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PRIORTIZATION AND PATIENTS`
RIGHTS: ANALYSING THE EFFECT
OF A REFORM IN THE
NORWEGIAN HOSPITAL SECTOR

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Prioritization and patients' rights: Analysing the effect of a reform in the Norwegian Hospital Sector

by

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Keywords: Prioritization; waiting time; hospital reform

Abstract

The right to equal treatment, irrespective of age, gender, ethnicity, socio-economic status and place of resident, is an important principle for several health care systems. A reform of the Norwegian hospital sector may be used as a relevant experiment for investigating whether centralization of ownership and management structures will lead to more equal prioritization practices over geographical regions. One concern was variation in waiting times across the country. The reform was followed up in subsequent years by some other policy initiatives that also aimed at reducing waiting lists. Prioritization practice is measured by a method that takes departure in recommended maximum waiting times from medical guidelines. We merge the information from the guidelines with individual patient data on actual waiting times. This way we can monitor whether each patient in the available register of actual hospital visits has waited shorter or longer than what is considered medically acceptable by the guideline. The results indicate no equalisation between the five new health regions, but we find evidence of more equal prioritization within four of the health regions. Our method of measuring prioritizations allows us to analyse how prioritization practice evolved over time after the reform, thus covering some further initiatives with the same objective. The results indicate that an observed reduction in waiting times after the reform have favoured patients of lower prioritization status, something we interpret as a general worsening of prioritization practices over time.

Introduction

Waiting lists and not least differences in waiting times are commonly observed problems in countries with predominantly public health care systems. There are at least two reasons for concern about differences in patients' waiting times. First it may indicate violation of principles of horizontal equity and equal access, which would be politically unacceptable. Secondly, variations in waiting times may also be observed across patient groups, potentially in conflict with objectives of vertical equity. On the other hand, the reason for the differences may be related to differences in interpretation of administrative regulations with less medical consequences. It is nevertheless a serious problem, since it makes governance of the hospital sector difficult.

We investigate whether actual waiting times vary geographically and over patient groups as measured by their prioritization status in Norway. We argue that the Norwegian health care reform of 2002 serves as an intervention that should result in equalization of waiting times and prioritization procedures. With this reform, the Norwegian central government took over ownership all public hospitals and other specialist care institutions. Previously the hospital sector was the responsibility of the county governments. Hospitals were reorganized into five Regional Health Authorities, as local enterprises or trusts. Thus, the hospital reform reduced the organizational unit for coordination and management to five bodies (as opposed to the 19 counties), where each body consists of a number of counties.[1] Since the number of organizational units is reduced and ownership rights are more concentrated, the reform has provided the central government with a more direct steering channel to influence prioritization. Hence we expect prioritization practice should be more geographically homogeneous after the reform compared to the pre-reform period. Most specifically, this is to be expected through the government issuing managing directives to the five regions, whose content when it comes to patient treatment

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practices, are equal. The reform has provided the government with an instrument for implementing the key objective of equal access and treatment.

In order to compare prioritization between geographical regions and over time, we need a way to measure prioritization practice. Here we use a method suggested by Askildsen, Holmås, & Kaarboe (2007; 2008). The method takes departure in recommended maximum waiting times from medical guidelines. We merge the information from the guidelines with individual patient data on actual waiting times. This way we can monitor whether each patient in the available register of actual hospital visits has waited shorter or longer than what is considered medically acceptable by the guideline.

Waiting lists and a corresponding demand for prioritization procedures among the patients are common features of public health care systems where prices are not used for rationing access. The management of the waiting lists may be more or less explicit. This raises normative issues concerning the basis for reasonable prioritization regulations, and how explicit the procedures should be formulated. Gravelle & Siciliani (2008) derive results indicating that it is welfare improving to prioritize on observable characteristics. Prioritization of patient groups should be governed by how sensitive patients are to length of waiting time, and their costs of waiting. Daniels & Sabin (2002) advocate explicit prioritization procedures through their suggested principle of 'accountability for reasonableness'.

Waiting time prioritization has been introduced in different ways in several countries, including Sweden, Scotland, Spain, Italy, Australia, New Zealand, Canada, Denmark and Norway (Edwards, 1999; Scottish Executive, 2000; Siciliani & Hurst, 2005). England introduced an

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elective surgery waiting time target in 2000 (Appleby, Boyle, Devlin, Harley, Harrison, & Thorlby, 2005).

There are few academic studies that have evaluated to which extent actual prioritization is in accordance with administrative regulation. Dimakou, David, Devlin, & Appleby (2009) study the impact of government targets on the distribution of waiting times in the NHS. They analyze how the probability of admission of any given patient vary during the time they wait and find that the probability of admission vary over time and that peaks in the probability coincide with targets and change when targets change. Arnesen, Erikssen, & Stavem (2002) investigated a relatively small sample of Norwegian patients referred to inpatient surgery. They found that access to treatment was related to several factors, which were not necessarily reasonable prioritization criteria. In this context our paper adds to the literature by using a data set covering all patients, and a period with explicit waiting time prioritization governed by an Act on Patients' Rights.

Although the prioritization regulations may differ from other countries, we will argue that the research approach and results are of general interest. First, the paper illustrates the importance of individual and diagnosis specific data when investigating prioritization among a heterogeneous patient population. Second, the results illustrate that adjustment of prioritization practice and waiting times may not be uniformly distributed over a patient population. It is of interest to figure out how responses may vary over the patient distribution depending on formulation of regulations. Thirdly, administrative reforms aimed at affecting waiting lists and prioritization within other regulatory regimes can be evaluated using the same approach.

Our results give some reasons for concern. We find no indication of more equal practices among the five regional health authorities, rather a slight indication of the opposite. On the other hand, we find evidence of more equal prioritization among hospitals within four of five regions. Regarding the more normative issue whether prioritization has improved, the results are worrying in the sense that an observed reduction in waiting times after the reform seems to have favoured patients of lower prioritization status.

Institutional features

The Norwegian specialised health care sector is predominantly publicly owned, and as of 2002 organised as state owned enterprises within five (north, mid, west, south, east) regional health authorities (RHAs). The RHAs have the responsibility for providing specialist health care to all patients within the region. Provision of this health care is organised through health enterprises owned and governed by the RHAs. These organizations can also contract with private suppliers for providing treatment. This outsourcing is in effect quite small compared to the overall treatment activity, and confined to a few diagnoses. Another important feature is the patents' right to free choice of hospital, in effect at a national level as of 2001. Relatively few patients have opted for the possibility of receiving treatment outside of the hospitals' natural catchment areas (Vrangbæk, Ostergren, Birk, & Winblad, 2007).

Patients who are referred to the specialist health care sector, have according to the Act on Patients Rights and the Priority Regulations the right to an evaluation of their medical condition, and an assessment whether this condition is such that it demands a right to treatment within an individually fixed waiting time (Ministry of Health and Social Services, 1999; 2003). More precisely, all patients may be categorized into one of the following categories:

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1. Acute care (AC)

2. Elective treatment, with individual maximum waiting time (elective with)

3. Elective treatment, without individual maximum waiting time (elective without)

4. Other health care services that may be demanded

In addition to AC-patients, for whom the health enterprises (hospitals) must deliver health care services, it is patients in priority group two (elective with) that comprises the core health care demand to be supplied by the public (governmentally owned) health enterprises. But also patients in group three (elective without) have the right to treatment. It is only demand from patients in group four that are excluded from the mandatory activities of the public health enterprises.

For elective patients, the Priority Regulations detail administrative procedures. It establishes that upon referral the assessment of a patient's conditions must consider

1. how serious the condition is (seriousness),

2. whether a suitable treatment exists that may improve the patient's condition (effect of treatment), and

3. the cost-effectiveness of this treatment.

The allocation of prioritization status to elective patients is formally done in the following way. When receiving a referral, within 30 days the hospital has to consider whether the patient belongs to group 2 or 3, or whether (s)he should not receive treatment at all. This decision is only based on the description of the medical condition given in a referral letter from the primary care physician. Each patient is to be considered according to the Priority Regulations. If the patient is considered to belong to group 2 (elective with), an individual maximum waiting time is given,

prescribing how long the patient may wait before treatment starts. The registered waiting time is measured from referral until the patient meets with a specialist from the hospital. This indicates starts of treatment, even though this may include periods of further diagnosing of the patient. If waiting time is exceeded, the patient has the right to file a complaint. The hospital is then given a short time frame for providing treatment. If treatment is still not given, the patient can choose treatment another place, privately, publically or abroad, at the cost of the initial health enterprise.

With the prevailing Act on prioritization and the Priority Regulations, Norway is quite in the forefront of formalising patient rights. But implementation of the regulations seems problematic. The RHAs have initiated projects for implementing prioritization procedures. The existing guidelines developed at the level of the RHAs typically include a description of medical conditions, and based on this a recommendation on treatment status, including a maximum waiting time when relevant and as outlined above. Regional variation is large and a matter for concern. The following table shows, for 2005, the share of elective patients given a maximum waiting time across, and within, the five RHAs:

[Table 1]

The share of elective patients who are given an individual right, varies from 32% to 97% among the health enterprises. Notice, however, even though we may observe large variations in the share of elective patients given an individual right, the actual waiting times between patients with an individual right (elective with) and patients without a prescribed maximum waiting time (elective without) may not be of a similar magnitude. It might be that there are larger variations in the way the regulations are implemented than in the actual pattern of medical treatments. This, however,

is a variation that should be reduced due to a hospital reform that provides more coordinated governance regulations.

Data and descriptive statistics

In the empirical approach we follow Askildsen et al. (2007) and use recommendations from medical guidelines outlined in Health Authority West, documented in Nordheim (2005), to analyse prioritization practice.[2] Based on descriptions of medical conditions, this report recommends whether a patient should be given an individual right to treatment with or without a recommended maximum waiting time. We have received assistance from medical professionals to attach ICD10-codes to the medical descriptions in the guidelines. We have then categorized the different medical descriptions with corresponding ICD10-codes into five prioritization groups based on the recommended maximum waiting times. In the empirical analyses we use data from the Norwegian patient register (NPR) for the period 1999 – 2005. The register includes patient information such as age, gender, first and secondary diagnosis, ICD10-codes, the actual waiting time, patients' place of resident and hospital of treatment. This way we are able to compare recommended waiting times to actual waiting times.

To ensure that there is a one-to-one relationship between the medical guidelines and the ICD10-codes some patient stays had to be dropped. This follows since the same ICD10-code in some cases is attached to several medical conditions, and these conditions may give different maximum waiting times. In addition, maximum waiting times are in some cases given with a relatively large band (e.g. between 12-30 weeks). These medical conditions are also dropped. The next table

gives an overview over the total number of patient stays and the number of patient stays with an attached recommended waiting time.

[Table 2]

Table 2 shows the number of elective in-patient stays at public hospitals during the period 1999-2005, in total (1 202 733 observations) and for the full sample after dropping codes with ambiguous grouping (410 037 observations). Before analysing the data, we had to make some further adjustments and exclusions. First, we only included the first hospital stay for each patient each year. Second, we dropped patients with missing observations. Third, patients with waiting times longer than two years were dropped. Finally, we left out patients within psychiatry (F00-F99) and also patients within P00-P96. After dropping these observations, we are left with a sample of 311 188 observations.

We allocate these patients into five groups according to the recommended maximum waiting time, as shown in Table 3:

[Table 3]

The next table shows how the patients within the relevant ICD10-chapters are allocated among the prioritization groups:

[Table 4]

In Table 5, comparing the pre-reform period 1999-2001 with the post reform period 2002-2005 for the five health regions, we report average waiting times and the share of patients with excessive waiting times. Except for Health Region North, we find that both average waiting times and the proportion of excessive waiting are considerably reduced, with the largest reduction in Health Region South. However, both in the pre-reform and the post-reform period there are relatively large differences across health regions in the reported measures, indicating that the hospital reform has not led to more equal prioritization practice.

[Table 5]

Another important question is whether the hospital reform has led to better prioritization practice. Because patients with different diagnoses are allocated into the prioritization groups according to recommended maximum waiting time, we expect patients in group one also to experience the shortest waiting times, and that patients in group five experience the longest waiting times. If we observe that waiting times increase as we move from highest (1) to lowest (5) prioritization group, we will conclude that in relative terms the health enterprises prioritize according to the administrative regulations of prioritization.

Table 6 shows average waiting times and the proportion of patients with excessive waiting times in the five prioritization groups prior to and after the hospital reform of 2002. We have also included recommended maximum waiting time in number of days. As expected we find that high priority patients wait shorter than low priority patients. However, we see that the average waiting times in groups one and two are higher than the recommended maximum waiting times. Group four patients wait shorter than maximum recommended waiting time, and during the period 1999-

2001 group three patients' average waiting time corresponded to the recommended waiting time. Looking at the proportion of patients with excessive waiting times, compared to lower prioritized patients, relatively more high priority patients wait longer than prescribed. The results indicate that in relative terms, low prioritized patients have a relatively better access to hospitals than high priority patients. Furthermore, comparing waiting times and the proportion of patients with excessive waiting times in the pre- and post-reform periods, we see that low-priority patients have obtained improved access in the post-reform period.

[Table 6]

In the appendix we give descriptive statistics for other explanatory variables used in the analyses. Table A1 compares sample characteristics in the pre- and post-reform period. Most characteristics seem to be quite similar in the two time periods, but we notice that number of sub-diagnosis is higher in the post-reform period. We also see that the proportion of patients treated at university hospitals is higher in the post-reform period. Table A2 compares patients in the five prioritization groups. As expected we find that number of sub-diagnoses is highest among patients in prioritization group 1 and lowest among patients in prioritization group 5. More surprisingly, there are large differences in the proportion of males, patients in different age groups, patients treated at different types of hospitals, and patients from the different health regions between the five prioritization groups.

Summarising, the results from the descriptive statistics indicate that the hospital reform has not led to an equalization of prioritization practices, and low priority patients have improved access after the reform. However, from Table A1 and A2 we see that several other factors likely to affect

waiting times vary between prioritization groups and over time. If, for example, the average patient is more severely ill after than before the reform, we would expect to find shorter waiting times after the reform even if the prioritization practice is unchanged. Thus, care should be taken in concluding from these descriptive analyses and in the next section we present results from multivariate regression analyses where we explicitly control for such factors.

Analytical results

In the multivariate regression analyses we focus on patients' actual waiting times and the probability that patients wait longer than medically acceptable. The first dependent variable is analysed by using a linear random effect panel data model and the second with a random effect probit model. The most important explanatory variables in the regressions are the dummy variables indicating the priority group and health region to which each patient belongs. In the regressions we use priority group 1 and Health Region East as reference groups. This means that we compare waiting times and the probability of excessive waiting times for patients in priority group 2-5 to patients in priority group 1, and likewise that we compare outcomes for patients from health regions South, West, Mid and North to patients living in Health Region East. In the regressions we control for patient case mix; patients' age, gender, diagnosis (main chapters in ICD10), number of sub-diagnoses and whether or not the treatment is surgical, as well as hospital type. We further control for hospital specific effects and include a time trend to allow for changes in prioritization practice common to all hospitals.

[Table 7]

In Table 7 we provide results from multivariate random effect regressions without isolating a reform effect. We find that, controlling for patient case mix and hospital effects, only patients living in Health Region West and Mid have waiting times significantly different from patients in Health Region East. Although the differences in waiting times are quite high (about 5% longer in Health Region West and 10% longer in Health Region Mid), the differences are much smaller than one could expect from the numbers reported in Table 1. If we look at differences in the probability that patients experience waiting times longer than what is considered medically acceptable, we find even smaller differences between the five health regions. These findings demonstrate that just looking at the proportion of patients that are allocated an individual right to treatment can lead to severe misinterpretations of the actual prioritization practice.

From Table 7 we also notice that high priority patients wait shorter than patients in lower priority groups. Patients in priority groups 2 and 3 wait 36% and 92% longer than patients in priority group 1, while patients in groups 4 and 5 have waiting times about 89% and 80% longer. Looking at the probability of excessive waiting, we find that patients in priority groups 2-4 have a significantly lower probability than priority group 1 patients for waiting beyond the medically acceptable time limit, and it is furthermore decreasing in lower priority status.

Some of the control variables are of interest on its own merit in this context. We see that the oldest patients have shorter waiting time than younger age cohorts. Waiting times decreases in number of sub-diagnoses, which may be explained by seriousness of condition, and if so, in accordance with prioritization guidelines. An interpretation is thus that within the relatively broad prioritization groups, the patients with the most serious conditions are given preference. Patients needing surgical treatment wait longer periods, which may not be unreasonable since the patient

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group we are considering does not include acute care patients. Waiting time is longer at the larger

regional hospitals. Importantly, we see that waiting time is reduced over time (time trend).

Without more specifically being able to pinpoint an exact reason, this indicates that conditions

during the period of investigation have made it possible to increase treatment intensity. This may

be due to larger budgets allocated to the hospital sector, higher productivity, or other factors that

affect decisions to put patients in line for treatment.[3]

In the rest of this section we will investigate how prioritization practices have developed across

health regions and prioritization groups. Our strategy for identifying potential reform effects is to

study geographical variations in our two dependent variables over time. By including interaction

variables between health regions and pre- and post-reform dummies in the random effect

multivariate regressions, we can test whether waiting times and the share of patients with

excessive waiting times are more homogeneous across the five health regions in the post-reform

period compared to the pre-reform period.

The results from these regressions are reported in Table 8.[4] In the analyses we use "Health East

pre reform" as the reference group and thereby compare waiting times and the probability of

excessive waiting in all regions, before and after the reform, to the corresponding numbers in

Health Region East before the reform.

We choose to focus on differences in waiting times. From Table 8 we see that the variable

"Health East post reform" is insignificant. We conclude that waiting times were the same in the

pre and post reform period in this health region. Before the reform, waiting times in Health

regions West and Mid were longer than in Health Region East. Thus, with no observed change in

waiting time in Health Region East, the objective of equalization would require a reduction in these two regions' waiting time. Contrary, we see that the relative waiting time has increased in both regions. Health Region South has deviated negatively (reduced waiting time) compared to Health Region East, while Health Region North has experienced an increase in waiting time that almost outweighs the before-reform shorter waiting time.[5] Altogether these results demonstrate that the reform effect has been in direction of less equalization of waiting times, and less similar prioritization practices among the five health authorities.

[Table 8]

The next question we raise is whether prioritization practice has *improved*. Since the hospital reform was not the only reform that took place in this period, it is difficult to isolate the effect of the hospital reform on potential improvements in prioritization practice. In this section we therefore focus on how prioritizations have changed over time. To analyse this question we include interaction variables between priority groups and pre- and post-dummy variables in multivariate random effect regression analyses. The relevant results are reported in Table 9; see Table A4 for the full set of results. We see that before the reform, patients in priority group 2 waited 43% longer than patients in group 1, patients in group 3 waited 102% longer, patients in group 4 waited 90% longer, while patients in group 5 (those without guaranteed maximum waiting time) waited 92% longer. Compared to the differences in the recommended waiting times, the differences in actual waiting times seem too small. The coefficient for the variable 'priority group 1 post' implies that the highest prioritized patients waited approximately 12% longer for treatment after the reform. For prioritization not to have worsened, also less prioritized patients should experience at least similar increase in waiting time. However, with the exception

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of patients in priority group 4, the tendency is the opposite. The same is observed by investigating probability of excessive waiting. The probability of excessive waiting has actually on average increased for the highest prioritized patients while it is reduced for priority group 3 patients, and remained fairly constant for groups 2 and 4. We conclude that waiting times among the five prioritization groups are less dispersed after the reform compared to the period before and we interpret this as a worsening of prioritization practices.

[Table 9]

Lastly, we investigate the development in the prioritization practises internally within each health authority. We have run similar regressions as reported in Table 8 and 9 for each of the five health regions.[6] We find that the hospital reform has led to more equal prioritization practices in all except one health region (Health region Mid). On the other hand, prioritization practice has not been improved in any health region over this period.

Discussion and concluding remarks

The results of the analyses do not indicate that centralization of ownership has led to more equal prioritization practices across the country. However, there is a tendency for more similar prioritization practices within the health authorities. We do not observe an improvement in prioritization practices over time, neither among the health regions nor within them, as measured by waiting times for patients of different priorities.

Lack of equalization of waiting times across the country does indicate that political objectives have not been met. Management of the health authorities has in some sense not been sufficiently strong or efficient. One lesson to be learned from the Norwegian experiment is thus that centralization of ownership is not sufficient to obtain equal access to specialized health care. On the other hand, it does seem like management structures may work well within the health regions. It is not surprising that it is easier to develop efficient management structures within a region than across the country. It is well known that agency costs (like asymmetric information and limited commitments between principals and agents) put effective limits for organizational integrations that are otherwise beneficial (Williamson, 1985; Olsen, 1996).

If the differences in prioritization practices across the country also imply real differences in access to treatment for patients of equal need, there are grounds for considerable concern. However, this cannot be confirmed with the data available here, since the observed patterns may be due to different reporting practices, and not differences in treatment practises. But the tendency for a worsening of prioritization practices may represent more of a real problem, and thus of some immediate concern for policy makers.

This study is not designed so as to be able to give a precise answer to what may explain these somewhat disturbing results. Average waiting times have in general been reduced over time, which is desirable, and this has been a stated political objective during the period in question. Health authorities and enterprises may however have been too much concerned with reducing average waiting times for each hospital unit. Objectives of reduction in waiting time is more easily met by focussing on patient groups that have at the outset long waiting times, since it is easer to make larger gains quantitatively in registered waiting times among those patients. This

might indicate that implementing vertical prioritization practices in addition to horizontal waiting-time prioritization does not provide unambiguous governing messages. Health care providers may then choose to focus on more easily observable horizontal waiting-time targets. If this is the case, there is an important lesson to be learned from the Norwegian reform for other countries that are considering implementing waiting time prioritization.

The financial situation of the health enterprises may also explain the observed waiting list development. The health authorities are financed partly by activity based DRG prices, partly by block grants. With activity based finance there are incentives to give treatment to patients where the DRG price is relatively high compared to costs. It is possible that this would more frequently be the case for patients with diagnoses of lower priority. It will be the purpose of future research to look further into to effect of the finance system.

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Table 1: Variation in proportion of elective patients with individual maximum waiting time

	Regional variation	Variation Health Enterprises*
Health authority East	62	46-86
Health authority South	59	32-81
Health authority West	73	56-82
Health authority Mid	91	85-97
Health authority North	56	35-77

* Variations among Health Enterprises within each region in share of patients with individual maximum waiting time.
Source: Norwegian Patient Register (NPR), May-August 2005.

Table 2: The number of stays per ICD10-chapter, total and sample

	All patient stays		Sample with recommended waiting time	
Chapters in ICD-10	Number of obs.	Percent	Number of obs.	Percent
Certain infectious and parasitic diseases (A00-B99)	5,445	0,45	684	0,17
Neoplasms (C00-D48)	203,033	16,88	92,055	22,45
Diseases of the blood .. (D50-D89)	5,078	0,42	1,903	0,46
Endocrine, nutritional and metabolic diseases (E00-E90)	20,972	1,74	12,523	3,05
Mental and behavioural disorders (F00-F99)	6,533	0,54	535	0,13
Diseases of the nervous system (G00-G99)	71,245	5,92	17,938	4,37
Diseases of the eye .. (H00-H59)	29,359	2,44	17,944	4,38
Diseases of the ear .. (H60-H95)	9,590	0,80	7,092	1,73
Diseases of the circulatory system (I00-I99)	110,234	9,17	23,966	5,84
Diseases of the respiratory system (J00-J99)	77,580	6,45	47,060	11,48
Diseases of the digestive system (K00-K93)	84,634	7,04	30,740	7,50
Diseases of the skin .. (L00-L99)	17,222	1,43	2,396	0,58
Diseases of the musculoskeletal system ..(M00-M99)	186,571	15,51	76,488	18,65
Diseases of the genitourinary system (N00-N99)	107,552	8,94	39,737	9,69
Pregnancy, .. (O00-O99)	56,397	4,69	8,911	2,17
Certain conditions originating in the perinatal period (P00-P96)	1,904	0,16	7	0,00
Congenital malformations, . (Q00-Q99)	28,188	2,34	4,684	1,14
Symptoms, signs, .. (R00-R99)	34,718	2,89	4,229	1,03
Injury, poisoning, .. (S00-T98)	52,060	4,33	17,743	4,33
External causes .. (V0n-Y98)	12	0,00	0	0,00
Factors influencing health status.. (Z00-Z99)	94,406	7,85	3,402	0,83
Number of observations	1,202,733	100,00	410,037	100,00

Table 3: The prioritization groups

Prioritization group	Recommended maximum waiting time	Number of observations
1	0-4 weeks	66,828
2	5-12 weeks	105,416
3	13-26 weeks	106,879
4	27-52 weeks	6,042
5	Elective without right	26,023

Table 4: Number of patients allocated to the different prioritization groups according to the ICD10-chapters. Sample analysed.

Chapter ICD-10	Group 1	Group 2	Group 3	Group 4	Group 5
Certain infectious and parasitic diseases (A00-B99)	399	-	24	-	-
Neoplasms (C00-D48)	38,682	22,238	13,010	-	-
Diseases of the blood.. (D50-D89)	1,315	-	-	-	-
Endocrine, nutritional and metabolic diseases (E00-E90)	8,764	-	-	-	-
Diseases of the nervous system (G00-G99)	6,206	3,011	-	-	150
Diseases of the eye.. (H00-H59)	-	-	-	-	13,734
Diseases of the ear.. (H60-H95)	-	2,937	-	1,933	-
Diseases of the circulatory system (I00-I99)	3,616	5,842	3,737	1,776	-
Diseases of the respiratory system (J00-J99)	200	36,721	88	984	-
Diseases of the digestive system (K00-K93)	625	15,100	7,573	1,322	-
Diseases of the skin .. (L00-L99)	-	899	310	-	54
Diseases of the musculoskeletal system ..(M00-M99)	-	2,817	46,162	-	11,923
Diseases of the genitourinary system (N00-N99)	3,016	11,102	17,668	-	-
Pregnancy, .. (O00-O99)	903	766	4,052	-	-
Congenital malformations, . (Q00-Q99)	-	2,210	1,030	-	-
Symptoms, signs, .. (R00-R99)	794	1,585	667	-	162
Injury, poisoning, .. (S00-T98)	-	-	12,539	27	-
Factors influencing health status.. (Z00-Z99)	2,308	188	19	-	-
Number of observations	66,828	105,416	106,879	6,042	26,023

Table 5: Average waiting times (in days) and the proportion of patients with excessive waiting times per health region

	Average waiting times		Proportion of patients with excessive waiting	
	1999-2001	2002-2005	1999-2001	2002-2005
Health region East	138.94 (153.25)	119.65 (152.37)	38.19	33.56
Health region South	149.22 (152.37)	122.55 (152.50)	43.62	36.52
Health region West	152.46 (159.16)	132.05 (140.39)	44.94	41.26
Health region Mid	153.08 (157.80)	132.84 (140.82)	43.87	39.00
Health region North	126.79 (141.20)	124.75 (138.41)	37.16	37.82

Means (standard deviations in parentheses) or proportions of variables.

Table 6: Average waiting times (in days) and the proportion of patients with excessive waiting times in the prioritization groups.

	Maximum acceptable waiting days	Average waiting times		Proportion of patients with excessive waiting	
		1999-2001	2002-2005	1999-2001	2002-2005
Group 1	28	74.53 (126.22)	74.21 (124.76)	42.00	42.93
Group 2	84	130.06 (147.34)	112.91 (132.18)	44.38	39.94
Group 3	182	182.93 (155.34)	156.61 (138.32)	39.10	32.12
Group 4	365	194.10 (169.59)	194.50 (173.41)	16.62	17.32
Group 5	-	202.42 (152.95)	167.05 (136.20)	-	-

Means (standard deviations in parentheses) or proportions of variables.

Table 7: Random effect linear model (Log waiting time) and random effect probit model (probability of excessive waiting time). Marginal effects.

	Log waiting time	Probability of excessive waiting
Male	0.0097** (0.0045)	0.0095*** (0.0021)
Age groups. Reference group: Age 30-66		
Age 80+	-0.1748*** (0.0072)	-0.0678*** (0.0034)
Age 67-80	-0.0788*** (0.0054)	-0.0339*** (0.0025)
Age 15-29	-0.0221*** (0.0088)	-0.0003 (0.0041)
Age 0-15	-0.1160*** (0.0082)	-0.0628*** (0.0037)
Number sub-diagnosis	-0.0199*** (0.0018)	-0.0039*** (0.0008)
Surgical	0.2245*** (0.0053)	0.0509** (0.0025)
Health regions. Reference group: Health region East		
Health region South	-0.0122 (0.0115)	-0.0070* (0.0039)
Health region West	0.0530*** (0.0189)	0.0047 (0.0081)
Health region Mid	0.0988*** (0.0216)	0.0129 (0.0097)
Health region North	0.0258 (0.0237)	-0.0204*** (0.0059)
Priority groups. Reference group: Priority group 1 (high priority patients)		
Priority group 2	0.3585*** (0.0075)	-0.1784*** (0.0033)
Priority group 3	0.9216*** (0.0084)	-0.2421*** (0.0036)
Priority group 4	0.8949*** (0.0173)	-0.3496*** (0.0033)
Priority group 5	0.8024*** (0.0140)	-
Hospital type. Reference group: local hospital		
University hospital	0.3651*** (0.0957)	0.1187*** (0.0114)
Central hospital	0.0485 (0.0665)	-0.0099** (0.0048)
Time trend	-0.0402*** (0.0011)	-0.0168*** (0.0005)
Main chapters in ICD10. Reference group: Diseases of the circulatory system (I00-I99)		
Certain infectious and parasitic diseases (A00-B99)	-0.1173** (0.0551)	-0.0434* (0.0237)
Neoplasms (C00-D48)	-0.2222*** (0.0109)	-0.1374*** (0.0049)
Diseases of the blood.. (D50-D89)	0.0863*** (0.0325)	0.0052 (0.0146)
Endocrine, nutritional and metabolic diseases (E00-E90)	0.7155*** (0.0162)	0.2113*** (0.0076)
Diseases of the nervous system (G00-G99)	0.9559*** (0.0155)	0.3000*** (0.0069)
Diseases of the eye.. (H00-H59)	0.7806*** (0.0193)	-
Diseases of the ear.. (H60-H95)	1.2165*** (0.0197)	0.3949*** (0.0075)
Diseases of the respiratory system (J00-J99)	1.0563*** (0.0131)	0.3616*** (0.0058)
Diseases of the digestive system (K00-K93)	0.5808*** (0.0121)	0.1982*** (0.0060)
Diseases of the skin.. (L00-L99)	-0.1580*** (0.0330)	-0.0736*** (0.0152)
Diseases of the musculoskeletal system ..(M00-M99)	0.9084*** (0.0119)	0.3005*** (0.0056)
Diseases of the genitourinary system (N00-N99)	0.6630*** (0.0118)	0.2041*** (0.0057)
Pregnancy,.. (O00-O99)	0.3929*** (0.0185)	0.2594*** (0.0081)
Congenital malformations, . (Q00-Q99)	0.6110*** (0.0224)	0.1866*** (0.0104)
Symptoms, signs, .. (R00-R99)	0.2262*** (0.0219)	0.0764*** (0.0108)
Injury, poisoning, .. (S00-T98)	0.4234*** (0.0146)	0.1951*** (0.0070)
Factors influencing health status.. (Z00-Z99)	0.6206*** (0.0249)	0.1982*** (0.0114)
Constant	83.4962*** (2.1514)	-
Number of observations	311188	285165
Number of hospitals	58	58

Note: Standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1% level respectively.

Table 8. Testing for more equal prioritization practice in the post reform period

	Log waiting time	Probability of excessive waiting
Health East post reform	-0.0144 (0.0099)	-0.0142*** (0.0047)
Health South pre reform	0.0215 (0.0132)	0.0023 (0.0050)
Health South post reform	-0.0478*** (0.0144)	-0.0278*** (0.0056)
Health West pre reform	0.0348* (0.0200)	-0.0162* (0.0090)
Health West post reform	0.0558*** (0.0205)	0.0049 (0.0093)
Health Mid pre reform	0.0798*** (0.0227)	-0.0061 (0.0103)
Health Mid post reform	0.0915*** (0.0231)	0.0134 (0.0106)
Health North pre reform	-0.0835*** (0.0246)	-0.0677*** (0.0068)
Health North post reform	0.0673*** (0.0247)	0.0030 (0.0077)
Number of observations	311188	285165
Number of hospitals	58	58

Note: Standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1% level respectively.

Table 9. Testing for improved prioritization practice in the post reform period

	Log waiting time	Probability of excessive waiting
Priority group 1 post reform	0.1226*** (0.0110)	0.0602*** (0.0052)
Priority group 2 pre reform	0.4341*** (0.0099)	-0.1442*** (0.0041)
Priority group 2 post reform	-0.4296*** (0.0116)	-0.1392*** (0.0045)
Priority group 3 pre reform	1.0190*** (0.0107)	-0.1837*** (0.0042)
Priority group 3 post reform	0.9786*** (0.0123)	-0.2143*** (0.0048)
Priority group 4 pre reform	0.8961*** (0.0247)	-0.3448*** (0.0039)
Priority group 4 post reform	1,0203*** (0.0228)	-0.3285*** (0.0044)
Priority group 5 pre reform	0.9206*** (0.0171)	-
Priority group 5 post reform	0.8451*** (0.0173)	-
Number of observations	311188	285165
Number of hospitals	58	58

Note: Standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1% level respectively.

Appendix.

Table A1: Descriptive statistics, before and after the hospital reform

	Pre-reform period	Post-reform period
Waiting time	144.22 (153.45)	125.46 (138.44)
Proportion with excessive waiting times	0.413	0.372
Male	0.380	0.377
Age 80+	0.107	0.113
Age 67-80	0.242	0.231
Age 30-66	0.437	0.456
Age 15-29	0.078	0.075
Age 0-15	0.136	0.125
Number sub-diagnosis	0.715 (1.062)	1.049 (1.339)
Surgical	0.718	0.712
Health region East	0.296	0.286
Health region South	0.242	0.246
Health region West	0.179	0.211
Health region Mid	0.145	0.144
Health region North	0.138	0.114
Priority group 1	0.204	0.222
Priority group 2	0.352	0.329
Priority group 3	0.329	0.354
Priority group 4	0.019	0.020
Priority group 5	0.095	0.075
University hospital	0.221	0.271
Central hospital	0.388	0.359
Local hospital	0.391	0.370
Certain infectious and parasitic diseases (A00-B99)	0.001	0.001
Neoplasms (C00-D48)	0.237	0.238
Diseases of the blood.. (D50-D89)	0.004	0.004
Endocrine, nutritional and metabolic diseases (E00-E90)	0.027	0.029
Diseases of the nervous system (G00-G99)	0.027	0.032
Diseases of the eye .. (H00-H59)	0.057	0.035
Diseases of the ear .. (H60-H95)	0.015	0.016
Diseases of the circulatory system (I00-I99)	0.045	0.050
Diseases of the respiratory system (J00-J99)	0.133	0.114
Diseases of the digestive system (K00-K93)	0.082	0.077
Diseases of the skin .. (L00-L99)	0.004	0.004
Diseases of the musculoskeletal system ..(M00-M99)	0.191	0.199
Diseases of the genitourinary system (N00-N99)	0.100	0.103
Pregnancy, .. (O00-O99)	0.012	0.023
Congenital malformations, . (Q00-Q99)	0.010	0.011
Symptoms, signs, .. (R00-R99)	0.010	0.011
Injury, poisoning, .. (S00-T98)	0.038	0.042
Factors influencing health status.. (Z00-Z99)	0.006	0.010
Number of observations	130914	180274

Means (standard deviations in parentheses) or proportions of variables.

Table A2: Descriptive statistics by prioritization groups

	Group 1	Group 2	Group 3	Group 4	Group 5
Waiting time	74.338	120.416	167.243	194.336	183.952
	(125.350)	(139.277)	(145.990)	(171.812)	(145.517)
Proportion with excessive waiting times	0.424	0.419	0.349	0.170	-
Male	0.509	0.392	0.262	0.439	0.454
Age 80+	0.128	0.062	0.118	0.077	0.238
Age 67-80	0.294	0.133	0.319	0.131	0.181
Age 30-66	0.435	0.404	0.501	0.509	0.425
Age 15-29	0.064	0.130	0.035	0.114	0.055
Age 0-15	0.080	0.270	0.027	0.170	0.100
Number sub-diagnosis	1.319	0.771	0.910	0.555	0.485
	(1.479)	(1.096)	(1.234)	(1.050)	(0.851)
Surgical	0.404	0.764	0.814	0.795	0.882
Health region East	0.313	0.262	0.315	0.246	0.253
Health region South	0.234	0.245	0.241	0.250	0.276
Health region West	0.196	0.213	0.179	0.202	0.211
Health region Mid	0.136	0.145	0.150	0.116	0.148
Health region North	0.121	0.135	0.115	0.188	0.112
University hospital	0.354	0.271	0.210	0.205	0.224
Central hospital	0.298	0.359	0.357	0.401	0.337
Local hospital	0.348	0.370	0.433	0.394	0.439
Number of observations	66828	105416	106879	6042	26023

Means (standard deviations in parentheses) or proportions of variables.

Table A3: Random effect regression results: Testing for more equal prioritization practice in the post reform period.

	Log waiting time	Probability of excessive waiting
Male	0.0098** (0.0045)	0.0096*** (0.0021)
Age groups. Reference group: Age 30-66		
Age 80+	-0.1741*** (0.0072)	-0.0676*** (0.0034)
Age 67-80	-0.0790*** (0.0054)	-0.0339*** (0.0025)
Age 15-29	-0.0218*** (0.0088)	-0.0001 (0.0041)
Age 0-15	-0.1163*** (0.0082)	-0.0628*** (0.0037)
Number sub-diagnosis	-0.0202*** (0.0018)	-0.0040*** (0.0008)
Surgical	0.2246*** (0.0053)	0.0509*** (0.0025)
Health regions. Reference group: Health region East		
Health East post reform	-0.0144 (0.0099)	-0.0142*** (0.0047)
Health South pre reform	0.0215 (0.0132)	0.0023 (0.0050)
Health South post reform	-0.0478*** (0.0144)	-0.0278*** (0.0056)
Health West pre reform	0.0348* (0.0200)	-0.0162* (0.0090)
Health West post reform	0.0558*** (0.0205)	0.0049 (0.0093)
Health Mid pre reform	0.0798*** (0.0227)	-0.0061 (0.0103)
Health Mid post reform	0.0915*** (0.0231)	0.0134 (0.0106)
Health North pre reform	-0.0835*** (0.0246)	-0.0677*** (0.0068)
Health North post reform	0.0673*** (0.0247)	0.0030 (0.0077)
Priority groups. Reference group: Priority group 1 (high priority patients)		
Priority group 2	0.3584*** (0.0075)	-0.1785*** (0.0033)
Priority group 3	0.9211*** (0.0084)	-0.2423*** (0.0036)
Priority group 4	0.8968*** (0.0173)	-0.3494*** (0.0037)
Priority group 5	0.8019*** (0.0140)	-
Hospital type. Reference group: local hospital		
University hospital	0.3691*** (0.0760)	0.1197*** (0.0142)
Central hospital	0.0486 (0.0530)	-0.0085* (0.0048)
Time trend	-0.0409*** (0.0020)	-0.0177*** (0.0010)
Main chapters in ICD10. Reference group: Diseases of the circulatory system (I00-I99)		
Certain infectious and parasitic diseases (A00-B99)	-0.1184** (0.0551)	-0.0438* (0.0237)
Neoplasms (C00-D48)	-0.2216*** (0.0109)	-0.1372*** (0.0049)
Diseases of the blood.. (D50-D89)	0.0857*** (0.0325)	0.0051 (0.0146)
Endocrine, nutritional and metabolic diseases (E00-E90)	0.7159*** (0.0162)	0.2117*** (0.0076)
Diseases of the nervous system (G00-G99)	0.9564*** (0.0155)	0.3002*** (0.0069)
Diseases of the eye .. (H00-H59)	0.7849*** (0.0193)	-
Diseases of the ear .. (H60-H95)	1.2160*** (0.0197)	0.3950*** (0.0076)
Diseases of the respiratory system (J00-J99)	1.0582*** (0.0131)	0.3628*** (0.0058)
Diseases of the digestive system (K00-K93)	0.5813*** (0.0121)	0.1988*** (0.0060)
Diseases of the skin .. (L00-L99)	-0.1519*** (0.0330)	-0.0706*** (0.0153)
Diseases of the musculoskeletal system ..(M00-M99)	0.9090*** (0.0119)	0.3011*** (0.0056)
Diseases of the genitourinary system (N00-N99)	0.6642*** (0.0118)	0.2047*** (0.0057)
Pregnancy, .. (O00-O99)	0.3939*** (0.0185)	0.2607*** (0.0081)
Congenital malformations, . (Q00-Q99)	0.6121*** (0.0224)	0.1867*** (0.0104)
Symptoms, signs, .. (R00-R99)	0.2255*** (0.0219)	0.0764*** (0.0108)
Injury, poisoning, .. (S00-T98)	0.4238*** (0.0146)	0.1953*** (0.0070)
Factors influencing health status.. (Z00-Z99)	0.6201*** (0.0249)	0.1980*** (0.0114)
Constant	84.7967*** (4.0403)	-
Number of observations	311188	285165
Number of hospitals	58	58

Note: Standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1% level respectively.

Table A4: Random effect regression results: Testing for improved prioritization practice in the post reform period.

	Log waiting time	Probability of excessive waiting
Male	0.0103** (0.0045)	0.0098*** (0.0021)
Age groups. Reference group: Age 30-66		
Age 80+	-0.1750*** (0.0072)	-0.0677*** (0.0034)
Age 67-80	-0.0782*** (0.0054)	-0.0338*** (0.0025)
Age 15-29	-0.0228*** (0.0088)	-0.0008 (0.0041)
Age 0-15	-0.1164*** (0.0082)	-0.0631*** (0.0037)
Number sub-diagnosis	-0.0209*** (0.0018)	-0.0042*** (0.0008)
Surgical	0.2247*** (0.0053)	0.0509*** (0.0025)
Health regions. Reference group: Health region East		
Health region South	-0.0126 (0.0115)	-0.0070* (0.0039)
Health region West	0.0525*** (0.0189)	0.0050 (0.0082)
Health region Mid	0.1001*** (0.0216)	0.0143 (0.0097)
Health region North	0.0258 (0.0237)	-0.0208*** (0.0059)
Priority groups. Reference group: Priority group 1 (high priority patients)		
Priority group 1 post reform	0.1226*** (0.0110)	0.0602*** (0.0052)
Priority group 2 pre reform	0.4341*** (0.0099)	-0.1442*** (0.0041)
Priority group 2 post reform	-0.4296*** (0.0116)	-0.1392*** (0.0045)
Priority group 3 pre reform	1.0190*** (0.0107)	-0.1837*** (0.0042)
Priority group 3 post reform	0.9786*** (0.0123)	-0.2143*** (0.0048)
Priority group 4 pre reform	0.8961*** (0.0247)	-0.3448*** (0.0039)
Priority group 4 post reform	1,0203*** (0.0228)	-0.3285*** (0.0044)
Priority group 5 pre reform	0.9206*** (0.0171)	-
Priority group 5 post reform	0.8451*** (0.0173)	-
Hospital type. Reference group: local hospital		
University hospital	0.3652*** (0.0957)	0.1182*** (0.0122)
Central hospital	0.0479 (0.0665)	-0.0107** (0.0048)
Time trend	-0.0418*** (0.0020)	-0.0180*** (0.0010)
Main chapters in ICD10. Reference group: Diseases of the circulatory system (I00-I99)		
Certain infectious and parasitic diseases (A00-B99)	-0.1166** (0.0551)	-0.0430* (0.0237)
Neoplasms (C00-D48)	-0.2230*** (0.0109)	-0.1377*** (0.0049)
Diseases of the blood.. (D50-D89)	0.0866*** (0.0325)	0.0055 (0.0146)
Endocrine, nutritional and metabolic diseases (E00-E90)	0.7165*** (0.0162)	0.2117*** (0.0076)
Diseases of the nervous system (G00-G99)	0.9537*** (0.0155)	0.2992*** (0.0069)
Diseases of the eye .. (H00-H59)	0.7678*** (0.0194)	-
Diseases of the ear .. (H60-H95)	1.2148*** (0.0197)	0.3938*** (0.0076)
Diseases of the respiratory system (J00-J99)	1.0572*** (0.0131)	0.3623*** (0.0058)
Diseases of the digestive system (K00-K93)	0.5800*** (0.0121)	0.1981*** (0.0060)
Diseases of the skin .. (L00-L99)	-0.1576*** (0.0330)	-0.0733*** (0.0152)
Diseases of the musculoskeletal system ..(M00-M99)	0.9079*** (0.0119)	0.3008*** (0.0056)
Diseases of the genitourinary system (N00-N99)	0.6632*** (0.0118)	0.2045*** (0.0057)
Pregnancy, .. (O00-O99)	0.3971*** (0.0185)	0.2629*** (0.0081)
Congenital malformations, . (Q00-Q99)	0.6107*** (0.0224)	0.1857*** (0.0104)
Symptoms, signs, .. (R00-R99)	0.2266*** (0.0219)	0.0770*** (0.0108)
Injury, poisoning, .. (S00-T98)	0.4239*** (0.0146)	0.1961*** (0.0070)
Factors influencing health status.. (Z00-Z99)	0.6087*** (0.0249)	0.1924*** (0.0115)
Constant	86.5170*** (4.0318)	-
Number of observations	311188	285165
Number of hospitals	58	58

Note: Standard errors in parentheses. *, ** and *** represent significance at 10%, 5% and 1% level respectively.

[1] Hagen & Kaarboe (2006) and Magnussen, Hagen, & Kaarboe (2007) give more detailed descriptions of the 2002-hospital reform.

[2] A potential problem is that medical guidelines developed in one health region might be affected by access to medical staff and medical equipment (capacity constraints), and that capacity constraints vary systematically among regions. Sveri (2005) finds that capacity constraints were not taken into consideration when the maximum waiting times were set

[3] We have checked whether there are diagnoses specific effects by running regressions for each diagnosis separately. This seems to be the case; however, it is beyond the scope of this paper to investigate effects for particular medical conditions, leaving this to further research using same procedure.

[4] Table A3 gives the full set of results from these regressions.

[5] Table A3 also presents the random effect probit results. The results show larger differences in the probability of excessive waiting times in the post-reform period relative to the pre-reform period

[6] All regression results are available on request.