# Monitoring prioritization in a public health care sector

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# Abstract

This paper presents a new way to monitor priority settings in public health care systems. We take departure in medical guidelines prescribing acceptable waiting times for different medical descriptions. Allocating ICD10 codes to the medical descriptions, we are able to compare actual waiting times to the recommended maximum waiting times. This way we use the medical guidelines as a tool for monitoring prioritization in the health sector. In an application, using data from the Norwegian patient register (NPR), we test statistically for compliance with the guidelines. The results indicate some degree of over-prioritization for patients of lower priority relative to patients of higher priority.



JEL classification code: I12, I18
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# 1. Introduction

A distinguishing feature of a public health care sector is limited availability of resources. The government or other public bodies decide on total capacity in terms of given budgets. Access to care is free for patients, or they face a low copayment only. Demand is then at any given moment in time likely to exceed supply in terms of short run treatment capacity. The basic reason for this is that the patients are not rationed by price. Instead there are waiting lists. Health care providers will then have to make decisions on which patients and diagnoses to be given treatment, and in which order.

There are several ways that this prioritization can be organized. Some countries have explicit waiting-time prioritization for certain types of treatments (Hurst and Siciliani 2005, Gravelle and Siciliani 2008). Examples include Sweden, Spain, Italy, Australia, New Zealand, Canada, Denmark and Norway. In some of these countries, prioritization schemes have a limited number of categories; (high and low priority in Denmark, Sweden, and Spain; recommended admission within 30 days, 90 days, and 1 year in Australia and Italy). Other countries have developed systems where patients receive points, and patients with higher scores have shorter waiting times, (New Zealand and Canada). In England, an elective surgery waiting time target was introduced in 2000. The target has been progressively reduced from 18 months in March 2000 to the current 6 months target (Appleby et al. 2005).

In Norway, priority setting is regulated by the «Act on Patients Rights» and corresponding administrative regulations. These official regulations stipulate that patients referred to hospitals by primary care physicians have the right to an evaluation of their medical condition, including an assessment of whether their condition is such that a right to treatment should be given. If so, the patient shall be given an individually fixed maximum waiting time until treatment starts. This right to treatment, within a given time limit, should be based on medical considerations only. Short run capacity for treatment or other personal characteristics of the patients should not be taken into consideration.

While several countries have developed systems for priority setting that are meant to improve welfare, less attention has been paid to developing methods that can shed light on the agreement between actual prioritization of patients and the administrative regulations.[1] According to our knowledge, there are also few academic studies that evaluate to which extent actual prioritization is in accordance with administrative regulation. When such studies are carried through, they are often done by examining

[1] It is not trivial to derive optimal length of waiting lists, and on theoretical grounds show which patients that should wait for a short period and which patients may face a longer wait. Gravelle and Siciliani (2008) show that it may be welfare improving to prioritize on observable characteristics, and that prioritization of patient groups should be governed by how sensitive they are to length of waiting time, and their costs of waiting.

patients' medical record. This research strategy is costly, and often the studies are done on a small sample, see e.g. Arnesen et al. (2002). [2]

In this paper we propose a new method to monitor prioritization in the public health care sector. We use medical guidelines and allocate ICD10 codes to the medical descriptions, which enables us to compare actual waiting times to the recommended maximum waiting times. Using medical guidelines as a tool to monitor prioritization implies that length of medically accepted waiting time signals prioritization. The method is relatively inexpensive in use, as it utilizes data from already existing data sources. To illustrate how the method works, we provide an application, based on data from the Norwegian patient register (NPR) covering inpatient treatment at all (public) hospitals in Norway. Specifically we examine whether patients belonging to different prioritization groups, ordered by medically maximum acceptable waiting times, wait shorter or longer than this waiting time.

The next section outlines some methodological issues related to monitoring prioritization by use of medical guidelines. In section 3 we present an example of how prioritization can be monitored by using Norwegian in-patient hospital data. Section 4 offers some concluding remarks and avenues for further research.

# 2. Monitoring prioritization by use of explicit guidelines

In a publicly-funded health care system, elective patients either arrive at a hospital specialist for assessment, or in a gate-keeper system, patients are referred to further treatment from a primary care physician (Hurst and Siciliani 2005). In the latter case, after assessing a written referral, the hospital specialist must decide which patients that meet whatever thresholds and add these patients to the waiting list.

Often thresholds are determined by clinical conditions like severity of condition, expected benefit, need, urgency, the decay rate of the disease, and the time already spent on the list (Hurst and Siciliani 2005). The tools developed might be more or less formalized, where more formalized systems often include ratings which assign a score to the need of each patient. Scores may be used for prioritizing, such that patients receiving more points should be treated earlier, and within a shorter maximum waiting time.

In Norway, two (of the four) health regions have carried through projects aimed at developing guidelines for the prioritization of patients, based on the criteria stated in the existing prioritization regulations. The medical guidelines cover 21 medical specialities. Based on descriptions of relevant medical conditions, a patient prioritization status is indicated by prescribing a maximum waiting time before treatment is to start. Some patients are not granted a maximum waiting time, indicating a condition with lower

[2] Dimakou et al (2008) study the impact of government targets on waiting times in the NHS. More specifically they analyze how the probability of admission of any given patient vary during the time they wait. They find that hazard rates vary over time and that peaks in them, high probability of admission, coincide with targets and change when targets change.

medical prioritization status. In Table 1 we present two examples from the medical guidelines.

Table 1: *Examples, medical guidelines*

| Patient group | Maximum waiting time (weeks) |
|---|---|
| Mb. Bekhterev | 8–16 |
| Long-lasting coughing | 26 |

From Table 1 we note that the descriptions of the medical diseases can be more or less precise (Mb. Bekhterev versus long-lasting coughing). Furthermore, the maximum waiting time can be more or less unambiguous (8–16 weeks versus 26 weeks).[3] Note also that the medical guidelines do not contain any International Classification of Disease-coding, which is necessary for tracking patients in official registers. However, with assistance from the medical profession, it is possible to map ICD-codes to the medical descriptions. The mapping allows a comparison of actual waiting times to the maximum waiting times prescribed in the medical guidelines. This way the medical guidelines can be used as a tool to measure and monitor prioritization in the health sector, e.g. analyse whether high priority patients actually have shorter waiting times than low priority patients, whether there are geographical differences in the prioritization practice, or how prioritization develop over time.

# 3. Monitoring prioritization – an example

In this section we use Norwegian in-patient data to demonstrate how medical guidelines can be used to monitor prioritization practice in the health care sector[4].

## 3.1 Institutional background

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; four from June 2007 when south and east were merged) regional health authorities. The regional health authorities have the responsibility for providing specialist health care to all patients within the region.[5] 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 in effect quite small compared the overall treatment activity, and

[3] One reason for this is that the assessment of a patient's condition includes an evaluation of the reduced quality of living if treatment is postponed. This clearly will depend on the individual patient's ability of handle pain. Hence, in some cases a clear cut maximum waiting time cannot be decided.

[4] In Askildsen, Holmås and Kaarbøe (2007) we use this method to analyse how a large hospital reform affected prioritization practice in the Norwegian hospital sector.

[5] See Hagen and Kaarbøe (2006) and Magnussen et al (2007) for more detailed descriptions of the Norwegian hospital sector and the 2002-reform where hospital ownership was transferred from the county councils to the central government.

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. However, relatively few patients seem to have opted for the possibility of receiving treatment outside of the hospitals' natural catchment areas (see Kjerstad and Kristiansen (2005) and Vrangbæk et al. (2007)).

According to administrative regulations, hospital patients may be categorized into one of the following categories:

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 hospitals must deliver health care services, it is patients in priority group two (elective with) that comprises the core health care supply of the public hospitals. 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 administrative regulations establish that upon referral, the assessment of a patient's condition must consider:

I. how serious is the condition (seriousness)
II. whether a suitable treatment exists that may improve the patient's condition (effect of treatment)
III. the cost-effectiveness of this treatment.

For each patient that is referred, all three criteria must be considered. Based on them, patients are divided into group 2 or 3, giving the patients the right to elective treatment «with» or «without» a maximum waiting time. For patients within group two, a finer grouping grants them an individual medically acceptable maximum waiting time before treatment is to take place. This maximum waiting time we use as a proxy for prioritization, in the sense that medical conditions which demand short waiting time are considered as diagnoses with high treatment priority, independent of other patient characteristics.

Patients receiving treatment at the public hospitals are either acute care patients, or they are elective patients referred to further treatment from a primary care physician (group 1–3). Thus, there is gate-keeper system regulating the access to planned treatment. The «Act on Patients Rights» and corresponding administrative regulations, in effect from 2001, determine in general terms the rule for vertical prioritization of referred elective patients. The allocation of prioritization status to elective patients is formally managed the following way. Upon receipt of a referral, the hospital has to consider within 30 days whether the patient belongs to group 2 or 3, or whether (s)he should not receive treatment at all. This decision is based on the description of the medical condition given by the primary care physician. Each patient is to be considered according to the priority regulations, implying an evaluation of seriousness, treatment potentials and cost-effectiveness, criteria I-III above. If the patient is considered to belong to group 2 (elective with), an individual maximum waiting time is given before treatment starts. 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.

There exist, however, no publicly endorsed guidelines outlining which medical conditions that give the right to elective treatment[6]. Still the physicians at the hospitals must decide on the individual treatment status, and allocate rights to treatment. In this paper we have taken departure in the medical guidelines developed by one of the Norwegian health authorities, Health Region West[7]. This region covers about 22 % of the population in Norway. The medical guidelines cover 21 medical specialities, and based on descriptions of possible medical conditions, patient prioritization status were indicated.[8].

## 3.2 Data

The empirical analysis makes use of individual in-patient data from the Norwegian Patient Register (NPR) over the period 2003–2006. From these individual level records we have information on waiting time and patient characteristics such as age, gender, and main and secondary diagnoses. However, not all observations are included in the analysis. First, we only focus on hospitalized surgical patients. Second, we only include the first hospital stay for each patient each year. Third, patients with waiting times longer than 2 years were dropped. Lastly, we drop patients with missing observations. After excluding these observations, we are left with a total of 313,946 surgical patients hospitalised at 54 different hospitals. By adding ICD10 codes to the medical guidelines we are able to merge individual patient information from NPR to information on corresponding maximum acceptable waiting time from the medical guidelines. However, to ensure that there is a one-to-one relationship between the medical guidelines and the IDC10-codes some patient stays had to be dropped. This follows because sometimes the same ICD10-code can be used to describe more than one medical condition, and these conditions may give different maximum waiting times. In addition, maximum waiting times are in some cases given with a relative large band (e.g. between 4 – 30 weeks) and these diagnoses are also dropped.

The next table compares the total number of patient stays and the sample of patients for whom we also have information on maximum waiting times (from the medical guidelines). We first notice that our sample is very large, consisting of about 46 percent of the total patient population (145,228 patients out of a total of 313,946). We further see that there are some differences between the sample and the patient population regarding the distribution of patients over ICD10 chapters.

[6] Directorate for Social and Health Affairs (SHDir) has initiated the project «Better prioritization in the hospital sector», considering medical conditions that should give patients treatment rights according to the prioritization regulations. This project is still ongoing (October 2008).

[7] 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 wary systematically among regions. However, a study done by Sveri (2006) suggested that capacity constraints where not taken into consideration when the maximum waiting times were set.

[8] We are grateful to Jacob Mosvold, 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 advice in use of the prioritization guidelines. See Askildsen, Holmås and Kaarbøe (2007) and Nordheim (2005) for further documentation.

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

| | All stays | | Sample | |
|---|---|---|---|---|
| Chapters in ICD-10 | Number of obs. | Percent | Number of obs. | Percent |
| Certain infectious and parasitic diseases (A00-B99) | 263 | 0.08 | 33 | 0.02 |
| Neoplasms (C00-D48) | 58,499 | 18.63 | 30,590 | 21.05 |
| Diseases of the blood (D50-D89) | 217 | 0.07 | 86 | 0.06 |
| Endocrine, nutritional and metabolic diseases (E00-E90) | 5,491 | 1.75 | 3,741 | 2.58 |
| Mental and behavioural disorders (F00-F99) | 519 | 0.17 | 2 | 0.00 |
| Diseases of the nervous system (G00-G99) | 5,066 | 1.61 | 1,446 | 1.00 |
| Diseases of the eye (H00-H59) | 8,596 | 2.74 | 4,764 | 3.28 |
| Diseases of the ear (H60-H95) | 3,367 | 1.07 | 2,370 | 1.63 |
| Diseases of the circulatory system (I00-I99) | 30,582 | 9.74 | 13,324 | 9.17 |
| Diseases of the respiratory system (J00-J99) | 24,655 | 7.85 | 19,639 | 13.52 |
| Diseases of the digestive system (K00-K93) | 26,859 | 8.56 | 10,129 | 6.97 |
| Diseases of the skin (L00-L99) | 2,920 | 0.93 | 34 | 0.02 |
| Diseases of the musculoskeletal system (M00-M99) | 61,811 | 19.69 | 32,636 | 22.47 |
| Diseases of the genitourinary system (N00-N99) | 43,765 | 13.94 | 16,835 | 11.59 |
| Pregnancy (O00-O99) | 7,777 | 2.48 | 1,642 | 1.13 |
| Certain conditions originating in the perinatal period (P00-P96) | 138 | 0.04 | 3 | 0.00 |
| Congenital malformations (Q00-Q99) | 7,420 | 2.36 | 1,358 | 0.93 |
| Symptoms, signs (R00-R99) | 2,933 | 0.93 | 479 | 0.33 |
| Injury, poisoning (S00-T98) | 18,472 | 5.88 | 6,097 | 4.20 |
| External causes (V0n-Y98) | 5 | 0.00 | 0 | 0.00 |
| Factors influencing health status (Z00-Z99) | 4,591 | 1.46 | 20 | 0.01 |
| Number of observations | 313,946 | 100.00 | 145,228 | 100,00 |

However, despite some differences, the sample seems to be a fairly representative sample of the total population of hospitalized surgical patients in Norway. Lastly, for some ICD10 chapters there are few observations and we therefore drop patients within the following 7 chapters: A00-B99, D50-D89, F00-F99, L00-L99, P00-P96, V0n-Y98 and

Z00-Z99. Our final sample than consists of 145,050 patients, and we allocate these patients onto four groups according to the recommended maximum waiting time in the medical guidelines. This categorising implies that patients in prioritization group 1 (patients with maximum waiting time of 0 – 4 weeks) have the highest priority, while patients in group 4 (patients with maximum waiting time higher than 27 weeks) have lowest priority. From Table 3 we see that the majority of the patients fall into prioritization group 1 to 3, implying that these patients should receive treatment within 26 weeks.

Table 3: *The prioritization groups*

| Prioritization group | Number of patients | Recommended maximum waiting time |
|---|---|---|
| 1 | 20,861 | 0 – 4 weeks |
| 2 | 54,040 | 5 – 12 weeks |
| 3 | 56,469 | 13 – 26 weeks |
| 4 | 13,680 | More than 27 weeks |

Table 4 shows how the patients in the sample are allocated among the prioritization groups within the ICD10-chapters included in the analysis.

Table 4: *The number of patients allocated to the different prioritization groups according to the ICD10-chapters. The sample analysed.*

| Chapter ICD-10 | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| Neoplasms (C00-D48) | 13,420 | 10,107 | 7,096 | - |
| Endocrine, nutritional and metabolic diseases (E00-E90) | 1,285 | 2,455 | - | - |
| Diseases of the nervous system (G00-G99) | 1,262 | 182 | - | - |
| Diseases of the eye (H00-H59) | - | - | - | 4,764 |
| Diseases of the ear (H60-H95) | - | 1,233 | - | 1,137 |
| Diseases of the circulatory system (I00-I99) | 2,719 | 7,234 | 2,508 | 862 |
| Diseases of the respiratory system (J00-J99) | 4 | 19,379 | 21 | 235 |
| Diseases of the digestive system (K00-K93) | 39 | 6,412 | 3,228 | 450 |
| Diseases of the musculoskeletal system (M00-M99) | - | 609 | 25,812 | 6,215 |
| Diseases of the genitourinary system (N00-N99) | 1,523 | 5,368 | 9,943 | - |
| Pregnancy (O00-O99) | 598 | 122 | 922 | - |
| Congenital malformations (Q00-Q99) | - | 880 | 450 | - |
| Symptoms, signs (R00-R99) | 11 | 59 | 407 | 2 |
| Injury, poisoning (S00-T98) | - | - | 6,082 | 15 |
| Number of observations | 20,861 | 54,040 | 56,469 | 13,680 |

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 four experience the longest waiting times. If we observe that waiting times increase as we move from highest (1) to lowest (4) prioritization group, we will conclude that the health enterprises prioritize in relative terms according to the administrative regulations of prioritization.

In table 5 we show average waiting times for the patients in the four prioritization groups. We see that patients in priority group 1 wait on average 68 days, and that waiting time for groups 2, 3 and 4 are increasing in lower priority status. Furthermore we see that waiting times for groups 1 and 2 are higher than the medically accepted maximum waiting time. For groups 3 and 4 average waiting time is on the other hand shorter than recommended, and in particular for group 4 there is considerable deviation. The differences in average waiting times therefore indicate some degree of over-prioritization for patients of lower priority relative to patients of higher priority. Looking at the proportion of patients waiting longer than the maximum acceptable waiting time reinforces this impression. As many as 45 percent of the patients in priority group 1 experience excessive waiting times, while the corresponding number is only 10 percent for patients in priority group 4.

Table 5: *Average waiting time in days for priority groups, 2003–2006*

| | Average waiting time (standard deviance) | Proportion waiting longer than the maximum acceptable waiting time | Maximum acceptable waiting days |
|---|---|---|---|
| Priority group 1 | 68 (108) | 0.45 | 28 |
| Priority group 2 | 109 (122) | 0.40 | 84 |
| Priority group 3 | 153 (134) | 0.30 | 182 |
| Priority group 4 | 169 (142) | 0.10 | 365 |

## 3.3 Empirical analysis

The descriptive statistics indicate an over-prioritization of low priority patients relative to patients of higher priority. However, because patients in high priority groups suffer from more severe conditions than patients in low priority groups, just looking at descriptive statistics will probably lead us to underestimate the degree of over-prioritization. Therefore, correcting for case-mix seems important and to do this we apply two simple econometric models. In the first model we focus on individual waiting times, estimating a fixed effect model where we control for patient case mix and hospital, municipality and time fixed effects. Using this specification we control for observed and unobserved time-invariant hospital characteristics that might be correlated with the prioritization decision as well as with waiting time. By including municipality and year dummies we also control for municipality specific time constant effects (like distance to the hospital) and common time trends in the prioritization practice. In the second model we focus on the probability that patients wait longer than the recommended maximum waiting time. We estimate a probit model where we control for patient case mix and hospital, municipality and time characteristics by including dummy variables for hospitals, municipalities and years in the regression. A problem with unconditional fixed effect probit models is that the estimated effects might be severely biased. However, Monte Carlo evidence (see e.g. Greene 2002, Arellano and Honore 2001) suggests that this bias drops off rapidly as the number of observation per group increases above three and is substantially reduced even at 20 observations per group. Having an average of 2480 patients per hospital, we assume that this bias is insignificant in our analysis.

What should we expect given that actual prioritization is consistent with the medical guidelines? Obviously a necessary condition for correct prioritization is that patients that are given higher prioritization wait shorter than lower prioritized patients, i.e., $wt^i \leq wt^j$, $i = 1,2,3$, $j = i+1$, where $wt^i$ ($wt^j$) denotes the waiting time of prioritization group $i$ ($j$). In addition $wt^j \leq wt^{i,max}$, where $wt^{i,max}$ denotes the maximal waiting time for group $i$. A similar condition holds for group $j$. In the probit model correct prioritization implies that no patient waits longer than the maximum waiting time. A weaker condition is that the probability of excessive wait is higher the lower prioritized the group is.

The results from the analyses of waiting time (model 1) and the probability of waiting longer than what is medically recommended (model 2, marginal effects) are presented in Table 6. We start by looking at the effect of some of the individual background

variables, which we think are of interest on its own merit in this context. In this discussion we focus primarily on the results from model 1. We see that older and younger patients wait shorter than the reference group (age 30–66). The effect is largest for the youngest (0 – 14) and the oldest age group (older than 80) with estimated average waiting time of about 27.5 and 24.5 days shorter than the reference group, respectively. Also notice that waiting times decrease in number of secondary diagnoses. This finding might be due to seriousness of condition, and if so, in accordance with prioritization guidelines. Somewhat surprisingly we find, after controlling for case-mix, that males have about 4 days longer waiting times than females.

Turning to the effect of hospital characteristics, our results indicate that waiting times are longer at larger hospitals (measured as number of beds) and that waiting times decrease in number of employees. However, the effects are relatively small and due to potential endogeneity problems the results should be interpreted with some caution[9].

We find that waiting time is reduced over time. This may be due to larger budgets to the hospital sector, higher productivity, or other factors that affect decisions to put patients in line for treatment.

Turning to the main question, which is whether patients who according to the medical guidelines should be given the highest priority experience the shortest waiting time, we see that the regression results are in line with the descriptive findings reported in Table 5. In the regression models we use prioritization group 1 as the reference group. From the estimates (model 1) we see that waiting time for patients in group 2, 3 and 4 are increasing in lower priority status. Compared to the means presented in Table 5, the differences in waiting times between prioritization groups are smaller (as expected), indicating an even larger over-prioritization of patients suffering from the least severe conditions relative to patients of higher priority than was suggested by the descriptive statistics.

The results from model 2 seem to confirm this result. We see that the likelihood of excessive waiting times (compared to the medical recommendations) is about 25 percent lower for patients in group 2 than for patients in group 1. The corresponding numbers for patients in group 3 and 4 are about 30 and 34 percent, respectively. If prioritization practice were in line with the medical guidelines, we would expect the probability for excessive waiting for priority group 1 to be lower, or equal, to the equivalent probability for the lower priority groups. As our results are to the contrary, we conclude that patients suffering from the most severe conditions wait longer than they should and thereby are under-prioritized in the Norwegian health care sector relative to patients of lower priority.

[9] Excluding these variables from the regressions do only marginally affect other results.

Table 6: *Regression results: waiting time (model 1) and probability that patients wait longer than the recommended maximum waiting time, marginal effects (model 2).*

| | Model 1 | Model 2 |
|---|---|---|
| *Individual characteristics:* | | |
| Male | 4.095*** (0.727) | 0.014*** (0.003) |
| DRG-weight | -2.606*** (0.251) | -0.007*** (0.001) |
| Number secondary diagnoses | -0.742*** (0.271) | -0.003*** (0.001) |
| Age (Reference category: age 30–66): | | |
| Age 80 + | -24.503*** (1.140) | -0.080*** (0.005) |
| Age 67–80 | -13.127*** (0.849) | -0.046*** (0.004) |
| Age 15–29 | -4.848*** (1.516) | -0.031*** (0.006) |
| Age 0–14 | -27.495*** (1.508) | -0.099*** (0.005) |
| Prioritisation groups (Reference category: group 1): | | |
| Group 2 | 5.708*** (1.260) | -0.250*** (0.005) |
| Group 3 | 54.989*** (1.346) | -0.304*** (0.006) |
| Group 4 | 49.599*** (2.056) | -0.335*** (0.004) |
| Main chapters ICD10 (Reference category: Diseases of the musculoskeletal system (M00-M99)): | | |
| Neoplasms (C00-D48) | -87.115*** (1.397) | -0.336*** (0.005) |
| Endocrine, nutritional and metabolic diseases (E00-E90) | 0.034 (2.426) | 0.087*** (0.011) |
| Diseases of the nervous system (G00-G99) | 36.853*** (3.656) | 0.142*** (0.019) |
| Diseases of the eye (H00-H59) | -26.633*** (2.563) | - |
| Diseases of the ear (H60-H95) | 86.364*** (2.818) | 0.222*** (0.015) |
| Diseases of the circulatory system (I00-I99) | -55.405*** (1.593) | -0.152*** (0.006) |
| Diseases of the respiratory system (J00-J99) | 11.808*** (1.943) | 0.143*** (0.009) |
| Diseases of the digestive system (K00-K93) | -33.482*** (1.622) | -0.061*** (0.007) |
| Diseases of the genitourinary system (N00-N99) | -26.660*** (1.410) | -0.077*** (0.006) |
| Pregnancy (O00-O99) | -81.602*** (3.327) | -0.211*** (0.008) |
| Congenital malformations (Q00-Q99) | -6.162* (3.726) | -0.006 (0.015) |
| Symptoms, signs (R00-R99) | 2.353 (5.610) | 0.001 (0.015) |
| Injury, poisoning (S00-T98) | -9.570*** (1.732) | -0.039*** (0.007) |

| | Model 1 | Model 2 |
|---|---|---|
| *Hospital characteristics:* | | |
| Number of beds/100 | 5.261*** (1.232) | -0.013*** (0.005) |
| Number of employees/100 | -0.399** (0.202) | 0.001 (0.001) |
| *Year (Reference category: 2003):* | | |
| 2004 | -5.053*** (0.950) | -0.016*** (0.004) |
| 2005 | -6.443*** (0.903) | -0.018*** (0.004) |
| 2006 | -5.668*** (0.874) | -0.005 (0.003) |
| Constant term | 125.497*** (6.153) | - |
| Number of observations | 145,050 | 134,069 |
| Number of hospitals | 54 | 54 |
| Hospital dummies | Yes | Yes |
| Municipality dummies | Yes | Yes |
| $R^2$/Pseudo $R^2$ | 0.144 | 0.118 |

## 4. Concluding remarks.

The purpose of this paper is to illustrate how medical guidelines can be used as a method for monitoring prioritization in a public health care sector. In such systems, patients are not rationed by price. Consequently, demand exceeds supply, which results in waiting lists. Often governments in countries with public health care systems have developed expectedly welfare improving prioritization procedures. However, to our knowledge less attention has been devoted to developing methods that may inform on the actual prioritization of patients as compared to prevailing administrative regulations.

The method we propose is to use medical guidelines and allocate ICD-codes to the medical descriptions, which enables us to compare actual waiting times to the recommended maximum waiting times. Using medical guidelines as a tool for monitoring prioritization implies that length of medically accepted waiting time signals prioritization. Furthermore, the method is relatively inexpensive in use, as it uses data from already existing data sources.

To illustrate how the methods work, we provide an application, based on data from the Norwegian patient register (NPR) covering inpatient treatment in all major (public) hospitals in Norway. Specifically we examine whether patients belonging to different prioritization groups ordered by medically maximum acceptable waiting times wait shorter or longer than recommended. Our results indicate that patients suffering from the most severe conditions are under-prioritized in the Norwegian health care sector relative to patients of higher priority. There are several possible explanations for this prioritization practice.

First, there may have been too much focus on bringing down waiting times[10]. Health authorities and enterprises may have been too much concerned with this issue, thus putting effort into reducing average waiting times for each hospital unit. Objectives concerning reduction in waiting time are more easily met by focussing on patient groups that have at the outset long waiting times, since it is easer to make quantitatively larger gains in registered waiting times among these patients.

Second, 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 the effect of the finance system.

On the other hand, our result concerning prioritization practices may be due to improvement in treatment potentials for lower prioritized patients without affecting highly prioritized patients negatively. For lower prioritized patients, treatment capacity may be easier to provide, and treatment may also have become relatively less expensive for these groups. For highly prioritized patients, which often suffers form more serious illnesses, changes on treatment technology and possibilities are likely to occur at a slower pace. Thus, there may be relevant factors which we have not been able to control for in this study.

In further work emphasis will be put on refining the guidelines and grouping of patients. Next we will include more external factors that are of importance for hospital behaviour, not least variables related to their payment systems.

[10] Waiting times have in general been reduced over time, which will of course be considered as desirable. This was also a political objective during the period in question.

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