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THE IMPACT OF DIFFERENT PRIORITISATION POLICIES ON WAITING TIMES: A COMPARATIVE ANALYSIS OF NORWAY AND SCOTLAND

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The Impact of Different Prioritisation Policies on Waiting Times: A Comparative Analysis of Norway and Scotland

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Abstract

We compare the distributional consequences of two different waiting times initiatives. The primary focus of Scotland's recent waiting time reforms has been on reducing maximum waiting times through the imposition of high profile national targets. In Norway, the focus has been on appropriate prioritisation of referrals to hospital based on disease severity, the expected benefit of the treatment and cost-effectiveness. We use large, national administrative datasets from before and after each of these reforms and assign priority groups based on the maximum waiting times stipulated in Norwegian medical guidelines. To equalise case-mix over time, we use Exact Matching to weight the pre-reform patients to the patient composition in the post-reform period. We regress patient-level waiting times on patient characteristics and on a post-reform indicator interacted with the patient's priority group. The analysis shows that the least-prioritised patients benefited most from both reforms. This was at the cost of longer waiting times for patients that should have been given higher priority in Norway, while Scotland's high priority patients remained unaffected. This comparative analysis indicates that blanket waiting times initiatives may be more effective in reducing waiting times while preserving prioritisation between patients with different health needs.

Key words: Waiting times, prioritisation, Norway, Scotland

JEL classification: I10, I18

1. INTRODUCTION

Waiting times and waiting lists are a significant concern in countries where the majority of health care services are provided within the public sector. The main reasons are that access to health care services is financed through taxes, copayments are low and all inhabitants have the right to treatment. This leads to rationing of patients by waiting lists.

In recent years there has been a trend for policy makers to set priorities on a more explicit basis. The most common policy is *blanket waiting-time target setting* (introduced in Australia, Denmark, England, Italy, Scotland, Spain, and Sweden). Under blanket waiting time targets, all patients have equal priority regardless of their clinical condition and the treatment they are waiting to receive. This unconditional guarantee may be effective in reducing long waiting times (Siciliani and Hurst, 2005), but the reduction of waiting times does not necessarily benefit all the patients because hospitals may choose to treat less needy patients. Other countries have introduced *vertical waiting time prioritisation*. With this type of prioritisation explicit guidelines are given on how patients should be prioritised. In New Zealand, patients receive points, and patients with more points have shorter waiting times (Edwards 1999). In Norway, three criteria - disease severity, the expected benefit of the treatment and cost-effectiveness of treatment - determine an individually set maximum waiting time. It is believed that vertical waiting time targets will lead to a higher prioritisation and reduced waiting time primarily for patients in most need of treatment.

Much attention has been paid to how prioritisation should be organised, at which levels decisions should be taken and how the resources should be distributed (Klein, 1993). From an ethical and public health viewpoint, some studies investigate normative approaches to prioritisation, see for example Daniels (2000) and Cappelen and Norheim (2006). From a theoretical point of view

waiting lists may be seen as suboptimal as waiting times are costly to patients and entail few benefits for the providers. However, with asymmetric information between payer and provider about the value of treatments, a public sector insurer may decide to ration resources allocated to hospitals so patients with low valuation exit the waiting list due to time costs. Two recent papers, Gravelle and Siciliani (2008a; 2008b) analyse how waiting times should be allocated among patients, given a rationing regime. In the first paper they show that it is welfare improving to prioritise on observable characteristics. Specifically, prioritisation of patient groups should be governed by how sensitive patients are to the length of waiting time, and their costs of waiting. Gravelle and Siciliani (2008b) investigate how a fixed health care budget should be allocated across treatments when patient charges are fixed and care is rationed by waiting within treatments. In this case the optimal allocation of resources across treatments should result in longer waiting times for treatments where demand is more elastic with respect to waiting times.

The empirical literature of prioritisation practices is limited, and differs in the kind of data that are used. Arnesen *et al* (2002) and Löfvendahl *et al* (2005) investigate patients' medical records. A problem with this approach is the limited sample that can be used, and the potentially very high cost of providing data of sufficient generality. As an alternative, Askildsen *et al* (2010a), Dimakou *et al* (2009) and Propper *et al* (2010) use register based data. Askildsen *et al* (2010a) evaluated whether prioritisation-practices changed following a Norwegian hospital reform, which changed ownership structures and catchment areas of the hospitals. Dimakou *et al* (2009) analyse how the probability of admission of any given patient varies during the time they wait. They find that hazard rates vary over time and that a high probability of admission coincides with targets, which changes when targets change. Propper *et al* (2010) analyse whether a planned reduction in waiting times, backed up by strong managerial sanctions and stringent monitoring, reduced waiting times. By comparing changes over time in England to those in Scotland (which adopted a similar policy later), they found

that the policy met the goal to reduce long waiting times without apparently diverting effort from less well-monitored aspects of health care. Their analysis of re-prioritisation, however, was inconclusive as the pre-intervention trends differed between the two countries.

In this paper we compare the consequences of two different prioritisation policies, blanket and vertical prioritisation, for inpatient treatments. For that purpose we use data from Norway and Scotland as different prioritisation policies have been introduced in the two countries over the same period. Specifically we analyse i) if the common concern of too low priority given to the most severely ill patients occurs when blanket waiting time targets are introduced, and ii) if more severe patients are prioritised better in a country where vertical prioritisation is introduced.

To evaluate the effects on prioritisation of the two different reforms, we use exact matching as a way to pre-process the data. This way the treatment group (post-reform patients) and control group (pre-reform patients) have the same background characteristics. Specifically we match on patient characteristics, diagnosis and the quarter of the year when treatment was provided. We then regress the patient-level waiting times on patient characteristics and the priority groups. We use the method developed by Askildsen *et al* (2010b) to assign patients to priority groups based on Norwegian medical guidelines. Since our main interest is if the prioritisation pattern has changed, we include a post-reform indicator interacted with the priority groups.

The results are somewhat surprising. The analysis shows that the patients with the lowest priority benefited most from the reforms in both countries. In Norway, where we should expect the vertical prioritisation to benefit the higher priority patients, the derived effect actually appears to have been at the expense of this group. In Scotland, however, waiting times for the high priority patients were unaffected.

The paper is organised as follows. The institutional settings in Norway and Scotland are contained in section 2. In section 3 we present the empirical method. The data and descriptive statistics are presented in section 4 while the estimation results are presented in section 5. Section 6 contains the discussion and the concluding remarks.

2. INSTITUTIONAL SETTINGS

2.1. Norway

The Norwegian specialised health care sector is predominantly publicly owned and, as of 2002, organised as state owned enterprises within five[1] (north, mid, west, south, east) regional health authorities. The regional health authorities have the responsibility for providing specialist health care to all patients within the region.[2] Provision of this health care is organised through health enterprises owned and governed by the regional enterprises. The regional health authorities can also contract with private suppliers for providing treatment. However, this outsourcing is quite small compared to overall treatment activity, and confined to a few diagnoses. Patients' access to specialised health care is either through a referral system (elective care) or by emergency care.

Regional Health Authorities are financed by a mixture of block grants, based on capitation or risk adjustment formula, and a DRG activity based system (implemented in the Norwegian hospital sector from 1 July 1997). Another important feature is the patients' right to free choice of hospital, which came into effect at a national level in 2001. However, relatively few patients seem to have

[1] Four from June 2007 when south and east were merged.
[2] See Hagen and Kaarboe (2006) and Magnussen *et al* (2007) for descriptions of the Norwegian hospital sector and the 2002-reform where hospital ownership was transferred from the county councils to the central government.

opted for the possibility of receiving treatment outside of natural hospital catchment areas (Vrangbæk *et al*, 2007).

An important principle within the Norwegian health care system is the right to access and to equal treatment for all inhabitants, irrespective of age, gender, ethnicity, socio-economic status and place of residence. This principle is regulated through the Act on Patients Rights and administrative regulation of prioritisation (Ministry of Health and Social Services, 1999; 2003). For elective patients, it establishes that, upon referral, the assessment of a patient's condition must consider: a) how serious is the condition, b) whether a suitable treatment exists that may improve the patient's condition, and c) the cost-effectiveness of this treatment. From September 2004 patients who are referred to the specialist health care sector have the right, within 30 days from referral, to an evaluation of whether or not their medical condition is such that it gives a right to treatment within an individual maximum waiting time.

According to the regulations all patients should be categorised into one of the following categories:

1. Urgent care
2. Elective treatment, with individual maximum waiting time
3. Elective treatment, without individual waiting time
4. Other health care services that may be demanded.

Patients in categories 1 and 2 comprise the core health care supply of Norwegian public hospitals. However, patients in category 3 also have the right to treatment. It is only demand from patients in category 4 that are excluded from the mandatory activities of the public health enterprises.

The allocation of prioritisation status to elective patients is formally managed in the following way. Upon receipt of a referral, within 30 days the hospital has to consider whether the patient belongs to category 2 or 3, or whether (s)he should not receive treatment at all. This decision is based only on the description of the medical condition given by the primary care physician. Each patient is to be considered according to the priority regulations, criteria a-c above. If the patient is considered as belonging to category 2, (s)he is given an individual maximum waiting time until start of treatment. If this 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 (typically 14 days). If treatment is still not given, the patient can choose treatment at another hospital, privately, publicly or abroad, at the cost of the initial health enterprise. The Norwegian Labour and Welfare Service (NAV) has organised a special unit to help patients choose their provider and ensure that the new provider gets paid.

2.2. Scotland

The Scottish specialised health care sector is also predominantly publicly owned. It is organised into 14 regional health boards[3], responsible for primary, community and secondary (hospital) health care services to the populations resident within their geographical boundaries. These boards receive an annual budget from the Scottish Government, based on a weighted capitation formula. Until 2004, responsibility for providing hospital services was held by NHS Acute Trusts who negotiated annual contracts with local health boards. From 2004, health boards took over direct responsibility for delivering these services. Activity-based financing has never operated for hospital services in Scotland. Contracts with private suppliers represent a very small proportion of NHS-financed hospital care and privately-financed (either directly or through insurance) hospital care is also a very small proportion of total hospital care expenditure.

[3] Previously 15 Health Boards until 2006.

Until recently, waiting times in Scotland were measured in parts of the patient journey. There was separate measurement of (a) the wait between GP referral and the first specialist visit and (b) the wait between the specialist's decision to admit a patient and the patient's receipt of treatment. The first aspiration to reduce waiting times by the new devolved administration was announced in 2000 (Scottish Executive 2000). The maximum waiting time was to be nine months by December 2003. A more ambitious target of six months was announced for 2005 in a 2002 press release (Audit Scotland, 2006), but it was not until February 2003 that these aspirations became firm policy commitments in a health White Paper (Scottish Executive, 2003). Just a year later in 2004, a further White Paper pledged to reduce waiting times to 18 weeks by 2007 (Scottish Executive, 2004).

3. EMPIRICAL METHOD

In order to investigate how prioritisation practice has evolved over time, we need a way to assign priorities. In this paper we use a method suggested by Askildsen *et al* (2010b) which derives maximum waiting times from Norwegian medical guidelines. These guidelines were developed at one of the Norwegian health authorities, Health Region West[4]. This region covers about 22 % of the population in Norway. The medical guidelines cover 21 medical specialities. Based on a description of a medical condition, they assign a recommended maximum waiting time (between 4 and 52 weeks), or no priority. By translating the medical conditions in the guidelines to ICD10 codes we have been able to assign patients in Norwegian and Scottish patient registers to maximum acceptable waiting time groups.[5] Patients are mapped into groups with maximum waiting times of 28 (which we label 'very high' priority), 56 ('high'), 84 ('medium') and 182 ('low') days. In

[4] 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.

[5] We are grateful to Jacob Mosvold, chief consultant physician at 'Diakonhjemmet hospital' (Oslo) for translating descriptions of medical conditions into relevant ICD10 codes, and to professor in medicine Ole Frithjof Norheim for advising us interpreting the guidelines. See Nordheim (2005) and Askildsen *et al* (2010b) for further documentation.

addition one group of patients are not given a maximum waiting time ('no' priority, corresponding to category 3). There are also some patients who receive treatments which correspond to ICD-10 codes not classified by the guidelines. We have grouped these patients into the group, 'unknown priority'.

A reasonable assumption is that if one patient group is given a shorter maximum waiting time relative to another patient group, the former group has higher priority. Thus we can compare actual waiting times for patients with medical conditions of different severity in different time periods and evaluate how the introduction of individual maximum waiting times for elective treatment and equal maximum waiting times have influenced prioritisation practice in the two countries. If, for a particular group of patients, the actual waiting time decreases (increases) relative to other patients, this might be interpreted as if this patient group is being higher (lower) prioritised.

Ideally, to allow for unobservable heterogeneity, we would compare waiting times for the same patient with exactly the same severity of medical condition before and after the reform. This is rarely possible, of course. Instead, we compare the patients in the two periods - before and after the introduction of the latest reforms - in the two countries.

We use exact matching (Ho et al, 2007; Iacus et al, 2009) as a way to pre-process the data set, so that the pre- and post-reform groups have the same observable characteristics. We sort all patients into strata, each of which has the same values of combinations of the matching variables. Strata that do not include at least one pre-reform observation and one post-reform observation are pruned from the dataset. The following weights (θ) are then calculated and applied to each of the pre-reform observations:

$$\theta_{i\in j,t=0} = \left(\frac{N_{j,t=1}}{\sum_j N_{j,t=1}} \right) \left(\frac{N_{j,t=0}}{\sum_j N_{j,t=0}} \right)^{-1} \quad (1)$$

in which N_j is the number of observations in strata j at time t, with t=0 and t=1 indicating the pre-reform and post-reform periods, respectively. All post-reform observations are assigned a weight of one.

We then undertake weighted regression of the patient-level waiting times on patient characteristics, the quarter of addition and, since the main interest is if the prioritisation pattern has changed, we include a post-reform indicator interacted with the patient's priority group. We estimate the following model:

$$\ln W_{it} = \alpha_0 + \alpha_1 P_{i\in g} + \alpha_2 D[t=1] + \alpha_3 D[t=1] P_{i\in g} + x'\beta + \varepsilon_{it} \quad (2)$$

where

W_{it} = waiting time for patient i added to the waiting list at time t

$P_{i\in g}$ = vector of dummy variables representing the priority group to which patient i is assigned

D[t=1] = binary indicator for the post-reform period

x = vector of individual characteristics: gender, age, number of co-morbidities, and the quarter of addition to the waiting list.

We use different matching criteria: first, we match only on the patient characteristics and the quarter of addition. In the extension of the matching procedure we also include the main full ICD-10 diagnosis. Our use of exact matching means that we prune observations for which there is no exact

match in the pre-reform period. Some observations are pruned from the dataset when we use richer matching criteria.

The two countries tackled the excess waiting times in different ways. In Scotland, the patients at risk of breaching the targets were diverted to a waiting times centre that the NHS had bought from the private sector. Thus, changing the distribution of patients across hospitals was part of Scotland's waiting times reform. Patients in Norway are given right to file a complaint if the maximum waiting time targets are exceeded. However, the same hospital is given an opportunity to treat the patient before an external hospital was contacted.[6] We present models including hospital fixed effects for both countries, but interpret the models without fixed effects in Scotland as the full effect of the reform.

Using this detailed matching procedure, we think it is reasonable to conclude that we compare similar individuals under different prioritisation regimes. Therefore, if, relative to the change observed for other groups of patients, a patient group has shorter waiting times after the reform compared to the pre-reform period, we interpret this as this patient group being higher prioritised after the reform.

There may be other changes that occurred at the same time as the prioritisation reform, such as increases in the amount of resource available, capacity and hospital productivity and we cannot distinguish these from the pure reform effect. Still, it is likely that these changes affect all patients rather than particular groups of patients selectively affected by the prioritisation reform.

[6] When violations occur, hospitals are given 14 days to treat these patients. The hospital is not penalised if this time limit is not violated.

4. DATA AND DESCRIPTIVE STATISTICS

The data in both countries are taken from the administrative patient registers covering the whole population of patients referred for elective inpatient hospital treatment in the period 2003 – 2006. The main interest in our analysis is the policy change and we therefore restrict the period of the analysis to two year periods: patients added to waiting lists between 1st of August 2003 – 31st of July 2004 are included in the pre-reform year, while patients added between the 1st of August 2005 – 31st of July 2006 constitute the sample for the post-reform period. This allows us to look at the patients that should, according to the Scottish policy, be waiting at most nine and six months, respectively. We are also able to capture the introduction of the maximum individual waiting time in Norway from the 1st of September 2004. Figure 1 illustrates the policy changes in the two countries and the observation periods.

[Figure 1 about here]

To avoid serial hospital admissions (e.g. dialysis treatment, radiotherapy and chemotherapy) we only include the first hospital stay for each patient in each year. In the analysis, we follow the individuals added to the list for up to 17 months. Small proportions of patients waiting longer than 520 days are excluded from the analysis in order to avoid censoring of the later additions to the list. In the Scottish dataset, the proportions waiting longer than 520 days are 0.9% and 0.4% in the pre-reform and post-reform periods, respectively. The same proportions in the Norwegian dataset are 4.7% and 1.5%. We have also dropped patients with missing or invalid waiting times and missing values on one or more of the explanatory or matching variables.

In order to have as similar coverage as possible, some observations had to be excluded from the Norwegian data as admissions for these conditions are recorded in different registers or in a different manner in Scotland. We excluded admissions for *psychological diseases*, *pregnancy*, *certain conditions originating in the perinatal period* and *external causes*. Descriptive statistics for the samples are provided in an Appendix.

4.1 The Norwegian dataset

The Norwegian data come from the Norwegian Patient Register (NPR). The register contains detailed information on inpatients, including patient characteristics (such as age and gender), waiting time, name and location of the hospital providing the treatment, type of treatment (medical, surgical) and diagnoses. Waiting times are measured from General Practitioner referral to admission at the hospital.

Table I shows the distribution of waiting times. There are only minor differences in the distributions in pre- and post reform periods. The mean waiting time has increased by one day and the waiting times below the median have also slightly increased. The median waiting time has increased by 5 days. At the 90^{th} percentile the waiting times have decreased by 12 days.

[Table I about here]

In Table II we report mean waiting times for different patient groups in the pre-reform and post-reform period. The 'very high' priority patients have the shortest average waiting time but this exceeds the guidelines by more than one month. The priority groups that have experienced a reduction in mean waiting time are the patients in the 'low' and 'no priority' groups. This might be an indication that hospitals are more concerned with the long waits rather than the maximum

waiting time targets. Unlike Dimakou et al (2007), we do not observe the probability of admission rising sharply just before the target.

[Table II about here]

Male patients wait about two days longer than females both before and after the reform. The waiting time decreases monotonically with age (except for children below the age of six). Waiting time is also generally decreasing in the number of co-morbidities and varies considerably across ICD-10 chapters.

4.2. The Scottish dataset

In the Scottish analysis, we make use of data from the Scottish Morbidity Record 01 (SMR01). This database records detailed information on all admissions to acute hospitals, including patient characteristics such as age and gender, waiting time, name and location of the hospital providing the treatment, type of treatment (medical, surgical), and diagnoses. In the Scottish dataset, waiting times are measured from the point at which the specialist decides that the patient needs an admission to the point at which the patient is admitted to hospital. All else equal, the available measures of waiting times in Scotland should be shorter than those in Norway.

In Scotland, the mean waiting time has fallen from 84 to 75 days (Table I). Waiting times have slightly increased below the median. At the 90^{th} percentile, the waiting time has fallen by 59 days. The distributional consequences are therefore as expected; an increased focus on those with longer waiting times is accompanied by longer waiting times for those with shorter waiting times before the reform.

Scottish waiting times are aligned with the priorities assigned by the Norwegian medical guidelines: with the exception of the 'no priority' group, patients with higher assigned priority wait a shorter time (Table II). Almost all groups experienced decreased waiting times but waiting times for the most prioritised patients have decreased the least in both relative and absolute terms. Males wait a shorter time for treatment than females in Scotland. The waiting time decreases monotonically with age for adults, and with the number of co-morbidities. Patients with musculoskeletal and eye conditions have experienced the largest reduction in waiting time.

5. ESTIMATION RESULTS

In the multivariate regression analyses reported in this section we compare changes in the conditional mean waiting times over time. The coefficient on the reform dummy captures the general trend in waiting times applied to all groups. A negative coefficient on the interaction variable between a particular priority group and the reform dummy means that waiting times reduced more over time for this group than the 'very high' priority group (the reference group).

The main results are presented in Table III for Norway and Table IV for Scotland.

[Table III and IV about here]

Model 1 contains only the priority group dummies and these dummies interacted with the post-reform period indicator. In Models 2-5 we also control for gender, age, number of co-morbidities and the quarter of addition.[7] Model 3 shows the results when we use the weights from exact matching on combinations of the patient characteristics and the quarter when patients were added to

[7] We control for quarters since hospital production varies systematically over the year.

the list. Model 4 shows the effect on Model 3 when hospital fixed-effects are added. Each of the Models 1-4 are estimated on the full sample as an exact match exists in the pre-reform period for each post- reform patient. Model 5 is estimated on a smaller sample once we have additionally matched on combinations of the previous matching variables and the full ICD-10 diagnosis. Where there is no patient in the pre-reform period that has the same patient characteristics and the same quarter of addition and the same full ICD-10 diagnosis as a patient in the post-reform period, these patients are excluded.

The Model 1 results for Norway (Table III) confirm that all priority groups had significantly longer logged waiting times compared to the 'very high' priority patients (the reference category) before the reform. This remains the case in all of the models. The coefficient on the post-reform period dummy is positive, suggesting that the mean logged waiting time for the 'very high' priority patient increased by 6-8 %. This change broadly applies across the high, medium and missing priority groups, since the interaction terms for these groups are generally insignificant. However, the interaction terms for the low and no priority groups are negative and of a similar magnitude to the main effect for the post-reform period. Thus, the low and no priority groups experienced no increase in waiting time. Indeed, when we also match on the full diagnosis in Model 5, the coefficients are slightly bigger, indicating that waiting times decreased more for the patients in the low priority group. However, the sample size in Model 5 is also reduced as a more detailed matching procedure is applied. As explained earlier, for Norway, we believe that models 4 and 5 are preferred as the hospital fixed effects are controlled for. The coefficients on other explanatory variables (not shown) suggest that these have a significant effect on waiting time. Men wait approximately 7% longer than women. Older patients wait significantly shorter than the youngest age group. Patients with more co-morbidities wait significantly shorter than those with no

comorbidities. These latter results might relate to more severely ill patients and might therefore be in accordance with the prioritisation guidelines.

The same models are estimated for Scotland. However, as a change in the distribution of patients across hospitals was part of the Scottish waiting time reform, the hospital FE are not included in Model 5. The Model 1 results for Scotland (Table IV) confirm that all groups wait longer for the treatment than the very high priority group before the reform, even if no explicit guidelines on vertical prioritisation are stated in Scotland. Indeed the magnitudes of the differences between the groups are substantially larger than in Norway. The coefficient on the post-reform indicator is generally small and insignificant, suggesting no change in waiting time for the very high priority group. This indicates that Scotland may have enjoyed more of a reduction in average waiting times if its case-mix had not shifted towards patients that tend to wait longer.

As in Norway, the changes over time for the high and medium priority groups are not statistically significantly different from the changes for the very high priority group. Also as in Norway, the low and no priority groups have however experienced a significantly different change over time. In Scotland, these groups have experienced a 10-15% reduction in mean waiting time relative to the very high priority group, which did not change over time. In Norway, the lowest prioritised groups have experienced a 7-12% reduction in mean waiting time relative to the very high priority group, which experienced a 6-8 % increase in waiting time.

6. DISCUSSION AND CONCLUDING REMARKS

In this paper we have evaluated the effects of two different prioritisation policies, namely blanket and vertical prioritisation. Norway and Scotland were used as special cases to investigate the consequences of these policies. In Scotland, blanket waiting-time prioritisation was introduced, where all patients have equal priority / equal maximum waiting time guarantee regardless of their clinical condition and the treatment they are waiting to receive. Vertical prioritisation, i.e. prioritisation within patient groups with corresponding individual maximum waiting time targets, was introduced in Norway.

According to the Norwegian guidelines, patients are allocated into groups based on disease severity, the expected benefits of treatments, and cost-effectiveness considerations. Correct prioritisation implies that more seriously ill patients, with higher expected benefits, and where a cost-effective treatment exists, should be treated first. If prioritisation is correct, we would expect patients with shorter maximum waiting times and more co-morbidities to experience lower waiting times after the policy change in Norway compared to similar patients prior to the reform. The regression results show that all priority groups waited for treatment longer than the most prioritised group before the reform. However, after the Norwegian reform, the waiting times for the higher priority patients did not change, while they reduced for the lower priority patients. There appears therefore to have been a switch in priority *away* from the highest priority patients.

The unconditional maximum waiting time targets introduced in Scotland do not take into account the severity of the patient's condition. Therefore, one of the concerns has been whether the reduced mean waiting times may lead to diversion of effort towards the least needy patients. Our results show that this is not the case in Scotland: the more aggressive maximum waiting time targets

contributed to shorter waiting times for low priority patients while leaving the high priority patients unaffected.

All in all, our analysis indicates that the individual maximum waiting times introduced in Norway did not succeed in reducing the waiting times for the highly prioritised patients. The reform required referrals to exhibit quite detailed information about the patient for the hospital specialist to correctly assess their prioritisation. We might thus expect that it will take some time before new prioritisation routines are established. In contrast, the stricter blanket prioritisation policy in Scotland, accompanied by increases in resources, did succeed in reducing the waiting times for those patients who previously waited longest without affecting the speed with which the most prioritised patients were treated. We therefore conclude that blanket waiting times targets do not necessarily lead to distortion of clinical priorities and that prioritisation based on clinical guidelines does not necessarily lead to better clinical prioritisation in the short term.

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Table I: Changes in the distribution of waiting times (days)

Period	Percentiles					Mean	N
	10th	25th	50th	75th	90th		
Norway							
Pre-reform	8	20	50	129	278	97.5	112,215
Post-reform	9	22	55	132	266	98.6	132,919
Scotland							
Pre-reform	5	13	44	129	231	84.1	144,190
Post-reform	5	15	49	119	172	74.9	145,082

Notes: Time waited between GP referral and admission in Norway. Time waited between specialist decision to admit and admission in Scotland. Pre-reform period is 1st August 2003 – 31st July 2004. Post-reform period is 1st August 2005 – 31st July 2006 in both countries.

Table II Mean waiting times (days) by patient category

	Norway			Scotland		
	Pre-reform	Post-reform	Change	Pre-reform	Post-reform	Change
Priority group (maximum wait)						
Very high (28 days)	62.3	65.3	3.0	33.8	31.1	-2.7
High (56 days)	71.7	73.5	1.8	36.2	32.3	-4.0
Medium (84 days)	86.1	91.6	5.5	79.4	68.4	-11.0
Low (182 days)	115.2	112.3	-3.0	141.1	116.0	-25.2
No priority (unlimited)	110.9	108.8	-2.1	107.2	90.1	-17.1
Missing priority	101.9	103.7	1.9	71.0	66.0	-5.0
Gender						
Female	96.6	97.6	1.0	85.4	76.4	-9.0
Male	98.5	99.5	1.1	82.5	73.1	-9.3
Age category						
Age 0 – 6	110.0	112.0	2.0	72.6	68.3	-4.4
Age 7 – 17	123.2	120.9	-2.3	86.5	74.1	-12.5
Age 18 – 39	111.4	114.0	2.7	94.9	85.7	-9.2
Age 40 – 54	103.0	107.3	4.3	88.7	80.3	-8.3
Age 55 – 64	96.6	98.4	1.8	84.4	76.1	-8.3
Age 65 – 74	88.2	89.2	1.0	83.2	71.3	-11.9
Age 75 – 84	80.1	79.5	-0.6	74.1	65.2	-9.0
Age 85+	66.7	65.1	-1.6	59.9	54.1	-5.8
Number of comorbidities						
None	103.9	104.9	0.9	91.2	80.7	-10.5
1	98.2	99.5	1.3	81.7	73.7	-8.0
2	88.9	92.9	4.0	77.2	70.8	-6.4
3	86.6	86.3	-0.3	72.2	65.0	-7.2
4	82.5	88.7	6.3	67.7	61.8	-5.9
5 or more	76.9	78.5	1.6	61.6	52.4	-9.2
ICD-10 chapter						
Infections (A00-B99)	77.1	82.6	5.6	41.7	36.2	-5.5
Neoplasms (C00-D48)	56.4	57.7	1.3	29.4	28.4	-1.0
Blood (D50-D89)	61.5	57.5	-4.0	29.2	30.1	0.8
Endocrine (E00-E90)	112.1	134.8	22.7	64.6	64.5	-0.1
Nervous (G00-G99)	115.4	124.9	9.5	51.9	66.7	14.8
Eye (H00-H59)	111.5	92.7	-18.8	110.6	84.3	-26.4
Ear (H60-H95)	182.2	188.5	6.3	104.5	103.0	-1.5
Circulatory (I00-I99)	80.7	80.2	-0.5	75.6	61.1	-14.4
Respiratory (J00-J99)	111.5	119.5	8.0	102.7	93.6	-9.1
Digestive (K00-K93)	87.6	83.8	-3.9	83.8	75.4	-8.5
Skin (L00-L99)	112.9	105.7	-7.2	73.3	68.0	-5.3
Musculoskeletal (M00-M99)	122.2	117.1	-5.1	154.1	124.0	-30.0
Genitourinary (N00-N99)	101.3	99.31	-2.0	87.6	79.4	-8.2
Congenital (Q00-Q99)	149.1	147.9	-1.2	108.3	95.4	-12.9
Symptoms & signs (R00-R99)	94.3	100.9	6.6	48.9	47.2	-1.7
Injuries & poisoning (S00-T98)	117.5	117.9	0.4	59.2	54.5	-4.8
Influencing factors (Z00-Z99)	115.6	118.6	3.0	90.2	80.9	-9.4
Health region						
Health region East	89.9	90.9	1.0	89.9	81.7	-8.2
Health region South	98.3	85.1	-13.2	n/a	n/a	n/a
Health region West	102.7	96.8	-5.9	79.8	69.0	-10.7
Health region Mid	97.6	102.5	4.9	n/a	n/a	n/a
Health region North	110.6	97.1	-13.5	85.2	78.1	-7.1

Notes: Time waited between GP referral and admission in Norway. Time waited between specialist decision to admit and admission in Scotland. Pre-reform period is 1st August 2003 – 31st July 2004. Post-reform period is 1st August 2005 – 31st July 2006 in both countries.

Table III Regression results: Norway

Priority group	Model 1	Model 2	Model 3	Model 4	Model 5
High	0.279**	0.305**	0.314**	0.296**	0.423**
	(0.021)	(0.021)	(0.021)	(0.020)	(0.025)
Medium	0.555**	0.463**	0.470**	0.472**	0.541**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.021)
Low	1.007**	0.999**	1.010**	0.993**	1.078**
	(0.016)	(0.016)	(0.017)	(0.016)	(0.021)
No priority	0.894**	0.840**	0.840**	0.823**	0.867**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.020)
Missing priority	0.640**	0.547**	0.549**	0.517**	0.666**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.021)
D[t=1]	0.077**	0.087**	0.088**	0.062**	0.058*
	(0.018)	(0.018)	(0.018)	(0.018)	(0.022)
High * D[t=1]	0.026	0.031	0.022	0.016	-0.010
	(0.027)	(0.027)	(0.028)	(0.027)	(0.032)
Medium * D[t=1]	0.059*	0.053	0.046	0.051	0.021
	(0.022)	(0.022)	(0.022)	(0.021)	(0.026)
Low * D[t=1]	-0.085**	-0.077**	-0.088**	-0.094**	-0.120**
	(0.022)	(0.022)	(0.022)	(0.021)	(0.026)
No priority * D[t=1]	-0.072**	-0.065*	-0.065*	-0.079**	-0.091**
	(0.021)	(0.021)	(0.021)	(0.020)	(0.025)
Missing priority * D[t=1]	0.004	0.010	0.007	-0.002	-0.024
	(0.021)	(0.020)	(0.020)	(0.020)	(0.025)
Adjusted R2	0.041	0.067	0.068	0.121	0.126
Observations	245,134	245,134	245,134	245,134	198,313

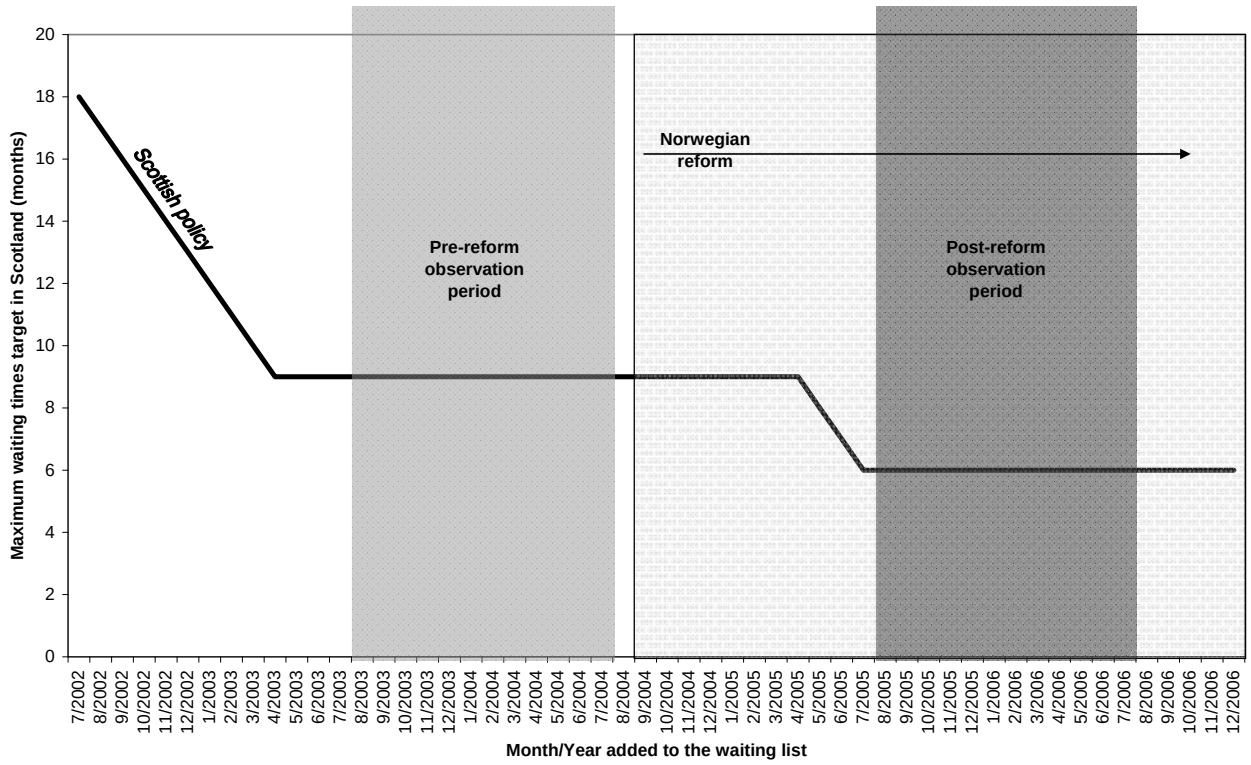
Notes: Standard errors in parentheses. * $p < 0.01$, ** $p < 0.001$. Dependent variable is ln(waiting time). D[t=1] is an indicator for the post-reform period. Model 1 contains only the variables shown. Models 2-5 contain the following covariates: male and dummy variables for age category, co-morbidity number and quarter of addition (not shown). Model 3 uses exact matching on combinations of male, age category, co-morbidity number and quarter of addition. Model 4 is as Model 3 but with hospital fixed effects (not shown). Model 5 additionally matches on combinations with the same full ICD10 diagnosis.

Table IV Regression results: Scotland

Priority group	Model 1	Model 2	Model 3	Model 4	Model 5
High	0.204***	0.209***	0.210***	0.142**	0.301**
	(0.027)	(0.027)	(0.027)	(0.026)	(0.037)
Medium	1.061***	0.979***	0.974***	0.853**	0.979**
	(0.019)	(0.018)	(0.019)	(0.018)	(0.024)
Low	1.946***	1.911***	1.920***	1.694**	2.044**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.022)
No priority	1.542***	1.439***	1.440***	1.287**	1.481**
	(0.017)	(0.017)	(0.017)	(0.016)	(0.021)
Missing priority	0.833***	0.779***	0.785***	0.717**	0.886**
	(0.016)	(0.016)	(0.016)	(0.015)	(0.021)
D[t=1]	0.005	0.005	0.007	0.018	-0.035
	(0.021)	(0.021)	(0.021)	(0.020)	(0.025)
High * D[t=1]	-0.053	-0.063	-0.064	-0.064	0.019
	(0.038)	(0.038)	(0.038)	(0.036)	(0.047)
Medium * D[t=1]	-0.043	-0.035	-0.030	-0.047	0.009
	(0.026)	(0.026)	(0.026)	(0.025)	(0.030)
Low * D[t=1]	-0.101***	-0.098***	-0.106***	-0.109**	-0.147**
	(0.024)	(0.024)	(0.024)	(0.023)	(0.028)
No priority * D[t=1]	-0.107***	-0.102***	-0.102***	-0.122**	-0.098**
	(0.023)	(0.023)	(0.023)	(0.022)	(0.027)
Missing priority * D[t=1]	0.049*	0.049*	0.042	0.020	0.075*
	(0.022)	(0.022)	(0.022)	(0.021)	(0.027)
Adjusted R2	0.111	0.125	0.126	0.183	0.130
Observations	289,272	289,272	289,272	289,272	241,662

Notes: Standard errors in parentheses. * $p < 0.01$, ** $p < 0.001$. Dependent variable is ln(waiting time). D[t=1] is an indicator for the post-reform period. Model 1 contains only the variables shown. Models 2-5 contain the following covariates: male and dummy variables for age category, co-morbidity number and quarter of addition (not shown). Model 3 uses exact matching on combinations of male, age category, co-morbidity number and quarter of addition. Model 4 is as Model 3 but with hospital fixed effects (not shown). Model 5 is the same as Model 3 with additional matching on combinations with the same full ICD10 diagnosis.

Figure 1. Policy changes in Norway and Scotland.



Appendix: Percentages of patients in each category

	Norway		Scotland	
	Pre-reform	Post-reform	Pre-reform	Post-reform
Priority group (maximum wait)				
Very high (28 days)	9.4	8.91	6.28	5.96
High (56 days)	6.41	6.94	2.65	2.66
Medium (84 days)	16.02	16.13	10.71	10.74
Low (182 days)	12.93	13.99	11.85	13.44
No priority (unlimited)	23.02	21.93	19.7	20.49
Missing priority	32.22	32.1	48.81	46.71
Gender				
Female	52.42	51.71	53.85	54.12
Male	47.58	48.29	46.15	45.88
Age categories				
Age 0 – 6	5.6	5.11	4.39	3.97
Age 7 – 17	5.11	4.81	5.02	4.72
Age 18 – 39	15.68	14.48	15.63	14.99
Age 40 – 54	20.64	20.13	20.2	20.82
Age 55 – 64	18.28	19.52	18.16	19.02
Age 65 – 74	16.47	17.25	19.75	20.02
Age 75 – 84	14.8	14.86	13.72	13.41
Age 85+	3.43	3.83	3.14	3.04
Number of co-morbidities				
None	46.39	43.4	52.07	51.37
1	25.7	25.98	21.79	21.8
2	14.16	14.89	11.52	11.59
3	7.28	8.07	6.35	6.7
4	3.41	3.95	3.76	3.96
5 or more	3.06	3.71	4.5	4.58
Chapter in ICD10				
Infections (A00-B99)	0.46	0.44	0.3	0.22
Neoplasms (C00-D48)	20.77	18.92	16.07	16.04
Blood (D50-D89)	0.44	0.51	0.59	0.53
Endocrine (E00-E90)	2.19	2.32	1.00	0.95
Nervous (G00-G99)	7.08	7.86	2.68	2.91
Eye (H00-H59)	2.33	1.61	3.4	2.84
Ear (H60-H95)	0.83	0.67	1.45	1.35
Circulatory (I00-I99)	9.03	9.79	8.92	8.86
Respiratory (J00-J99)	5.53	6.21	6.31	6.24
Digestive (K00-K93)	7.68	7.57	14.61	14.24
Skin (L00-L99)	1.36	1.2	1.94	1.78
Musculoskeletal (M00-M99)	16.55	16.32	14.14	16.18
Genitourinary (N00-N99)	10.4	10.78	11.63	11.39
Congenital (Q00-Q99)	2.4	2.04	1.75	1.83
Symptoms & signs (R00-R99)	3.19	4.02	4.73	4.2
Injuries & poisoning (S00-T98)	4.23	3.79	2.57	2.69
Influencing factors (Z00-Z99)	5.54	5.95	7.9	7.75

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