients' labour market association when entering the waiting list is important, given the age composition of the patient population. Neither was private health insurance or use of commercial private hospitals an issue during the period studied. Possible explanations are that more well-off and/or more educated individuals communicate better with health care personnel. Their search costs may be lower, for instance because of better informed networks or because they are more apt in acquiring information about the functioning of the health care system.

6. Conclusion

The literature on socioeconomic differences in waiting time is scarce, in contrast to the great political interest in waiting time and the declared health policy aim of "equal treatment for equal need". We claim that this analysis is a major contribution to the existing literature, because of the data set applied. Having relevant and reliable data on SES and a comprehensive set of controls for medical condition is a prerequisite for undertaking such an investigation. This analysis, which benefits from individual level data from administrative and high-quality health registers, detects socioeconomic differences in waiting time. Our measures of socioeconomic status are level of education and gross income, which is available over several years. We find that higher SES reduces waiting time both for men and women, but interestingly, the SES measure of importance varies by gender. For men there is a statistically highly significant negative association between income and waiting time, while educational level does not seem important. In contrast, more educated women, i.e., having an education above compulsory schooling, experience lower waiting time than their fellow sisters with the lowest level of education. The analysis proves that controlling for supply side factors is crucial when assessing the impact of income and education on waiting time. In addition, it is imperative that the sample size allows for a gender-specific analysis.

The association estimated is of some magnitude, on average a woman who has completed at least some as opposed to no secondary education experiences a 6.2 per cent reduction in waiting time, which corresponds to a reduction of 10 days, *cet.par*. Among men, a rise in income of NOK 10,000 (about 1250 Euros) is associated with a reduction in waiting time of 48 days for primary hip replacement.

A caveat should be made that the population studied, although one of the largest within elective surgery, may not be representative of the hospital patient population in general.

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Figures

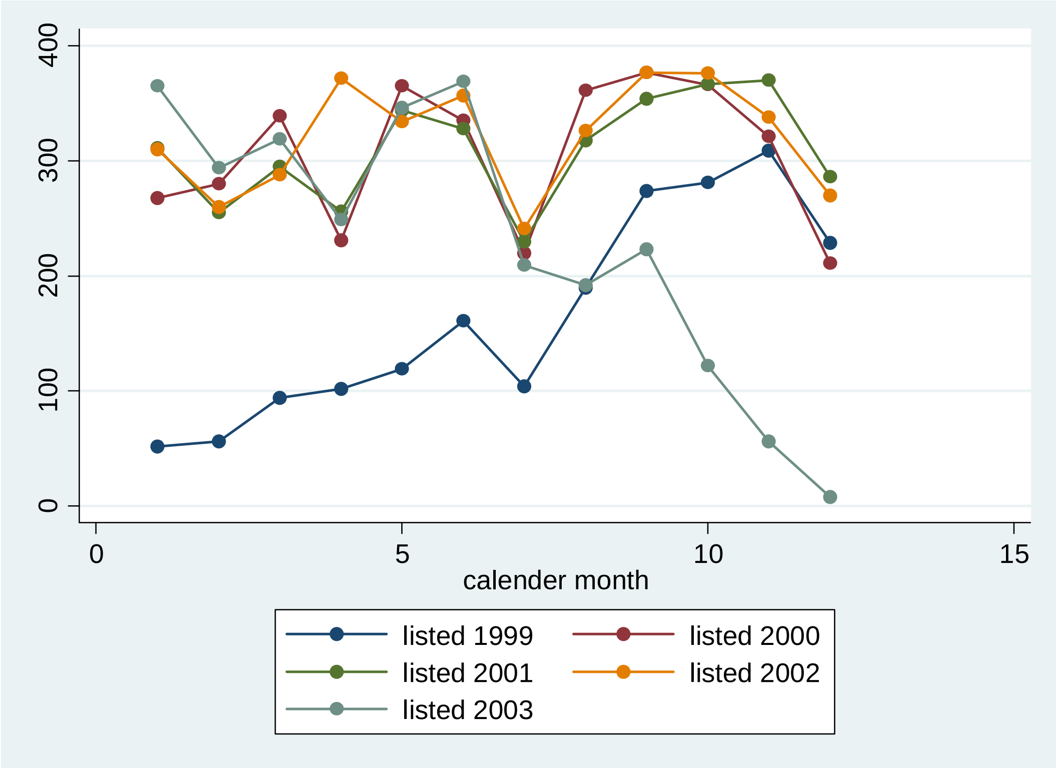

Figure 1. Seasonal variation in entry to the waiting list.

The vertical axis displays, for each year, the number of patients entering the waiting list in a given calendar month.

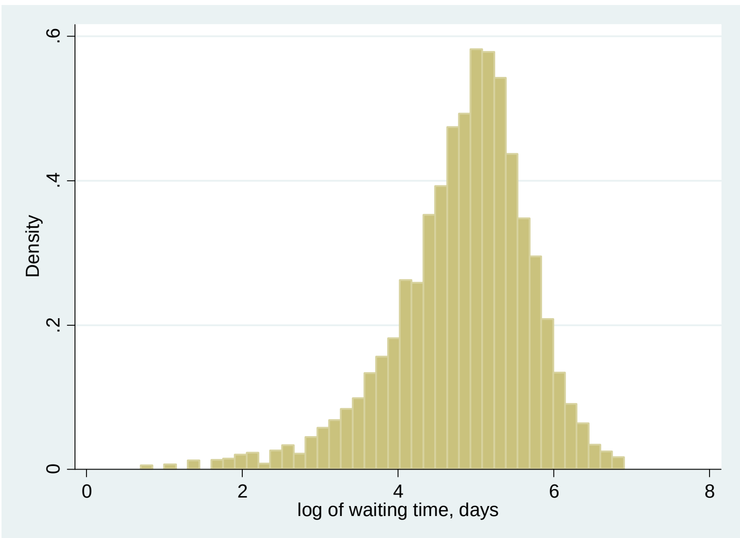

Figure 2. The distribution of the dependent variable, log of waiting time.

Tables

T1. Sample selection

	No. of observations
No. of primary hip operations for which waiting time data is potentially available	17 879
Restrictions and missing on key variables:	
missing on patient's home municipality	-8
missing on waiting time	-1 434
waiting time is less than 2 days	-233
waiting time exceeds 999 days	-264
the patient's age when listed is below 25	-12
the patient was registered on waiting list later than June 2003	-761
the patient was registered on waiting list prior to November 1999	-1 675
compulsory schooling is not completed	-30
missing on level of education	-112
missing on marital status	-2
Estimated sample	13 348

T2. Descriptive statistics

	men (4009 obs)		women (9339 obs.)	
	Mean	Std. Dev.	Mean	Std. Dev.
Waiting time, days	173.7	135.6	166.7	127.6
age when registered on waiting list	67.9	10.9	70.3	10.4
Income and education:				
gross income year (t-1), price-deflated, NOK	275921	333923	156330	132247
average gross income 2000-2003, price-deflated, NOK	273179	333394	158827	127560
1 if any education completed above compulsory schooling	0.67	0.47	0.58	0.49
1 if completed at least 3 years of secondary education	0.35	0.48	0.19	0.39
Main diagnosis, no.of comorbidities, register-specific information				
Marital status, having children under the age of 18				
Time and place, supply:				
Patient's health region and county				
1 if registered on waiting list in 1999	0.04	0.21	0.04	0.19
1 if registered on waiting list in 2000	0.27	0.44	0.27	0.44
1 if registered on waiting list in 2001	0.27	0.44	0.27	0.45
1 if registered on waiting list in 2002	0.28	0.45	0.28	0.45
1 if registered on waiting list in 2003	0.13	0.34	0.14	0.35
1 if private hospital	0.21	0.41	0.23	0.42
1 if university hospital	0.08	0.27	0.07	0.26
Distance to hospital, hours by car	1.24	2.36	1.08	2.02

T3. Results – waiting time and socioeconomic status

	men		women	
	(I)	(II)	(I)	(II)
loginclist	-0.117***	-0.078***	-0.002	0.006
	(-5.30)	(-3.58)	(-0.25)	(0.67)
edu_above2	-0.054*	-0.019	-0.102***	-0.062***
	(-1.78)	(-0.63)	(-5.59)	(-3.46)
listage	-0.008***	-0.007***	-0.009***	-0.008***
	(-4.70)	(-4.51)	(-7.60)	(-7.41)
multprim	-0.275***	-0.264***	-0.223***	-0.201***
	(-5.88)	(-5.87)	(-7.58)	(-7.09)
v2	0.126*	0.151**	0.066	0.057
	(1.67)	(2.08)	(1.43)	(1.28)
bdiag_count	0.006	0.007	0.027***	0.027***
	(0.54)	(0.61)	(3.69)	(3.85)
list00	-0.220***	-0.181**	-0.179***	-0.206***
	(-2.90)	(-2.47)	(-3.39)	(-4.04)
list01	-0.331***	-0.301***	-0.264***	-0.281***
	(-4.36)	(-4.11)	(-5.06)	(-5.58)
list02	-0.437***	-0.405***	-0.387***	-0.407***
	(-5.76)	(-5.52)	(-7.37)	(-8.00)
list03	-0.863***	-0.831***	-0.793***	-0.814***
	(-10.19)	(-10.10)	(-13.78)	(-14.62)
private		-0.237***		-0.192***
		(-5.06)		(-6.37)
univhosp		0.198***		0.131***
		(3.29)		(3.32)
dist		-0.047***		-0.048***
		(-7.94)		(-10.85)
Control for:				
patient health region	no	yes	no	yes
county of residence	no	yes	no	yes
marital status	yes	yes	yes	yes
having children <18	yes	yes	yes	yes
main diagnosis	yes	yes	yes	yes
operation duration	yes	yes	yes	yes
reason for hip replacement	yes	yes	yes	yes
calendar month	yes	yes	yes	yes
N	3943	3943	9223	9223
r2_a	0.102	0.171	0.099	0.166

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX

App. Table 1. Descriptive and summary statistics

variable name		Obs	Mean	Std. Dev.	Min	Max
Dependent variable:						
wait	Waiting time, days	13348	169	130	2	994
logwait	log of waiting time, days	13348	4.821	0.872	0.693	6.902
Age and gender:						
female	1 if female, otherwise 0	13348	0.700	0.458	0	1
listage	age when registered on waiting list	13348	69.626	10.586	25	98
Medical information:						
multprim	1 if primary hip replacement on both hips within period studied	13348	0.098	0.297	0	1
v2	1 if has had any hip operation prior to hip replaceme	13348	0.100	0.301	0	1
v12_1	1 if reason for hip replacement is unspecified	13284	0.026	0.161	0	1
v12_2	1 if reason for hip replacement is spondyloarthrithis (Bechterew)	13284	0.003	0.053	0	1
v12_3	1 if reason for hip replacement is idiopathic osteoarthritis of the hip	13284	0.784	0.412	0	1
v12_4	1 if reason for hip replacement is rheumatoid arthritis	13284	0.024	0.154	0	1
v12_5	1 if reason for hip replacement is secondary to Perthes' disease or slipped capital femoral epiphysis (SCFE)	13284	0.012	0.107	0	1
v12_6	1 if reason for hip replacement is secondary to developmental dysplasia of the hip (DDH)	13284	0.070	0.256	0	1
v12_7	1 if reason for hip replacement is secondary to DDH with dislocation	13284	0.003	0.055	0	1
v12_8	1 if reason for hip replacement is secondary femoral neck fracture.	13284	0.078	0.268	0	1
hd_m059	1 if main diagnosis is M059	13348	0.007	0.082	0	1
hd_m160	1 if main diagnosis is M160	13348	0.219	0.414	0	1
hd_m161	1 if main diagnosis is M161	13348	0.567	0.496	0	1
hd_m162	1 if main diagnosis is M162	13348	0.018	0.134	0	1
hd_m163	1 if main diagnosis is M163	13348	0.027	0.164	0	1
hd_m165	1 if main diagnosis is M165	13348	0.014	0.119	0	1
hd_m166	1 if main diagnosis is M166	13348	0.010	0.099	0	1
hd_m167	1 if main diagnosis is M167	13348	0.019	0.137	0	1
hd_m169	1 if main diagnosis is M169	13348	0.030	0.171	0	1
hd_s720	1 if main diagnosis is S720	13348	0.007	0.085	0	1
hd_T841	1 if main diagnosis is T841	13348	0.009	0.095	0	1
hd_T931	1 if main diagnosis is T931	13348	0.025	0.156	0	1
bdiag_count	Number of secondary diagnoses	13348	0.865	1.239	0	7
optime	Duration of hip operation, minutes	13229	98	29	19	507

App. Table 1. Descriptive and summary statistics, *cont.*

Time and place, supply:						
list99	1 if registered on waiting list in 1999	13348	0.039	0.194	0	1
list00	1 if registered on waiting list in 2000	13348	0.268	0.443	0	1
list01	1 if registered on waiting list in 2001	13348	0.273	0.446	0	1
list02	1 if registered on waiting list in 2002	13348	0.283	0.451	0	1
list03	1 if registered on waiting list in 2003	13348	0.137	0.344	0	1
pregion	Patient's health region (by patmunno)	13348	2.492	1.409	1	5
pcounty	Patient's home county (by patmunno)	13348	9.677	5.598	1	20
hregion	Hospital's health region (by hospmunno)	13348	2.461	1.411	1	5
hcounty	Hospital's location, county (by hospmunno)	13348	9.531	5.657	1	20
private	1 if private hospital	13348	0.221	0.415	0	1
univhosp	1 if hospital used is university hospital	13348	0.074	0.262	0	1
dist	Distance to hospital, travel time by car, hours	13348	1.126	2.1	0	44.1
cl_dist	Distance to closest hospital, travel time by car, hours	13348	0.488	0.8	0	7.7
clnext_dist	Distance to closest-next hospital municipality, travel time by car, hours	13348	1.344	1.3	0.2	9.5
bypass	1 if closest hospital is bypassed	13348	0.402	0.490	0	1
Income:						
inclist	price-deflated gross income, the year prior to wating list registration, NOK	13348	192261	220741	0	10100000
incav	average gross income 2000-2003, price-deflated, NOK	13348	193178	217970	0	12000000
rbrto_2000	gross income 2000, price level of 2000, NOK	13347	190342	215296	0	10100000
rbrto_2001	gross income 2001, price level of 2000, NOK	13345	189586	191151	0	6971597
rbrto_2002	gross income 2002, price level of 2000, NOK	13275	197437	254142	0	12500000
rbrto_2003	gross income 2003, price level of 2000, NOK	13149	197289	314255	0	20500000
Education:						
edul2	1 if education completed=level 2	13348	0.394	0.489	0	1
edu_above2	1 if any education completed above compulsory schooling	13348	0.606	0.489	0	1
edu_above3	1 if completed at least 3 years of secondary education	13348	0.239	0.427	0	1
Marital status, children:						
single	1 if single	13348	0.070	0.255	0	1
married	1 if married or registered partner	13348	0.568	0.495	0	1
widow	1 if widow(er) or if partner is deceased	13348	0.271	0.445	0	1
divorced	1 if divorced or separated	13348	0.091	0.288	0	1
kids	1 if parent to children<18 years of age, year prior to wait	13348	0.147	0.354	0	1

App. Table 2. Robustness checks

	men		women	
	longest waits excluded	highest income excluded	longest waits excluded	highest education excluded
	(A)	(B)	(A)	(C)
loginclist	-0.065***	-0.058*	0.010	0.007
	(-2.94)	(-1.82)	(1.14)	(0.71)
edu_above2	-0.036	-0.014	-0.049***	-0.060***
	(-1.17)	(-0.41)	(-2.74)	(-3.22)
listage	-0.004**	-0.007***	-0.004***	-0.008***
	(-2.35)	(-3.09)	(-3.70)	(-6.58)
multprim	-0.194***	-0.304***	-0.113***	-0.190***
	(-4.32)	(-4.99)	(-4.02)	(-6.18)
v2	0.144*	0.192*	0.039	0.038
	(1.92)	(1.93)	(0.84)	(0.79)
bdiag_count	0.004	0.008	0.015**	0.030***
	(0.32)	(0.60)	(2.09)	(4.01)
list00	-0.088	-0.259***	-0.088	-0.217***
	(-1.07)	(-2.88)	(-1.59)	(-3.98)
list01	-0.149*	-0.369***	-0.101*	-0.295***
	(-1.81)	(-4.11)	(-1.83)	(-5.46)
list02	-0.144*	-0.449***	-0.147***	-0.419***
	(-1.77)	(-4.98)	(-2.66)	(-7.68)
list03	-0.426***	-0.918***	-0.386***	-0.837***
	(-4.78)	(-9.00)	(-6.50)	(-14.00)
private	-0.156***	-0.211***	-0.133***	-0.201***
	(-3.45)	(-3.37)	(-4.54)	(-6.08)
univhosp	0.029	0.200***	-0.020	0.127***
	(0.45)	(2.61)	(-0.47)	(3.01)
dist	-0.039***	-0.055***	-0.039***	-0.052***
	(-6.80)	(-6.87)	(-9.33)	(-10.47)
N	3097	2440	7440	8025
r2_a	0.122	0.170	0.126	0.165

t statistics in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes:
1. The following exclusion criteria have been applied: In specification (A); observations within the highest quintile of waiting time, in (B), the highest quintile of income, and in (C), having completed some higher education, i.e., above three years of upper secondary schooling.
2. The same controls have been used across specification (A)-(C). Included, but not reported in the table, are controls for patient health region and county of residence, marital status and parenthood to children under the age of 18, main diagnosis, operation duration, medical reason for hip replacement, and calendar month when the patient was registered at the waiting list.

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