The relationship between socioeconomic status and waiting time among elderly people in Norway

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Innhold

Abstract

We investigate whether socioeconomic status affects hospital waiting times for elderly men when controls for severity and supply/choice variables are included. Socioeconomic status is measured by small area level education. We estimate a series of regressions explaining waiting time as a function of education level. We find that patients of different socioeconomic status are treated differently when only fixed effects for birth year is included. When we control for medical condition the effect increases and is large: male patients with tertiary education wait 48 % shorter than other patients. When we include fixed effects for local hospital, the estimated effect on waiting time of tertiary education falls from 48 % to 30 %. Thus, the negative correlation between waiting time and education level across local hospitals explain a little more than one third of the educational gradient in waiting time, whereas variation between the waiting time and education level across patients within local hospitals explain about almost two thirds of the gradient. When we analyse the educational gradient within local hospitals we find that travel distance and the quality of primary health care explain the gradient. Hence, we do not find evidence of discrimination against elderly men without tertiary education.

Introduction

It's a well-known fact that the people with higher educated have better access to health care also in publicly funded health system. This may seem problematic as these health systems aim to provide equal access to care independent of socioeconomic characteristics.

Better access can take various forms. Van Doorslaer *et al.* (2004) find that more educated individuals in many European countries are more likely to see a specialist. Propper *et al.* (2005) find that the better educated patients with arthritis receive higher amount of resources in the English National Health Service. Iversen and Kopperud (2005) find that the better educated in Norway tend to use more specialized care.

Another aspect of access to health care is waiting time. Recently, several papers have looked into the association between waiting time and socioeconomic status (Siciliani and Verzulli 2009; Kaarboe and Carlsen 2012; Laudicella *et al.* 2012; Petrelli *et al.* 2012; Johar *et al.* 2013). These studies find that high socioeconomic status, measured by education or income level, is associated with lower waiting time in several European countries and in New South Wales, Australia.

None of the studies of waiting time present results for the elderly. We believe it is of interest to study seniors as they account for a large share of hospital utilization, and the share is going to increase in most industrialized countries.[1] Moreover, aging brings declines in health and cognitive abilities, and there is a strong correlation between socioeconomic status, health and cognitive skills in older age (van Kippersluis *et al.* 2009, 2010; Bonsang et al. 2012; Schneeweis *et al.* 2012). This raises the question of whether seniors with low socioeconomic status are able to navigate, express themselves and make choices that secure their rights in modern health care systems.

To shed light on this issue, we use Norwegian administrative data to examine the relationship between socioeconomic status and waiting time for people above the statutory retirement age of 67. We have access to a rich data set of hospital patient episodes that allows for controls for patients' medical condition (severity of illness). The data set also contains information about several supply and choice variables that may affect waiting time: hospital catchment area, choice of hospital, treatment at university hospital, travel distance to hospital, quality of primary care physicians, quality of long term care and the supply of private specialists.

Socioeconomic status is measured by small area level education.[2] The analysis is confined to elderly men as few elderly women have taken higher education. We do not have ambitions to discern the causal relationship between education level and waiting time. The aims of the study are to examine, first, whether elderly men with low education have longer waits than elderly men with more education, and, second, how the relationship between education level and waiting time is affected by medical conditions and supply/choice variables. We estimate a series of regressions explaining

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[1] For example, persons 60 and above account for almost half of all inpatient episodes and more than one third of all outpatient episodes in Norwegian hospitals (Statistics Norway, 2012).

[2] Income is not a good measure of socioeconomic status since we focus on retired individuals.

waiting time as a function of education level, successively including more and more controls for medical condition, supply and choice. Any remaining correlation between waiting time and education level that cannot be explained by the full set of controls is interpreted as evidence of discrimination on the basis of education.

As for the results, we find that patients of different socioeconomic status are treated differently when only fixed effects for birth year is included. The effect is quite large as elderly men with tertiary education wait 45 % shorter than men without tertiary education. When we control for medical condition (combinations of main and secondary diagnoses) the effect increases slightly: male patients with tertiary education wait 48 % shorter than other patients. When we include fixed effects for local hospital, the estimated effect on waiting time of tertiary education falls from 48 % to 30 %. Thus, the negative correlation between waiting time and education level across local hospitals explain a little more than one third of the educational gradient in waiting time, whereas variation between the waiting time and education level across patients within local hospitals explain about almost two thirds of the gradient. When we analyse the educational gradient within local hospitals, we find that travel distance and the quality of primary health care can explain the gradient. Hence, we do not find evidence of discrimination against elderly men without tertiary education.

The paper is organized as follows. Section 2 discusses why waiting times might differ between patients with different socioeconomic status, while section 3 gives a short description of the Norwegian health care sector. In section 4 the data are presented. Section 5 contains the empirical analysis. Concluding remarks are given in section 6.

Relationship between socioeconomic status and waiting time

In this section we discuss potential pathways between socioeconomic status and waiting time. Broadly speaking, we divide the pathways into three groups. The first is patients' disease pattern; the second is related to at which hospitals patients get their treatment; the third is related to factors that affect waiting time within the hospital.

One pathway why patients with different socioeconomic status experience different waiting times is that their disease pattern is different. Higher morbidity (and mortality) has been reported for people of lower socioeconomic status across a wide range of lifestyle related diseases, see e.g. Lynch *et al.* (1998) and Mackenbach *et al.* (2008). Differences in waiting time might therefor be caused by the fact that some diseases have longer waiting times than others. In the analyses we control for patients' medical conditions.

The second pathway we will emphasize is that people with high and low socioeconomic status receive treatments at different hospitals. If people with higher socioeconomic status live in areas and receive treatments at hospitals with lower waiting time, there will be a negative correlation between waiting time and socioeconomic status. In the analyses, we will control for hospital catchment area.

The third pathway we examine relates to aspects that might matter for unequal treatment of different socioeconomic groups within hospital catchment areas. People

with low socioeconomic status may wait longer because they are less able to navigate health care systems and overcome bureaucratic hurdles (Petrelli *et al.* 2012). Among the elderly, persons with low socioeconomic status have enhanced occurrence of functional disability and cognitive impairment, including dementia (Albert *et al.* 1995; Black and Rush 2002; Le Carret *et al.* 2003; Reyna *et al.* 2009; Schneeweis *et al.* 2012). Functional and cognitive decline may impair communication between hospitals and patients about treatment schedules and consequences of delayed treatment, and prevent patients from keeping appointments.

Waiting time at a hospital may also be affected by travel distance. People living closer to the hospital might fill open slots on short notice and hence obtain lower waiting time, and might also show up at the hospital without a referral, but still get elective treatment. If there, in addition, is a systematic difference in how close to hospitals individuals with different socioeconomic status live, travelling time will contribute to a correlation between waiting time and socioeconomic status. In Norway, people with lower socioeconomic status live in more rural areas, so we expect this correlation to be negative. We control for travel distance to the closest hospital in the analyses.

Patient choice of hospital has been introduced in Norway. Waiting time is, together with travel distance, an attribute in choosing a hospital (Sivey 2012). Persons of different socioeconomic status may exercise this option at different degrees, for example if more educated individuals are better able to obtain information published on internet about waiting time.[3,4] In the analyses, we control for treatment in a hospital that is not the patient's local hospital.

We also control for treatment at a university hospital. Waiting time at university hospitals are typically longer compare to similar treatments at local hospitals. The quality of treatment might however be higher. If individuals with high socioeconomic status are better able to obtain treatment at university hospitals, this will contribute to a positive correlation between waiting time and socioeconomic status.

Supply of private specialists is another factor we consider. Private specialists offer treatment that is an alternative to some of the treatment provided by public hospitals. We measure supply of private specialists as the number of private specialists relative to the number of inhabitants in a municipality. If elderly patients choose private treatment when waiting times are long, we expect a negative relationship between the supply of private specialists and waiting time. If, however, the supply of private specialists is higher in areas with higher need for specialist health care, we would expect a positive association between the supply of private specialists and waiting time. A related explanation that will give the same association is that better supply of private specialists increases the diagnostic capacity, which might reveal higher need for hospital services. We therefore think that supply of private specialists has an ambiguous effect on the waiting time.

We control for the quality of primary health care, measured by the share of inhabitants that do not have a permanent relationship with their primary care physician.

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[3] In Norway, information about hospital waiting time is published on the web-site: frittsykehusvalg.no

[4] A survey conducted among Norwegian patients in 2004 found that the patient's socioeconomic position was significantly associated with hospital choice (Ringard, 2012).

Primary care physicians that have a long-lasting relationship with their patients are better to diagnose what is wrong with the patient and follow up the referrals sent to hospitals.

Finally, we include the quality of long term care measured by the labour input of health personnel in the analyses. More health personnel might contribute to healthier patients and thus lower demand for hospital care. On the other hand, more health personnel might indicate sicker residents in primary long term institutions, and thus higher demand for hospital care.

Institutional features

The Norwegian health care sector is organized into primary and secondary health care sectors. The former is the responsibility of municipalities while the latter is the responsibility of the central government.

The primary care sector consists of primary care physicians and long term care. Primary care physicians are mostly private practitioners. A regular General Practitioner Scheme was implemented in 2001. It requested that each inhabitant should be listed with a GP. Over 95 % of the inhabitants complied with the request. The GP provides the patient's initial medical services in a nonemergency case. Long term care, which consists of home and institutional services, is also the responsibility of the municipalities.

The secondary health sector is organized through regional health authorities.[5] The authorities have the responsibility for commissioning and financing health care services for the population in the region, and providing these services. The provision takes place mainly through its own hospitals, or is supplied by independent private specialists. Some hospitals, denoted local hospitals, are responsible for providing hospital treatment to the population within their catchment areas. A patient may have different local hospitals for different types of treatment. Patients are free to choose hospital at the national level, but cannot choose a university hospital. Relatively few patients received treatment outside the catchment area of their local hospital, Vrangbæk *et al.* (2007). There are substantial travel distances in Norway, and reluctance to travel is considerable, Monstad (2007).

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[5] Hagen and Kaarboe (2006) and Magnussen *et al.* (2007) provide for more detailed descriptions of the Norwegian hospital sector.

Data description

Our data source of nonemergency hospital treatment is the National Patient Register for the period 2004–2005. The register has information about hospital, referral and admission dates, primary and secondary diagnoses, patient's birth year and gender and patient's place of residence (municipality or part of city) for all patient episodes (both inpatient and outpatient treatment) in somatic hospitals. We set waiting time equal to the number of days between referral and admission.

Information about education level cannot be linked to patients at the individual level as the register does not have a personal identifier. However, since the register has information about birth year, gender and resident municipality, patient episodes can be uniquely linked to population cells that combine age, gender and municipality. For each population cell, we used administrative registers of Statistics Norway to compute the population share with tertiary education in the cell, where tertiary education is defined as minimum one year of completed education at college/university.[6]

To avoid serial hospital admissions, we only included the first hospital stay for each patient. We assume that all hospital episodes where a patient is given the same date of referral and has the same gender, age, main diagnosis, and place of residence (municipality or part of city), refers to one and only one patient.

We confine the analysis to elderly men as few elderly women had tertiary education. The statutory retirement age in Norway is 67, so we consider cohorts born 1937 and earlier. We focus on patients with a date of referral during the first eight months of 2004 that received treatment during 2004 or in 2005. A change in the law of Patients' Rights from September 1 2004 may have altered the prioritisation practice of the hospitals.[7] Some patients referred before 1. September and who waited more than 16 months may not be represented in our data set. However, since only 1.5 % of the patients in the data set waited more than 16 months, we expect this problem to be of minor importance. We can limit the number of lost patient episodes by reducing the referral period to, say, the first four months of 2004, but that would reduce the size of the data set. We have considered alternative referral periods, and none of our main conclusions are affected by choice of referral period.

In 2004–2005, men born 1937 and earlier had 202 481 elective hospital episodes with referral date between the 1st of January and the 31st of August, 2004. We deleted: i) 77 225 follow-up (not first stay) patient episodes, ii) 3 878 patient episodes in a hospital where more than 90% of the patients lacked information about waiting time and iii) 2 100 episodes where patients resided in a municipality that did not provide information about primary health care or long term care. The remaining 119 284 episodes constitute our data set. 73 hospitals are included in the data set, and the patients belong to 6 171 different population cells.

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[6] We collapsed cells with birth year 1917 or earlier into one cell since many of these cells were empty. The same was done for cells with birth year 1918–1922.

[7] Askildsen *et al.* (2010; 2011) and Januleviciute *et al.* (2010) find very little effect of the reform.
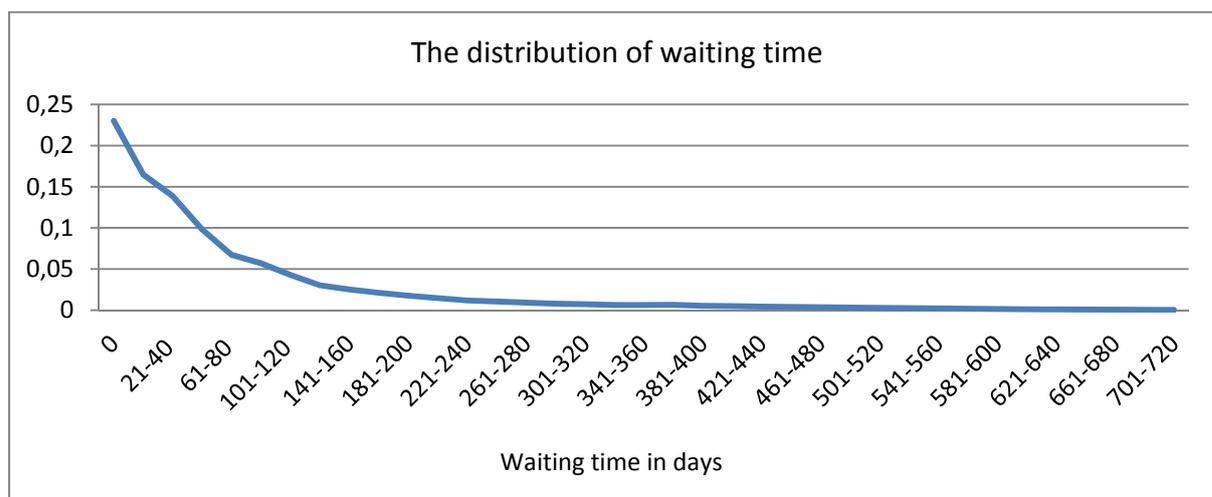
Figure 1. The distribution of waiting time.

Table 1: *Variable description and summary statistics. 119 284 patient episodes. Males aged 67 and older*

		Mean	St.d.	Median	Max	Min
Waiting time	Days	77.0	110.9	35	720	0
Age		76.2	6.09	76	92	67
Diagnoses	Number of diagnoses (main + secondary)	1.34	0.91	1	8	1
Tertiary education	Share of cell population with at least one year of college/university education (2004)	0.15	0.10	0.14	1	0
Travel distance to hospital (10^{-2} km)	Travel distance to closest hospital (2003)	0.21	0.37	0	4.65	0
Patient choice	Dummy = 1 if treatment not in local hospital and not in university hospital	0.21		0	1	0
University hospital	Dummy = 1 if treatment not in local hospital and in university hospital	0.06		0	1	0
Private specialists per capita ($* 10^{3}$)	Per capita share of private somatic specialists in municipality (2004)	0.14	0.14	0.16	1.39	0
Lack of primary care physicians	Dummy = 1 if more than 20 % of patient lists in municipality were vacant or handled by temporary staff (2004)	0.07		0	1	0
Weekly physician hours per patient in institutions	Weekly input of physician hours per patient in long term care institutions (2007)	0.35	0.20	0.33	2.68	0.02
Person years per patient in care for the elderly	Input of person years per patient in long term care and home care (2007)	0.53	0.10	0.53	1.17	0.27

Figure 1 shows the distribution of the waiting time and Table 1 presents summary statistics. The density of waiting time is decreasing with a long right tail. Average waiting time is more than two times higher than median waiting time (77 days versus 35 days). 63 % wait less than 2 months, whereas 4.4 % wait more than one year.

Some patients wait almost two years, raising the issue of measurement error in waiting time. To check the robustness of our conclusions, we have repeated all analyses, deleting patient episodes with more than 18 months or more than 12 months waiting time. The results are very similar to the results reported in the paper, and none of the main conclusions are affected.

The mean cell share with tertiary education is 0.15. 16 % of the patients belong to population cells where more than 25 % have tertiary education, and 16 % belong to cells where less than 5 % have tertiary education.

There exists no official classification of local hospital catchment areas according to diagnosis. We chose to define a local hospital to be the hospital that has the highest number of treatments for a given municipality, gender and main diagnosis (first letter in the ICD-10 code). 65 out of 73 hospitals is a local hospital for at least one combination of municipality, gender and diagnosis. Waiting time and education level is negatively correlated across local hospitals; the correlation is -0.10. Hence, local hospitals with low average time tend to have a high share of patients with tertiary education.

Our measure of travelling distance is the driving distance from the centre of the patient's municipality of residence to the centre of the municipality where the closest hospital is located. 55 % of the patients live in a municipality with hospital, whereas 5 % must drive more than 100 kilometres to the closest hospital, and 1.5 % must drive more than 150 kilometres. There is a strong negative relationship between travel distance and education level (Table 2). Among patients residing in a hospital municipality, the average cell share with tertiary education is 19 %. The corresponding share is only 6 % for patients who must drive more than 100 kilometres to a hospital. The correlation between waiting time and travel distance across patients is positive (Table 2).

Table 2: *Correlations between waiting time, education level and other covariates. 119 284 patient episodes. Males aged 67 and older*

	Waiting time	Tertiary education
Travel distance to hospital (10^{-2} km)	0.045	-0.428
Patient choice	-0.026	0.124
University hospital	-0.003	0.059
Private specialists per capita ($* 10^{3}$)	-0.010	0.483
Lack of primary care physicians	0.025	-0.226
Weekly physician hours per patient in institution	0.019	0.026
Person years per patient in care for the elderly	-0.006	-0.021

To describe patient choice, we introduce a dummy variable that is turned on if treatment took place outside the local hospital but not in a university hospital. Average waiting time is somewhat lower for patients that exercised choice (71 versus 79 days), whereas the cell share with tertiary education is somewhat higher (17 % versus 14 %). We also include a dummy variable for treatment at a university hospital that is not local hospital. This variable is not correlated with education level or waiting time (Table 2).

Our data set does not include treatment by private specialists. To describe the supply of treatment by private specialists, we use the per capita number of private somatic specialists in the municipality. Most private specialists are located in cities, creating a strong positive relationship between education level and the supply of private specialists (Table 2). The average cell share with tertiary education is 19 % (8 %) for hospital patients residing in municipalities with (without) a private specialist. Information about private specialists has been downloaded by us from the web sites of the regional health authorities.

To characterize the quality of primary health care, we use the share of patient lists in the municipality without a regular primary care physician. The relationship between this variable and average waiting time is nonlinear; it is positive when more than 20 % of the patient lists in the municipality are vacant, and non-positive otherwise. We therefore include a dummy variable that is turned on if the hospital patient resided in a municipality where the primary care physician vacancy rate exceeded 20 %. This dummy variable is negatively correlated with education level (Table 2). Information about patient lists has been downloaded by us from the web site of the national primary care physician date base.

To characterize the quality of long term care, we use labor input per user in long term care (both institutional care and home care). For long term care institutions, we also have information about input of physician hours per user. Both variables are registered at the municipal level. Information about quality of long term care is from the KOSTRA data base put together by Statistics Norway and is available from 2007. The two variables describing long term care are only weakly correlated with waiting time and education level (Table 2).

Empirical specification and results

To examine the relation between waiting time and education level, we estimate the following OLS-model:

$$wt_i = \delta_0 + \vec{\delta}_1 BIRTHYEAR_i + \vec{\delta}_2 MEDCON_i + \vec{\delta}_3 LOCHOSP_i + \delta_4 EDU_i + \vec{\delta}_5 COVAR_i + \varepsilon_i$$

where wt_i is the log of the number of days (plus one) between the days of referral and admission for patient episode i, $BIRTHYEAR_i$ is a vector of dummy variables for the year of birth, $MEDCON_i$ is a vector of dummy variables that saturates all combinations of first and secondary diagnoses, $LOCHOSP_i$ is vector of dummy variables for local hospital, EDU_i is the cell share with tertiary education, and ε_i is an error term. The coefficient of EDU_i gives the log difference in waiting time between a patient with tertiary education and a patient without tertiary education.

$COVAR_i$ is a vector that includes travel distance to the closest hospital, dummy variables for treatment outside the local hospital, private specialists per capita, a dummy for patient lists without regular physician and two measures of labor input in long term care. The scalars δ_0, δ_4 and the vectors $\vec{\delta}_1 - \vec{\delta}_3, \vec{\delta}_5$ are parameters to be estimated.

The results are presented in Table 3 and Table 4. In the first column of Table 3, we include only $BIRTHYEAR_i$ and EDU_i. In the next two columns, we introduce controls for medical condition; fixed effects for main diagnoses in column (2) and fixed effects for combinations of main and secondary diagnoses in column (3). In column (4), fixed effects for local hospital are included in column (4). In Table 4, we retain fixed effects for combinations of main and secondary diagnoses and fixed effects for local hospitals, and explore how inclusion of the other covariates affect the educational gradient in waiting time.

There is a strong negative relationship between waiting time and education level, column (1) of Table 3. The parameter estimate of EDU_i implies that, conditional on age, elderly men with tertiary education wait 45 % (about 35 days) less than men without tertiary education.[8]

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[8] Exp(-0.593) = 0.55

Table 3: *Association between log (1+waiting time) and cell share with tertiary education. t-statistics (absolute values) clustered at cell level reported in parentheses. 119 284 patient episodes. Males aged 67 and older*

	(1)	(2)	(3)	(4)
Tertiary education	-0.593 (3.60)	-0.503 (4.56)	-0.660 (5.69)	-0.356 (3.19)
Adjusted R^2	0.003	0.260	0.284	0.324
Fixed effects:				
Birth year	x	x	x	x
Main diagnosis		x		
Main diagnosis x 2dary diagnoses			x	x
Local hospital				x

Fixed effects for ICD-10 main diagnosis are included in the second column.[9] There are 3891 different main diagnoses in the sample. Compared to the specification without controls for medical conditions, the effect of tertiary education becomes somewhat weaker when we control for main diagnosis: patients with tertiary education wait 40 % less than other patients. The third column includes 18 738 fixed effects for combinations of main and secondary diagnoses. The effect of education now becomes somewhat stronger: patients with tertiary education wait 48 % less other patients. From these results we can conclude that educational differences in diagnoses cannot explain differences in waiting time by education level.

65 fixed effects for local hospital are included in column (4) of Table 3. The estimated effect on waiting time of tertiary education now falls from 48 % to 30 %. Thus, the negative correlation between waiting time and education level across local hospitals explains a little more than one third of the educational gradient in waiting time, whereas variation between the waiting time and education level across patients within local hospitals explain almost two thirds of the gradient.

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[9] The International Statistical Classification of Diseases and Related Health Problems (ICD) provides codes to classify diseases and a wide variety of signs, symptoms, abnormal findings, complaints and external causes of injury or diseases. Norway uses the ICD-10 version to classify all hospital stays.

Table 4: *Association between log (1+waiting time) and educational achievement. t-statistics (absolute values) clustered at cell level reported in parentheses. 119 284 patient episodes. Males aged 67 and older*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tertiary education	-0.015 (0.12)	-0.388 (3.45)	-0.135 (1.11)	-0.277 (2.46)	-0.321 (2.87)	0.051 (0.41)	0.003 (0.02)
Travel distance to hospital (10^2 km)	0.183 (7.24)					0.152 (5.27)	0.166 (6.34)
Patient choice		-0.083 (3.16)				-0.098 (3.77)	
University hospital		0.074 (1.60)				0.068 (1.47)	
Private specialists per capita ($* 10^3$)			-0.276 (4.05)			-0.112 (1.51)	
Lack of primary care physicians				0.139 (4.86)		0.087 (2.93)	0.088 (2.96)
Weekly physician hours per patient in institution					0.012 (0.35)	0.021 (0.59)	
Person years per patient in care for the elderly					-0.222 (2.48)	-0.141 (1.58)	
Adjusted R^2	0.324	0.324	0.324	0.324	0.324	0.325	0.324
Fixed effects:							
Birth year	x	x	x	x	x	x	X
Main diagnosis x 2^{dary} diagnoses x	x	x	x	x	x	x	X
Local hospital	x	x	x	x	x	x	x

When travel distance is included, column (1) of Table 4, the coefficient of tertiary education becomes close to zero and statistically insignificant, whereas the coefficient of travel distance is positive and very significant. Hence, correlation between waiting time and education level within local hospitals can be explained by differences in between patients that live close to the hospital and patients that live further away from the hospital. Patients with long travel distance have long waiting time and low education level, whereas patients with short travel distance have short waiting time and high education level.

In column (2) of Table 4, dummy variables for patient choice and treatment at university hospital are included. The effect of patient choice is negative and significant, whereas the coefficient of university hospital is positive but insignificant. The coefficient

of tertiary education is hardly affected, suggesting that treatment outside the local hospital cannot explain the educational gradient in waiting time.

The supply of private specialists outside hospitals has a negative and significant effect on waiting time, column (3), and the effect of tertiary education becomes weaker; the shorter wait of patients with tertiary education falls by about two thirds. Hence, geographical variation in private specialists – many specialists in areas with low waiting time and relatively well educated patients – is a possible explanation for a substantial share of the educational gradient in waiting time.

The quality of primary health care can also explain some of the educational gradient. The dummy variable for lack of regular primary physician has a positive and significant effect on waiting time and the estimated effect of tertiary education becomes weaker. The shorter waits of patients with tertiary education fall by about one fifth, column (4).

Weekly input of physician hours in long term care institutions does not seem to affect waiting time, but overall labor input in long term care has some effect, column (5). The effect of these variables on the coefficient of tertiary education is, however, small.

In column (6), all covariates are included. The coefficient of tertiary education now becomes positive, but small in size and statistically insignificant. Three of the other covariates remain significant: travel distance, patient choice and primary health care. In column (7), only travel distance and primary health care are included. The coefficient of tertiary education is now close to zero, and the effects of the two covariates remain stable. Hence, variation between local hospitals in waiting time and education level, and variation between patients within local hospitals in travel distance and primary health care can explain the educational gradient in waiting time for elderly men. We do not find evidence of discrimination against patients without tertiary education.

Discussion

In this paper we have investigated whether socioeconomic status, measured by education, affects waiting time for elderly men when we control for patients' medical condition (severity of illness) and supply/choice variables. We estimate a series of regressions explaining waiting time as a function of education level, successively including more and more controls for medical condition, supply and choice. Any remaining correlation between waiting time and education level that cannot be explained by the full set of controls is interpreted as evidence of discrimination on the basis of education.

We have chosen to focus on the elderly men. Our arguments for doing so are the following. First, elderly patients already account for a large share of hospital utilization, and the share of the elderly is going to increase in most industrialized countries. Second, aging brings declines in health and cognitive abilities, and there is a strong correlation between socioeconomic status, health and cognitive skills in older age. Thirdly, we believe that education is a better indicator of socioeconomic status than income for retired individuals, and few elderly women have taken higher education.

We find that patients of different socioeconomic status are treated differently when fixed effects for birth year and controls for medical condition (combinations of main and secondary diagnoses) are included. Inclusion of fixed effects for local hospital reduces the estimated effect on waiting time of tertiary education falls from 48 % to 30 %. Thus, the negative correlation between waiting time and education level across local hospitals explain a little more than one third of the educational gradient in waiting time, whereas variation between the waiting time and education level across patients within local hospitals explain about almost two thirds of the gradient. We do not find evidence of discrimination against elderly men without tertiary education since travel distance and the quality of primary health care can explain the educational gradient within local hospitals.

Our result of no discrimination resembles the results found in Kaarboe and Carlsen (2012) for the working age population. A closer comparison of the results from this paper does however indicate that the socioeconomic differences are largest for the elderly. This follows since with extensive controls for medical conditions elderly men with higher education wait 48% shorter, while younger men with tertiary education wait 15–33 % shorter depending on which level of education (secondary or primary) one compares with. The comparison of the results also indicate that the mechanism behind the results are similar for both age groups as (i) inclusion of fixed effects for local hospitals explain about 50% of the difference in waiting time, and (ii) travel distance explains most of the within hospital waiting time difference.

We include extensive controls for medical conditions, supply and choice. Specifically we include controls for the quality of primary care and the quality of long term care, factors we believed are particular relevant for the relationship between socioeconomic status and waiting times for elderly patients. From the results, we learned that controlling for the quality of primary health care is important. Furthermore, and as in Kaarboe and Carlsen (2012) and Laudicelle *et al.* (2012) we see that controlling for hospital fixed effects are important when analyzing inequalities. However, we do not find that omitting hospital fixed effects underestimates the socioeconomic inequality in waiting times as is sometime the case in the two mentioned papers.

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