UNIVERSITY OF OSLO

HEALTH ECONOMICS RESEARCH PROGRAMME

Measuring the Quality of Hospital Services

Hospital Specific Factors and Individual Evaluations

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The Ragnar Frisch Centre for Economic Research and HERO

Working Paper 2005: 10

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Health Economics Research Programme at the University of Oslo
Financial support from The Research Council of Norway is acknowledged.
ISSN 1501-9071, ISBN 82-7756-155-05

Preface

This thesis was written while I was working with a project headed by Senior Research Fellow Sverre Kittelsen at the Frisch Centre for Economic Research. It is a joint project with Jon Magnussen at SINTEF UNIMED NIS Health care research, and is part of HERO – Health Economic Research Programme at the University of Olso. The title of the project is "Economics of scope in health services production – Evaluation of regional health cooperation". It is financed by the Department of Health.

I especially want to thank Sverre Kittelsen, who was also my supervisor, for constructive and critical remarks and suggestions which proved to be important and helpful guidelines throughout my work on this thesis.

I thank Øyvind Christensen, Daniel Nguyen and Karl-Gerhard Hem at SINTEF Health in Oslo for valuable help with providing the necessary data on hospitals' readmission rates and waiting time, the two hospital specific factors used in the analysis.

Ingeborg Strømseng Sjetne and Øyvind Andresen Bjertnæs at the Norwegian Knowledge Centre for Health Services provided data from the patient surveys used here as indicators of hospital service quality as experienced by patients admitted to somatic hospitals in Norway.

The Frisch Centre provided me with a workplace and assistance with the statistical packages I needed. I am also grateful to Erik Hernæs for valuable comments and help and to Liv Hernæs Kvanvig for grammatical corrections.

I also want to say a special thanks to Simen Markussen for his help with formulating the problem for the thesis, as well as with comments, suggestions and moral support at all times.

This thesis is dedicated to Hennie Hernæs Kvanvig who was born 12 August 2005.

Summary

Is an increase in the quality of health services, as perceived by the hospital, appreciated by the consumers? If so, patients should respond positively to an increase in the quality of hospital services. Using two indicators to capture the quality of hospital services I investigate the relationship between these indicators and inpatients' experiences.

The health sector has increased substantially in most OECD countries over the last few decades. In Norway, total health care expenditures as a percentage share of the GDP, has grown from 2.9 % in 1960 to 8.7 % in 2002.

In 2002 the state took over ownership of the Norwegian hospital sector and organized it through five regional semiautonomous companies. The motivation behind this was more efficient use of hospital resources, equal access despite geographical differences, and a higher quality of health services.

Cost efficiency, measured as total activity relative to total costs, decreased during the 1990s. Part of the decrease can be explained by increased labour costs. It is often assumed that decreasing costs lead to lower quality. If this is the case in the health sector, one would expect to see a higher level of quality when costs per patient increase.

Health services are paid for by taxpayers who are also the users of these services. For this reason, and especially since costs have increased, they should be able to evaluate the quality of the services they receive. This leads to an important question: What aspects of quality are important to consumers of health services? Do quality indicators, such as readmission rates and waiting time, capture the quality that consumers demand? This thesis is an attempt to answer these questions.

The method I use is standard OLS. I also investigate possible cross-effects between hospitals' readmission rates and age and look at the effect of a one standard deviation change in four of the explanatory variables. I also consider the use of an alternative estimation method that allows for stronger correlation between patients within hospitals but assumes independence between patients at different hospitals. The estimations are done using the statistical package StataSE 8.

Using a simple regression model I have investigated the relationship between patients' experiences during a hospital admission and the readmission rate and mean waiting time at the hospital they were admitted to. The data on these two hospital specific variables

were provided by SINTEF Health who runs the Norwegian Patient Register. The register is owned by the Directorate of Health and Social Affairs.

The data on patient satisfaction with hospital services were taken from an anonymous survey among patients admitted to somatic hospitals. They received the surveys two to three weeks after discharge. The response rate was approximately 50 %. The questions in the survey concerned issues such as health personnel's ability to convey and receive relevant information, as well as provide care, treatment, and pain relief. There were also questions on patients' impression of hospital equipment, general standard, and facilities and sanitary conditions.

The survey consisted of 50 questions that I grouped into seven category variables, according to the type of service the different questions concerned. These categories were *content*, *info*, *info2*, *facisani*, *care*, *org*, and *improve*. Patients were also asked about their gender, age, health status, education level, number of admissions last two years, and whether their first language was Scandinavian. I was thus able to control for these characteristics.

My main empirical finding is that hospitals' readmission rates have a negative and significant effect on inpatients' experiences. Patients admitted to hospitals with low readmission rates are more content with the care, treatment, and information they receive from hospital personnel. They are also more content with hospital facilities and sanitary conditions and organization of hospital staff.

The results for waiting time were more ambiguous. Patients' impression of hospitals' facilities and sanitary conditions was better at hospitals with longer waiting time. It may be that other quality aspects are better at these hospitals, and that these other aspects are more important for patient satisfaction.

Patients' age, health status, number of previous admissions, and education level significantly affected their satisfaction with hospital services. The age effect was positive but decreasing. Investigating the cross-effect between age and the readmission rate showed that younger patients respond more negatively to a given readmission rate than older patients. Patient satisfaction decreased with the number of admissions and with patients' education level but increased with patients' health status.

Patient characteristics explained the main share of the variation in patients' experiences. Including dummies for hospitals increased the share of variation explained indicating that there are hospital specific factors present that affect patient satisfaction. Of this increase readmissions and waiting time explained a small part. More precise measures of hospital level quality may be needed in order to capture more of this variation.

Contents

1. Introduction

Is an increase in the quality of health services, as perceived by the hospital, appreciated by the consumers? If so, patients should respond positively to an increase in the quality of hospital services. Using two indicators to capture the quality of health services I investigate the relationship between these indicators and inpatients' experiences.[1]

The health sector has increased substantially in most OECD[2] countries over the last few decades (OECD 2005). In Norway, total health care expenditures as a percentage share of the GDP, has grown from 2.9 % in 1960 (NOU 2003:1) to 8.7 % in 2002 (OECD 2005).

In 2002 the state took over ownership of the Norwegian hospital sector and organized it through five regional semiautonomous companies.[3] The motivation behind this was a more efficient use of hospital resources, equal access despite geographical differences, and a higher quality of health services (Stortingsproposisjon nr. 1, 2004).

Cost efficiency, measured as total activity relative to total costs, decreased during the 1990s. Part of the decrease can be explained by increased labour costs (NOU 2003:1). It is often assumed that decreasing costs lead to lower quality. If this is the case in the health sector, one would expect to see a higher level of quality when costs per patient increase.

Health services are paid for by taxpayers who are also the users of these services. For this reason, and especially since costs have increased, they should be able to evaluate the quality of the services they receive. This leads to an important question: What aspects of quality are important to consumers of health services? Do quality indicators, such as readmission rates and waiting time, capture the quality that consumers demand? I will try to answer these questions in the following sections.

The thesis is organized as follows. In section 2 I define quality and present the health care triad with the three parties' different demands concerning health service quality. I then present the patient survey providing the basis for the data on inpatients' experiences and the model used to investigate the relationship between patients' experiences and the two indicators of hospital service quality.[4]

[1] The inpatients in my sample are patients spending two or more nights in hospital.
[2] Organization for Economic Co-operation and Development
[3] Regionale helseforetak (RHF) in Norwegian.
[4] The survey is available on request.

In section 3 the eight national health quality indicators are presented. Section 4 contains a discussion of the two quality indicators, readmission rates and waiting time, and how I expect these to influence the patients' experiences that are used in the empirical analysis.

Section 5 contains a presentation and discussion of the results from an OLS regression on the model presented in section 2. I also look at the effect of a one standard deviation change in four of the explanatory variables. The last part of this section investigates the cross-effect between age and the readmission rate.

There has been some debate as to whether the patient register in Norway should be established as a register that allows for personal identification. I give a short summary of this debate in section 6.

The last section is a summary of the main empirical findings as well as a discussion of the use of readmission rates as indicators of hospital service quality.

2. The quality of health services

2.1 Defining quality

According to Crosby, quality is coherence with demands (Kirke-, utdannings- og forskningsdepartementet, 1998). Producers of health services must adhere to demands from consumers, as well as from the government who pays the costs. Producers may have demands of their own regarding the type of services they wish to produce, e.g. whether they wish to specialize in certain services. Consumers may have differing preferences. However, good sanitary conditions, high building and equipment standards, and attention and relevant information from health personnel are some quality aspects that are, in general, appreciated.

I find it convenient to distinguish between medical and service quality aspects of health services. Donabedian (1966) defines quality of medical care as "a reflection of values and goals current in the medical care system and in the larger society of which it is a part" (p. 167). This is the definition I will use. Consumers often lack relevant information needed to assess medical quality. What they observe is how well they were informed and treated during an admission and the effect of the treatment on their well-being. They also observe the waiting time, i.e. the time from a referral made by their general practitioner to a hospital where they are to receive treatment. These are the aspects I refer to when I use the term service quality.

2.2 Operationalizing the definition; coherence with whose demands?

A health market can be described by a triad consisting of the payer/purchaser, the provider/producer, and the consumer. The idea for this triad is taken from Kornai and Eggleston (2001). The three parties in this triad have different demands for the health services in question.

Accessibility and efficacy of treatments are important for consumers of health services. A priori, consumers want to know that in case of illness they will receive help. If they do get sick they want the best possible treatment. Consumers' demands also have a stochastic element rising from their subjective preferences. This element varies according to

age, gender, and health status. It can also vary according to geographic and ethnic differences or social status.

The Norwegian government has stated demands for the health services that are produced in the public health sector.[5] Its three goals are efficient use of resources, high quality care, and equal access to health resources despite geographical differences (NOU 2003:1).

Do hospitals have an interest in treating patients as such and keeping a high level of quality? If they are altruistic, as is sometimes assumed in models on hospitals' and physicians' behaviour, their interests coincide with that of the government (Chalkley and Malcomson, 2000, Biørn et al., 2003). However, hospitals also have interests of their own that may or may not conflict with the purchaser's demands. Chalkley and Malcomson (2000) give a thorough description of how different payment systems affect patient turnover and the level of quality on hospital services.

When defining the quality of hospital services, the provider-purchaser-consumer triad must be taken into account. Whose demands should be adhered to when defining what the level of quality should be? The government's demand for high quality is, one must assume, with regard to the benefit of the patient. There are, however, at least two potential sources of conflict. One is that the government may have a different view of what quality is from that of the patients. This is related to what Slagsvold (1997) calls quasi-quality and is elaborated on in part 6.1.6. The other is that the government cannot directly observe the level of quality. It must rely on second-hand information.

2.3 Patients' experiences

The Foundation for Health Services Research[6] (now part of the Norwegian Knowledge Centre for the Health Services[7]) performed surveys among patients admitted to hospital in the five Regional Health Authorities (RHA) in 2002 (Northern, Central, and Western RHA) and 2003 (Eastern and Southern RHA).[8] Patients were asked to evaluate the effect of the treatment, the care and information given, and building and equipment standard, as well as health staff's skills. They are thus explicitly asked to assess the outcome of the treatment, the process leading up to it, and the structure it was given in. Patients were asked to rate the

[5] See for instance St.prp. nr. 1 by The Ministry of Health and Care Services (Helse- og omsorgsdepartementet).
[6] Stiftelse for helsetjenesteforskning (HELTEF) in Norwegian
[7] Nasjonalt kunnskapssenter for helsetjenesten in Norwegian
[8] They are called regionale helseforetak in Norwegian. The term semiautonomous companies used in the introduction is closer to the Norwegian term.

hospital on each of the questions from 1 to 10, 10 being the highest possible score. The survey contains important information both for the hospital and for the government concerning patients' demands.

Consumers have a direct utility of having good health. Following Grossman (2000), I consider health a stock that one invests in. By spending time on activities such as exercise and recreation, or money on medicine, one's level of health increases. For a given level of health, consumers are able to extract a "flow" of utility, since their health determines their ability to work, recreate, exercise, etc. This ability to transform health into utility is commonly thought to depend on individual factors such as age, gender, social status, and level of education (Grossman 2000). The relation between health and utility can be expressed by a simple utility function:

$$(1) \qquad U_i = u\left(H_i, M_i\right)$$

Consumers' utility (U) is a function of their health stock (H) and other goods that the consumers have preferences for (M). I use M for money to indicate that consumers obtain these goods by paying for them. An illness is experienced as a decrease in one's health stock and thus in one's utility level. I assume there to be a time cost associated with loss of health as less time is left for other activities. Being ill and waiting for treatment is therefore a negative experience in itself. Assuming that patients cannot work when their health deteriorates, being ill is also associated with a temporary loss of income with less money available to buy other goods.

The costs associated with illness will increase if patients have to wait to receive treatment or if they have to be readmitted after ended treatment. The two indicators waiting time and readmissions may therefore affect patients' utility. An increase in the waiting time or in the readmission rate may be thought of as causing a reduction in the utility level.

This utility function is the basis for the model used in this thesis. Patients' assessment of health service quality, expressed in the patient surveys, is used as an indicator of the utility level generated from the health services they receive. Patients' experiences are expressed by their rating of the hospitals on a scale of one to ten. According to the above assumptions hospitals with shorter waiting time and lower readmission rates are preferred and thus rated higher by the respondents to the patient surveys.

2.4 The model

My hypothesis is that patients' experiences are affected by hospital specific factors. The basic regression model I use for investigating this relationship is:

(2)

$$y = \alpha + \beta_1 age + \beta_2 agesq + \beta_3 gender + \beta_4 health + \beta_5 adm + \beta_6 edu + \beta_7 notscand + \lambda_1 readm + \lambda_2 waiting + \varepsilon$$

The dependent variable, *y*, in equation (2) represents patients' experiences. These experiences are captured in an anonymous survey conducted among patients after a hospital stay. The survey comprises questions on patients' age, gender, perception of their own health status, their number of admissions the last two years, their level of higher education, and whether they have Scandinavian as their first language. Options for admissions are 1, 2, 3-5, 6-10, or more than 10 times the last two years. The variable takes the value 1 for one admission, 2 for two admissions, 3 for three to five admissions, 4 for six to ten admissions, and 5 for ten or more admissions last two years. For health status the options were excellent, very good, good, quite good, and bad. These are given the values 5, 4, 3, 2, and 1, respectively. These are the control variables for patient characteristic. The explanatory variable for age squared (*agesq*) captures changes in the age effect, if such changes are present.

The two variables *readm* and *waiting* are the hospitals' readmission rates and mean waiting time. These variables are measured at hospital level not at an individual level, as are the patient characteristics. Using a multilevel model one would be able to incorporate the level difference between patient characteristics and the two hospital specific factors.[9] I have here used a single level approach. I am aware that the results from the OLS regression may therefore be inefficient. This is further elaborated on in part 5.1 under the discussion of the OLS results.

Returning to the simple model presented in equation (2) the coefficients for the two hospital specific variables, λ_1 and λ_2, should be significantly different from zero if my hypothesis is correct. Using an extended version of the basic regression model I also investigate the cross-effect between age and readmissions. The results from the cross-effects analysis are presented in part 5.7.

[9] Rice and Jones (1997) may serve as an introduction to multilevel models in health economics.

Donabedian (1966) distinguishes between outcome, process, and structure when discussing measurements for the medical quality of care. Outcome refers to the recovery or survival of a patient. Process refers to the process of care or treatment given to the patient. The structure is the setting patients are in when receiving treatment. Buildings and equipment as well as administration and staff qualifications are part of the structure.

From an economic perspective the process and structure can be viewed as means to a successful outcome. They are not necessarily interesting in themselves and therefore not the subject of investigation. The focus is on the outcome, e.g. the survival of the patient. This does not mean that the structure and the process are not interesting as hospital equipment and health personnel's qualifications are important determinants for a successful outcome. One reason for the emphasis on outcome is that it is often easier to measure.

Patients, however, may have an interest in being treated at a hospital with high quality both when it comes to hospital buildings and equipment and staff's qualifications. It may increase their sense of trust in the hospital as well as their well-being. Patients can therefore value the quality of the structure and the process as such even if this is not taken into account from an economic point of view.

The hospital may also have an interest in patients having trust in them, especially when patients can freely choose which hospital they want to be treated at. This gives hospitals incentives to increase the level of quality on hospital services even if this increase comes at a cost, assuming that producing high quality services are more costly. Hospitals' interests are then not purely economic; they are also concerned with their reputation which depends on the level of quality on the services they produce.

3. Measuring quality

According to Erlandsen et al. (1996), quality is an attribute which is hard to define and measure. However, this does not mean that it is impossible, only that one must take these difficulties into account. The government aims both for cost efficiency and high quality. High quality may come at a cost, e.g. if more staff and resources is needed for a higher level of quality to be achieved. When the government sets a budget for the health sector, it must take this trade-off into account.

3.1 Why do we need quality indicators?

I use the term indicator to denote an approximation to a variable that is not directly observable and therefore hard to measure. A quality indicator is a proxy for one or several quality aspects that are difficult to measure. The validity of an indicator depends on how well it captures the quality aspects it is meant to capture. Mortality and readmission rates have been used as indicators for the medical quality of treatments given at previous admissions. This rests on an assumption that the risks of the two adverse outcomes, death or readmission, can be reduced if the patient were given better care. I do not know of previous use of waiting time as a quality indicator in itself. I use it here as an indicator of accessibility to health services. Waiting involves a time cost for the patient and may affect the outcome of the treatment. This is elaborated on in the discussion of waiting time as quality indicator in Part 3.

3.2 The National Health Quality Indicators

The Directorate for Health and Social Affairs (SHD) has formulated eight indicators for assessing the quality of health services in Norway. These indicators present different and interesting aspects of the Norwegian health services. To some extent they reflect aspects of hospital service quality that are important from the government's point of view. They are not stated as telling the full story about quality of hospital services but are meant as guidelines for patients when choosing which hospital they want to receive treatment at. The table on the next page summarizes the main characteristics of each indicator. The main reference for this

table and the following discussion is the Directorate's presentation of the indicators, available at their web page.[10]

Table 1: Summary of the National Health Quality Indicators

Quality indicator	Definition	Data (start registration)	What it measures, or why it is a Q.I.	Remarks
1. Epicrise	Summary of patients' medical history, should be sent to patient's GP within 7 days after discharge	Only inpatients (01.04.03)	Communication between hospital and other health care services	
2. Corridor patients	Number of patients in bed in corridor, living room, bathroom, etc, at 7 am.	Each unit counts each day, all year (01.04.03)	Hospitals' ability to give proper care to patients	Registration has been limited to one week per year. Uncertain data.
3. Frequency of Caesareans	Deliveries by Caesareans in total. Also elective and non-elective separately.	(01.05.04)	Great variations between hospitals and possibility for complications for mother call for closer inspection.	Variances may be caused by patient mix and characteristics
4. Waiting time before operation for fracture of femur	Patients over 65 years with fracture of femur operated on within 48 hours	Only non-elective patients (01.04.03)	It occurs frequently among and has long-lasting consequences for the elderly.	Other illnesses or patient characteristics may also give postponement
5. Waiting time before operation for colorectal cancer	Median and maximum w.t. for elective patients before first treatment	Only elective patients (01.05.04)	Most frequent neoplasm. Indicates accessibility	
6. Frequency of hospital infections	Number of infections at given point in time relative to the number of inpatients	(04.06.03)	Infections cause complications and increase costs	Low frequency gives imprecise measure, vulnerable to differences in registration practice
7. Cancellations of scheduled operations	Share of patients not operated on the day they are scheduled for	(01.05.04)	Negative experience for patient. Demands extra resources	Can be caused by high number of non-elective patients
8. Individual plan	Patients with right to individual plan that have this as share of all those with this right	(01.05.04)	Assures coordinated health care for those in long-term care that need a long-lasting plan	

[10] http://www.shdir.no/portal/page?_pageid=134,67665&_dad=portal&_schema=PORTAL&_piref134_76551_134_67665_67665.artSectionId=545&_piref134_76551_134_67665_67665.articleId=14568. Last read on 15 August 2005. No English version was available at this time.

1. Epicrise

When a patient has been admitted to a hospital an epicrise should be sent to the health personnel responsible for the patient's follow-up within seven days. It is measured as the share sent out within seven days. As such it is considered a better measure for the degree of communication between the hospital and the patients' general practitioner than a measure of the quality of the care the patient receives when hospitalized.

2. Corridor patients

Being placed in the corridor instead of having the privacy of a room is considered very unfortunate for a patient and should be used as a last resort. A low share of corridor patients is therefore an interesting measure of the quality a hospital is able to give patients. Registration has been conducted one or two weeks per year by counting patients placed on the corridor. Data are therefore highly sensitive to the frequency of corridor patients in this particular week. Improvements in data are needed for this to be a reliable quality indicator.

3. Caesarean section

A surgical delivery of the baby may cause complications for the mother as well as increase the probability of a surgical delivery at the next birth. The use of caesarean sections varies greatly among hospitals and is one reason for the choice of it as quality indicator. Discovering the reasons for these variations can provide the insight needed to reduce the frequency of surgical deliveries of babies. There are some indications that the frequency has increased over the last few years causing some concern in the health sector.[11]

4. Waiting time before operation for fracture of thighbone

This kind of fracture occurs quite frequently among elderly people. As well as being painful it may reduce their ability to function in everyday life or even their remaining life span. Including only patients over 65 years the indicator captures to what extent this age group is prioritized in the health sector.

5. Waiting time before operations for colorectal cancer

This is the most common form of cancer in Norway for both women and men and is on the rise in all of Northern Europe. The indicator is chosen in order to say something about

[11] http://www.aftenposten.no/helse/article956847.ece

accessibility for patients waiting for an operation where the waiting time may affect the outcome of the operation. Waiting is both painful and difficult for the patient, underlining the importance of this quality indicator.

6. Hospital infections

Prevalence of hospital infections depends to a large extent on the well-being of a patient. Factors such as severity of illness and age should therefore be controlled for. This is, at least partially, possible but the prevalence of these infections in Norwegian hospitals is very low. Data are therefore sensitive to measurement errors and differences in registration practices.

7. Cancellation of scheduled operations

Cancellations of operations are defined as the share of operations that are not performed the day they were scheduled for. It is an interesting indicator for assessing the use of resources and organization of hospital personnel.

8. Individual plan

Patients undergoing long-lasting treatment are entitled to an individual plan. Patients' needs as to the kind and amount of resources needed, coordination between different units of the health sector involved, etc, are included in this plan. The responsibility lies with the institution the patient is admitted to. As indicator it captures how well these patients are taken care of and to what degree legislation is followed.

3.3 Why these indicators cannot be used here

It would be interesting to use each of these indicators in an analysis where the relationship between them and patients' experiences is investigated. Unfortunately, my data on patients' experiences are from the end of 2002 and the beginning of 2003. The earliest registration of data on the national health quality indicators started 1 April 2003. In order to run a cross-section analysis, as I do here, one needs data from the same time periods. Since the data on the national health quality indicators are from a later point in time I could not match them with the available data on patients' experiences. The two quality indicators I use in this thesis are hospitals' readmission rate and mean waiting time.

3.4 Readmission rates

A readmission is defined as a non-elective[12] admission that occurs within 30 days after an index admission. The time limit is set in order to link the readmission to the quality of care given at the previous admission. This definition follows the one Goldacre et al. (1991) use for emergency admissions. Ashton et al. (1997) conclude that an "early readmission [that occurs within 31 days after the prior admission] is significantly associated with the process of inpatient care." In this thesis, a low readmission rate is taken as an indicator of high quality care. Planned readmissions cannot be taken as indicators of low-quality care as they are usually part of a series of treatments. A hospital's readmission rate is the number of non-elective readmissions within 30 days of an index admission as a share of the hospital's number of first admissions.

There has been some debate on the use of readmission rates as an indicator of medical quality. Some of the contributors to this debate are Chambers and Clarke (1990), Clarke (1990), Clarke and Milne (1990), Goldacre et al. (1991), and Kopjar et al. (1999).

Chambers and Clarke (1990) conclude that "readmission rates can be measured with routinely collected health service data" (p. 1136), standardized for age and gender. These readmission rates can be used for annual comparisons between specialties.

Clarke (1990) warns against the use of readmission rate as an outcome indicator of hospital inpatient care. The reason she gives is that few of the readmissions she found were unavoidable. Increasing inpatient care would not help prevent these readmissions from happening.

Clarke and Milne (1990) disqualify readmission rates as an outcome indicator of the medical quality of hospital care. They argue that the readmission rate can be manipulated thus creating perverse incentives for clinicians, encouraging them not to readmit patients who should be readmitted.

Goldacre et al. (1991) argue, in response to Clarke and her colleagues, that emergency readmission rates, as quality indicators, are useful. They studied index admissions and readmissions in Oxford in the period 1975 to 1984. They "found a substantial peak in emergency admissions in the first month after discharge" (p. 414). They see this as proof that the emergency admissions are linked to events that occur in this time interval. Further research is needed in order to identify events that lead to emergency admissions but readmission rates may shed light on what kind of research is needed.

[12] A non-elective admission is a non-planned or acute admission.

Kopjar et al. (1999) argue that readmissions cannot be used as indicators of medical quality. The reason, they claim, is that one is not able to control for all relevant factors that affect the readmission rate. Among these factors are differences in practice style between hospitals, hospital capacity, and travel distance to the hospital. The latter is controlled for when the readmission rates and waiting time were estimated by SINTEF Health, who provided me with the hospital data used here. Other factors are age, gender, severity of illness, and whether the index admission was acute or elective. I control for both age and gender. When estimating the readmission rate we distinguished between acute and elective index admissions. I am thus only unable to control for severity of illness. This would only be possible if the Norwegian Patient Register allowed for personal identification. This is further discussed in part 6.1.

In a study on the risk of readmissions among elderly patients Heggestad (2002) finds that this risk depends on both hospital and patient variables. For early readmissions, i.e. within 30 days of discharge, she found support for the hypothesis that hospital operating conditions affect the probability of early readmissions. These findings support the use of readmissions as indicator for quality of hospital care.

Some of the main arguments against the readmission rate as quality indicator are that it cannot be used to improve the quality of care. I see readmissions as outcome indicators that reflect the end result of a process of care. I do not see it as a formative indicator, i.e. one that provides insight into how quality of care can be improved.

A readmission is not only linked to the care a patient receives. Patient characteristics, such as age and general health condition, as well as the seriousness of the disease, are important determinants for the probability of being acutely readmitted. The degree to which a hospital is specialized may therefore affect its readmission rate. The hospitals included in this study are large public hospitals. Their patient mix is therefore more balanced than in small, specialized hospitals. In the following I therefore presume that differences in readmission rates between hospitals reflect different levels of medical quality. I expect patients to appreciate high medical quality and respond positively to a low readmission rate.

3.5 Waiting time

Waiting time is defined as the time from a referral to an admission date. A referral is made to a hospital or a specialist if the patient's doctor cannot provide recommended treatment. Long waiting lists have been of political concern and two articles by Tor Iversen (1993, 1997) consider how they may be reduced. As previously mentioned when discussing why quality

indicators are necessary, waiting time may affect the outcome of a treatment. One's health condition may deteriorate while waiting thus reducing the probability of a successful outcome. Waiting can also mean loss of income. Long waiting time is negative service quality in itself, enhanced by the negative effects it can have on one's health status and income. These factors may also affect one's impression of the hospital prior to the admission.

If the reason for the long waiting time is inefficient organization of hospital staff and resources, patients are more likely to stay discontent with the hospital after the admission. There may be other reasons for the long waiting time. A hospital that specializes in a particular treatment, or excels in the performance of it compared to other hospitals, may well be favoured by patients seeking this specific treatment. With free hospital choice, as is the case in Norway today, this can increase waiting lists at such hospitals.[13] Waiting will then be a quality sign. Waiting time can therefore be either negatively or positively correlated with patients' experiences.

3.6 Readmission rates, waiting time, and patients' preferences

Heggestad (2002) found that the risk of early readmission was significantly lower at hospitals with relatively longer lengths of stay. Increasing the length of stay for each patient will necessarily reduce patient turnover, thus increasing waiting time for patients on waiting lists. This suggests that readmissions and waiting time are negatively correlated.

This could be viewed as a trade-off between medical quality on the one hand and service quality on the other. High medical quality may be represented by a low readmission rate while short waiting time indicates high service quality.

A hospitals' production can be represented by a simple production function $\mathbf{y} \leq f(\mathbf{x})$. The input vector $\mathbf{x}$ indicates that the hospital has a set of resources available for production. The hospitals in this analysis produce a variety of hospital services. I therefore use a vector $\mathbf{y}$ to represent the hospital's set of output. The less or equal sign allows for inefficiency in production. If $\mathbf{y} < f(\mathbf{x})$ there is inefficiency in production. If $\mathbf{y} = f(\mathbf{x})$ the hospital produces at full capacity, utilizing all available resoures. For simplicity I define hospital output as the number of patients who are treated, given by the variable B, as well as the level of medical (q) and service (s) quality. The vector $\mathbf{y}$ is thus defined by

[13] See http://www.sykehusvalg.no/sidemaler/VisStatiskInformasjon____2156.aspx for further information.

$$\mathbf{y} = g\left(B, s, q\right)$$

Given $\mathbf{x}$ the hospital chooses B, s and q according to how many patients the it has to, or wants to, treat and what its desired level of medical and service quality is. The relation between output and input can now be written as

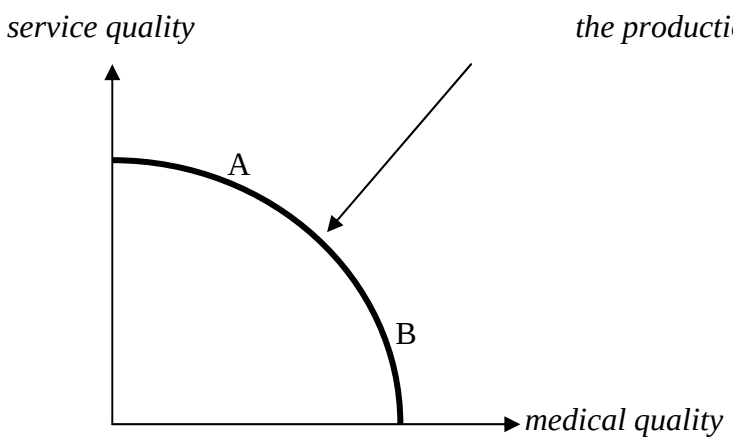
(3) $$g\left(B, s, q\right) - f\left(\mathbf{x}\right) \leq 0$$

One may reformulate equation (3) so that output and input can be expressed as a function of the three variables and the input vector. Assuming full capacity, production equals inputs:

(4) $$F\left(B, s, q, \mathbf{x}\right) = 0$$

This function defines a production front for the hospital. At full capacity the hospital is located on this production front. In figure 1 I have drawn the production front for a hospital when it only considers the medical and service quality of its services, i.e. the number of patients it treats and the amount of input available is held constant. A similar figure could be drawn with the number of patients on one axis and quality on the other.

Figure 1: Hospitals' production front for service and medical quality



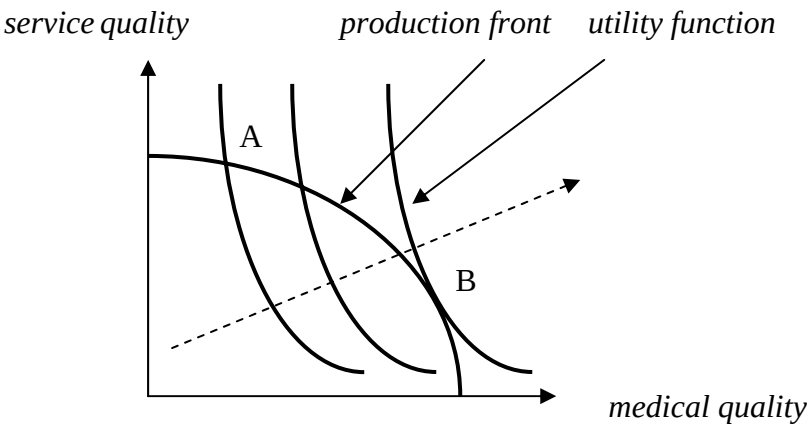
When it uses all its resources the hospital is located on the production front. I assume that hospitals are near or at full capacity since efficiency is not the issue in this thesis. Let A

and B represent two possible solutions for a hospital. At point A it uses a lot of resources to increase its patient turnover in order to reduce waiting time. Fewer resources are left for a high level of medical quality to be reached. At point B it prioritizes medical quality instead of service quality, decreasing its readmission rate and increasing waiting time. There is thus a trade-off between the two quality aspects from the hospital's point of view.

The patients' utility function can be drawn in the same figure. Let waiting time and the readmission rate indicate service and medical quality, respectively. Following the discussion under parts 2.3 and 2.4 a decrease in the waiting time, i.e. higher service quality, or in the readmission rate, i.e. higher medical quality, increases utility.

Patients appreciate both high service and medical quality but may have stronger preferences for one of the aspects. The importance of medical quality may be higher when one is admitted to hospital and treatment starts, reducing the importance of waiting time prior to admission. The utility gain for a given increase in medical quality is then higher compared to the gain from the same increase in service quality. I assume that the utility function is concave, i.e. it is positive but decreasing in each of its arguments. Patients' preferences over the two quality aspects can then be represented by quasi-concave utility functions. The steepness of these functions results from a preference for medical quality.

Figure 2: Hospitals' production front together with patients' preferences for service and medical quality



Utility increases in the direction of the dotted line, i.e. when moving away from the origin. Patients admitted to a hospital that prioritizes medical quality, represented by the point *B*, generate a higher utility level than patients admitted to a hospital that gives high service quality priority.

4. Data

The national health quality indicators were implemented in 2003 but the earliest registrations, on indicators 1, 2, and 4, are from 1 April that year. Registration of hospital infections started two months later and of the last four on 1 May 2004. My use of these indicators is limited by the fact that I only had access to data on patients' experiences for the years 2002 and 2003. I therefore had to construct quality indicators based on already existing data.

The Norwegian Patient Register (NPR)[14] collects and verifies data on patients admitted to all somatic and psychiatric, as well as some private, hospitals in Norway. It is owned by the Ministry of Health and Social Services but run by SINTEF Health, a research institute. These data are the basis for the two hospital specific factors used in this thesis. They are calculated according to the above definitions.

4.1 Differences in registration practices between hospitals

Patients in Norway are given a unique patient identification number when admitted to a hospital. The number does not follow the patient from one hospital to another. Hospitals report their activity to the Norwegian Patient Register. Since the patient identification number varies between hospitals one cannot tell from NPR data whether the same patient was admitted twice to two different hospitals or whether two different patients were admitted.

The identification numbers are also reset at the beginning of a year. Two admissions for the same patient, first in December and then in January, might as well be two admissions for two different patients. This registration practice has consequences for the number of registered readmissions. A readmission to another hospital or in the following year will not be registered as a readmission but as a new admission (another person). Being able to identify patients from one year to the next and between hospitals would give a more precise measure of the readmission rate. One could also create dummies for whether patients were readmitted or not when investigating the effect of readmissions on patient satisfaction with hospital services.

[14] Norsk pasientregister in Norwegian.

A hospital admitting a patient should ideally register the date the patient was referred from his or her doctor. This rule also applies if a hospital is receiving a patient from another hospital. If the receiving hospital does not know the initial referral date, they have to register the patient with the date for when they received the patient. Since the patient is given a new number in such a transfer, one cannot know whether same patient is admitted twice or if two different patients are admitted.

This has consequences for patients' waiting time. If the initial referral date is registered the waiting time calculated with NPR data will be the patient's total waiting time, i.e. from the referral to the treatment is ended. If he is registered with the date he is admitted to the hospital where he receives treatment, one is only able to calculate the waiting time at that particular hospital. If one were able to identify patients from one hospital to the next this problem would be avoided. One would also be able to use each patient's total waiting time when looking at the effect on patients' satisfaction with hospital services.

4.2 Patients' experiences; grouping the questions

13700 patients responded to the survey on patients' experiences. The return rate on the total number of surveys that was sent out, however, was only 50 %. This may have implications for the answers if there are systematic differences between patients who answered and patients who chose not to answer. The patients that are least content have reason to use the survey as an opportunity to voice their complaints. If this were the case, it would affect patients' experiences negatively. The means on the seven category variables show that patients are quite content with the hospital services they receive. Subtracting one standard deviation from each mean still keeps the score above five. Only *info2* falls to 4.91 but this is also the group question with the least respondents.

On the other hand, there is a risk that the weakest patients, e.g. the oldest patients or the ones with the most severe illnesses, do not have the strength to fill out the survey. A problem in this regard may be the length of the survey, as it contains fifty questions and is sent out two to three weeks after patients' discharge. The weakest patients may not have had the time to recover. If these patients are also the least content this will bias the results from the survey towards the highest scores.

There is also a risk that patients who do not speak or understand Norwegian very well are not able to fully understand the survey questions and thus do not respond. Knowing how many of patients who did not respond whose first language is not Scandinavian could shed light on whether difficulties with understanding the questions are a problem. What we

do know is that 7 % of the respondents answered having another language than Scandinavian as their first language. If this share is far smaller than the total share of non-native patients at public hospitals in Norway it may indicate that this group is underrepresented in the survey.

Another problem with using data from surveys as the one used here is that respondents may misinterpret the questions or interpret them differently from each other. Discovering a misinterpretation is impossible when respondents are simply to give a value from one to ten, as they are to do here. Differences in interpretations may result in respondents of the same opinion giving different responses to the same question. Alternatively, respondents who differ in their opinion may appear as being in accordance with each other. Answers are therefore not necessarily consistent.

It is difficult to say to what extent this is a problem in the sample used here but it might be confusing that the scale of one to ten is not always formulated such that ten is best. For some questions the positive response “yes” refers to high quality, for other questions it indicates that the patient is not at all satisfied. With fifty questions and different scaling from one question to the next this might result in some patients expressing a higher degree of contentment or discontentment than what they intend to.

If certain questions are easier to misinterpret this may also result in systematic errors in the data. This problem is not solved by having many respondents. I have not controlled for any of these possible problems so this must be kept in mind when considering the results. For future patient surveys a review of the questions, the scale and the formulation of the question may be considered in order to avoid some of the problems listed here.

The age ranged from 15 to 98, with slightly more women than men in the sample. Years of higher education ranged from zero to 25. Patients had approximately two previous admissions the last two years.

In order to limit the number of regressions and make the results more accessible, I grouped the questions in the survey on patients’ experiences into seven category variables. They are grouped according to different aspects of hospital service quality but also according to how well they are correlated. The category variables are listed in table 2 together with the questions each variable is based on.

Table 2: Summing up the questions for the seven category variables.

content	Do you have trust in the hospital? Were you content with care and treatment? What were your expectations in advance? What effect did the hospital stay have on your health condition? Were you given the wrong treatment? What was your impression of hospital equipment and the hospital in general? Did lack of resources affect treatment? Would you recommend it to family and friends? Would you choose the same hospital again?
info	Were you told everything about your condition? Did you understand the doctors and the health personnel? Were you given all relevant information about the examinations, their results, and test results? Were you informed about future pains and what you yourself could do? Were you taken in on counsel or were decisions made over your head?
info2	Were you given enough information concerning effects and side-effects of new medication? Did you have any unanswered questions concerning medication at discharge?
facisani	Were you content with a) tranquillity in your room, b) toilet facilities, c) shower facilities, d) food, e) cleaning, f) telephone access
care	Did health personnel *i*) give you efficient pain relief, *ii*) show care, *iii*) show professional skills, *iv*) have enough time, *v*) operate as one group? Did the doctors *i*) show care, *ii*) professional skills? Was one doctor in charge?
org	What was your impression of work organization? Was there unexpected waiting? Was information on you conveyed to the right people? Did health personnel cooperate well when giving you care and treatment? How were your relatives received? Could they easily obtain information during your admittance?
improve	Is there need for improvements in the *i*) care service, *ii*) doctors' service, *iii*) organization of work, *iv*) equipment, *v*) way relatives are received, *vi*) information on examinations, *vii*) information on medication, *viii*) information and follow-up after discharge, *ix*) communication between patient and staff?

The categories are *content* (contentment with and trust in hospital), *info* (information), *info2* (information about medication), *facisani* (facilities and sanitary conditions), *care* (health staff's care and skills), *org* (organization of work, etc.), and *improve* (questions about what should be improved).

Each category variable is divided by the number of questions it consists of so as to keep the score from 1 to 10. There was one question concerning how patients experienced

sleeping in the corridor but only 2014 patients answered this question. When including it in the *org* variable, the number of observations in this variable dropped from 7301 to 1293. I therefore decided to leave out the question on corridor patients from the group variables.

The same reasoning was done for the information variables. When including the two questions concerning medication in the *info* variable the number of observations dropped from 4867 to 2829. By itself the *info2* variable has 4173 observations. 7110 respondents answered the question on effects and side-effects, while 8888 responded to whether they had any unanswered questions at discharge. Approximately 5000 more respondents answered the other questions in the survey, excluding the corridor question. I therefore let the questions concerning medication be a separate variable.

The question on whether one would choose the same hospital again took only values from one to four. One was “the same hospital”, two was “any other hospital”, three was “another (specified) hospital”, and four was “no opinion”. I had to reformulate these values so as to avoid a bias towards zero. The answer “the same hospital” was given the score 8 to indicate that patients were quite content with the hospital. I dropped the “no opinion” answer (2231 observations) finding it difficult to rank this on a scale from one to ten. I gave the two remaining answers the value 3 assuming that patients who preferred another hospital were somewhat discontent.

If patients have answered some but not all of the questions constituting the different category variables, this might explain why so many respondents fall out of several of the group questions. The number of observations on each of the initial questions Nearly everybody answered the questions concerning facilities and sanitary conditions, perhaps because these are easily observed.

Table 3 on the following page presents the number of observations, means, and standard deviations on the seven category and the six control variables. I included readmission rates and waiting time, although the data on these two variables do not come from the patient surveys but from NPR as mentioned above.

Table 3: Some information on the seven category variables, the six control variables, and the two hospital specific factors

Variable	*Observations*	*Mean*	*Standard deviation*
Category variables, presented in table 2			
content	7197	7.93	1.17
info *(information)*	7335	7.90	1.91
info2 *(questions on medication)*	6544	7.57	2.66
facisani *(facilities and sanitary conditions)*	10983	8.55	1.65
care	10001	8.22	1.60
org *(organization of staff, etc.)*	7301	8.29	1.69
improve *(need for improvements)*	8954	7.76	2.10
Patient characteristics (control variables)			
age	11499	57.73	18.31
gender *(1 = male, 0 = female)*	13700	0.47	0.50
health *(scale of 1 (bad) to 5 (excellent))*	13396	2.70	1.10
adm *(no. of admissions last two years)*	13316	1.97	3.33
edu *(years of higher education)*	12287	3.97	3.33
notscand	13373	0.07	0.25
Hospital specific factors			
readm *(readmission rate)*	12063	0.069	0.017
waiting *(waiting time for treatment in days)*	12511	157.31	30.82

The questions in the survey can be seen in relation to the three quality dimensions defined by Donabedian (1966) and described in part 2.4. The questions concerning care and information received belong to the process of the treatment. The questions on trust in the hospital, the effect of the treatment on one's condition, and whether one would recommend or choose the same hospital again refere to the outcome dimension. Finally, questions concerning hospital facilities, equipment, professional skills, organization of work, and how relatives were received belong to the structure dimension. The patient survey thus contains information along all three dimensions which should increase the interest and validity of the survey.

5. The results

5.1 Standard OLS on the basic regression model

Table 4: Regression results for the seven category variables.

	content	***info***	***info2***	***facisani***	***care***	***org***	***improve***
age	0.0383***	0.0999***	0.0287**	0.0266***	0.0674***	0.0564***	0.0626***
	(0.00531)	(0.00833)	(0.01290)	(0.00604)	(0.00591)	(0.00690)	(0.00774)
agesq	-0.0002***	-0.0008***	-0.0001	-0.0001**	-0.0005***	-0.0003***	-0.0004***
	(0.00005)	(0.00008)	(0.00012)	(0.00005)	(0.00005)	(0.00006)	(0.00007)
gender	0.0049	0.0513	0.2258***	0.0824**	0.0734*	0.1195***	0.0913*
	(0.03379)	(0.05341)	(0.08199)	(0.03814)	(0.03885)	(0.04739)	(0.05226)
health	0.3360***	0.3653***	0.3559***	0.1106***	0.2360***	0.2354***	0.3212***
	(0.01797)	(0.02814)	(0.04431)	(0.02030)	(0.02035)	(0.02519)	(0.02741)
adm	-0.1380***	-0.0707***	-0.1500***	-0.1172***	-0.1011***	-0.1728***	-0.1886***
	(0.01761)	(0.02639)	(0.03998)	(0.01951)	(0.01991)	(0.0375)	(0.02658)
edu	-0.0364***	-0.0280***	-0.0066	-0.0414***	-0.0482***	-0.0492***	-0.0505***
	(0.00533)	(0.00831)	(0.01257)	(0.00602)	(0.00611)	(0.00732)	(0.00815)
notscand	-0.1176*	0.0530	0.2541	0.1708**	-0.1741*	0.0708	-0.3021***
	(0.07051)	(0.10917)	(0.15989)	(0.07920)	(0.07974)	(0.09331)	(0.10707)
readm	-2.8401***	-3.6216**	2.8471	-5.7454***	-3.2768***	-4.0368**	-2.5334
	(1.01372)	(1.61351)	(2.49533)	(1.16565)	(1.19312)	(1.47830)	(1.59391)
waiting	0.0005	-0.0002	0.0005	0.0011*	0.0009	0.0011	-0.0001
	(0.00060)	(0.00098)	(0.00148)	(0.00067)	(0.00069)	(0.00086)	(0.00094)
cons	6.5186***	4.0517***	4.3206***	7.6823***	5.7982***	6.3906***	4.3331***
	(0.21505)	(0.32996)	(0.51288)	(0.24165)	(0.24174)	(0.29332)	(0.31626)
Adj R-sq	0.1400	0.0728	0.0380	0.0427	0.0764	0.1098	0.0704
No. of obs	4722	4867	4173	7174	6638	4831	6095
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
*p < 0.01= *** p < 0.05 = ** p < 0.10 = *							

Coefficients are reported with their respective standard errors in parenthesis and stars to indicate significance level. The readmission coefficients are negative, as expected, and significant. The positive readmission coefficient for the variable *info2* is not significant. The effect of waiting time is ambiguous and only significant for the category variable *facisani*, where the effect is positive.

5.2 The effect of readmissions and waiting time on patient satisfaction with hospital care

The results from a standard OLS regression on each of the seven category variables are presented in table 4 on page 25. The main empirical result is that the readmission rate has a negative and significant effect on patients' experiences while the effect of waiting time for the most part is insignificant.

As mentioned in part 2.4, combining data on two different levels may render the results from an OLS regression inefficient. This is discussed in Rice and Jones (1997). A general practitioner or hospital is likely to give patients with the same diagnosis the same package of treatment. This package will differ from the ones given by other health service providers depending on differences in practice style. By clustering individual patients who use the same health service provider, one can make use of the information that lies within groups, such as practice styles.

This method could, and perhaps should, have been used here since patients admitted to the same hospital, registered with the same diagnosis, are likely to receive similar treatments. There are two consequences of using a single level approach. The first is that combining data on hospital level with individual data reduces the degrees of freedom. While there are several thousand individuals in the sample there are only 46 hospitals. This means that the estimated standard errors reported in table 4 are too small and that the results for the readmission rates, interpretable as an indicator of hospital quality, may no longer be significant.

In StataSE 8, the statistical package I use, there is a command that allows for clustering individuals at hospital level. No restrictions are laid on the covariance matrix for individuals admitted to the same hospital but individuals are assumed to be independent across hospitals. The cluster command does not change the estimated coefficients but affects the estimated standard errors and the variance-covariance matrix of the estimators. The estimated variances are robust to any type of correlation within hospitals.

When clustering on hospitals the estimated standard errors of the readmission rate and the waiting time coefficients are approximately doubled. According to these results readmissions no longer have a significant effect on patients' experiences. Only one variable, *facisani*, reports a significant effect of readmissions but only at a 10 % level. Waiting time continues to be insignificant.

I am not certain that the cluster command is the right one to use on the data set that I have here. There may be reason to believe that there is a stronger correlation between

individuals at the same hospital than there is between individuals at different hospitals. However, the hospitals included here offer a wide range of hospital services. Patients admitted to different wards at the same hospital will be treated by different doctors and may therefore receive different "packages of treatment". This decreases the degree of correlation between patients within hospitals. A better approach could therefore be to cluster by ward or post or even by doctor where correlation between patients is likely to be higher than at hospital level. This approach would require information on the readmission rate and waiting time at these levels, information I do not have.

On the other hand, the two hospital level variables, the readmission rate and the mean waiting time, contain a lot of "noise". They are based on individual data but all information on patient level is lost when constructing one readmission rate and a single mean waiting time for each hospital. If the information on these two variables were kept on an individual level this would increase the degrees of freedom which pulls in the direction of significant regression results. The statistical association between the patient evaluation scores and their *individual* readmission record could well be stronger than it is possible to capture here. I do not know which of the two effects on the degrees of freedom is the strongest.

I thus continue by reporting the results from the standard OLS regression which is a well-known and more transparent method than the cluster approach. For all category variables, except *info2* and *improve*, the readmission coefficients have the expected negative sign and are significant. This indicates that patients admitted to hospitals with low readmission rates are more content with their hospital stay. They are content with the care and information they receive, have trust in the hospital and staff's professional skills, are more positive to being admitted to the same hospital again, as well as to recommending it to family and friends. All these results were significant at 5 % or 1 % level of significance. If readmissions do in fact capture quality aspects of hospital services, these results support the hypothesis that patients react positively to higher quality. To the extent that the readmission rate only captures aspects of medical quality the hypothesis that patients value medical quality is supported.

Regional hospitals may have lower readmission rates than local hospitals. If patients experience complications after having returned home from a treatment at a regional hospital they are more likely sent to their local hospital since this is nearer and allows them to save travel time. I have not controlled for this in my analysis.

The results for waiting time were ambiguous. The reason may be, as previously discussed, that once admitted to hospital waiting time matters little to patients. With free

hospital choice long waiting time may result from patients' preference for particular hospitals. Alternatively it may be the result of bad organization of hospital resources.

The only variable, on which waiting time has a significant effect, however only at a 10 % level of significance, is the category variable *facisani*. Patients are more content with the tranquillity in their rooms, toilet and shower facilities, food, and cleaning at hospitals with longer waiting time. I find it hard to believe that long waiting time is the cause for patients' contentment; increasing waiting time is not likely to increase the level of quality on hospital facilities and sanitary conditions. There may be some underlying factor explaining this result. This is also the variable where readmissions had the strongest effect; the coefficient is –5.75 with the t-value –4.93. Why should hospitals with low readmission rates and long waiting time rate higher amongst patients when it comes to facilities and sanitary conditions? I do not see how these conditions in particular can increase the medical quality. As previously discussed keeping a high level of medical quality requires use of resources. This leaves fewer resources available to increase patient turnover and thus reduce waiting time. Improving facilities and sanitary conditions also requires use of resources that could have been used elsewhere. This may add to an increase in the waiting time if less priority is given to service quality aspects captured by the waiting time variable.

An important question is whether readmission rates and waiting time capture some or any level of quality of the services hospitals produce and offer. What do they tell us? The correlation coefficient between readmissions and waiting time is -0.2429, indicating that hospitals with a low readmission rate have longer waiting time and vice versa. This confirms the discussion of a possible trade-off between service and medical quality presented in part 3.6. If patients have stronger preferences for medical quality this might explain why hospitals that give priority to a high level of medical quality, which in this sample is thought to be captured by a low readmission rate, are rated higher amongst patients.

5.3 Patient characteristics

The control variables were for the most part significant. Table 5 gives some indication of how the different patient characteristics "move together" and affect patients' experiences.

Table 5: Correlation coefficients for the control variables

	age	***gender***	***health***	***adm***	***edu***	***notscand***
age	1					
gender	0.11	1				
health	-0.33	-0.01	1			
adm	0.09	0.00	-0.40	1		
edu	-0.15	0.02	0.17	-0.04	1	
notscand	-0.03	-0.01	-0.06	0.02	0.02	1

Number of observations: 10105

The correlation coefficients for the six control variables indicate that health is negatively correlated with age and the number of previous admissions. The other correlation coefficients are quite small.

The correlation coefficients between the control variables show that patients' perception of their own health status is negatively correlated with patients' age and the number of previous admissions. It is not very surprising that patients who consider their health status as "good" have fewer admissions than other patients. The negative correlation between age and health indicates that older patients have a more negative perception of their health status. The opposite can be said of patients with higher education.

From the regression results in table 4, it is clear that age has a positive effect on patient satisfaction. Older patients are thus more content than younger patients with the quality of the services they receive. The negative coefficient for age squared, however, means that the age effect is declining; as age increases the differences between age groups decrease. The age effect is significant for all the category variables.

An increase in the number of admissions the last two years has a negative effect. This means that patients that have more contact with hospital services because they are admitted more frequently are less content. The effect is significant for all variables except *facisani*.

The more content patients are with their own health status, the more content they are with the quality of the health services they receive. The negative correlation coefficient

between health and admissions indicates that patients who are more content with their health status have fewer admissions. It could be worth while to look more closely at why patients who are discontent with their own health and/or are admitted more frequently are less content with the quality of the hospital services they receive.

Patients with higher education were less content with their hospital stay. The results were significant for all category variables except for *info2*. The control variable *gender* was significant for the category variables *info2*, *care*, *org*, and *improve*, and showed that men were more content with hospital services than women were.

Patients whose first language was not Scandinavian expressed stronger sentiments than other patients towards need for improvements. They were also somewhat less content with the care they received, but this difference was only significant at a 10 % level. On the other hand they were more satisfied with facilities and sanitary, significant at a 5 % level. The lack of significance for the other variables is most likely caused by the small number respondents who report having another language than Scandinavian as their first language (only 7 %).

Of some concern is the number of observations lost in each regression. Two thirds fall out of the group questions on information and on organization of staff, etc. When summarizing each question (not the group questions) the questions that lack the most respondents are the ones concerning medication and how relatives were treated by hospital staff. The two variables *facisani* and *care* have the most respondents.

5.4 OLS on each question separately

Running OLS on each question separately, instead of grouping the questions, gave more or less the same results for the control variables. The effect of having a long waiting time was for the most part not significant. However, I did find some support for the hypothesis of waiting time as a quality sign. Patients were asked if they would choose the same hospital again. Here, waiting time had a positive and significant effect. Patients also had a better impression of the hospital in general and expressed contentment with WC conditions, cleanliness, and telephone access. The only negative and significant relationship I found was that patients experienced more unexpected waiting at hospitals with long waiting time. The readmission rate was not significant for all questions but the results where the effects were significant were negative and thus consistent with the results for the category variables.

5.5 Do hospital specific factors matter for patients' experiences?

How much of the variation in patients' answers is explained by hospital factors and how much is explained by patient characteristics? Comparing adjusted R squared for three different regression models provides insight into the causes for variation in how patients respond.

Table 6: Adjusted R-squared for four different models for the seven category variables

Variable	Model 1: Adj R^2, patient characteristics	Model 2a: Adj R^2, readmissions and waiting	Model 2b: Adj R^2, readmissions	Model 3: Adj R^2, hospital dummies
content	14.45 %	14.19 %	15.16%	16.42 %
info	5.01 %	7.26 %	7.28%	6.73 %
info 2	3.56 %	3.80 %	3.82%	5.15 %
facisani	2.34 %	4.27 %	2.83%	7.90 %
care	6.01 %	7.64 %	7.63%	8.06 %
org	8.82 %	10.98 %	9.55%	11.88 %
improve	6.05 %	7.04 %	7.05%	8.26 %

Adjusted R squared for one model with only patient characteristics, one with readmissions and waiting time, and one with hospital dummies. The table gives an indication of how much hospitals matter for patient satisfaction with hospital services.

The starting point for all three models is the basic regression model given by equation (2). In model 1 the hospital specific factors waiting time and readmissions are left out of the equation. This leaves only patient characteristics on the right hand side. Model 2a is identical to the basic regression model with readmissions and waiting time in addition to patient characteristics. Since waiting time for the most part had no significant impact on patients' experiences, I report R-squared for model 2, leaving out the waiting time variable and call this model 2b. For some of the group questions adjusted R-squared decreases but for other variables, such as *content*, *info*, *info2*, and *improve* it actually increases. In model 3 hospital dummies replace the readmission rate and the mean waiting time. The hospital dummies capture all hospital specific factors that may affect patients' experiences.

The general impression from the results is that most of the variation explained by the different models is explained by patient characteristics. Here the variable *content* stands out with an adjusted R-squared that is two to three times larger than for the other variables. The

questions in this variable concern general content with the hospital, the effect of treatment, expectations in advance, etc. The variation in the answers to these questions seems to depend more strongly on patient characteristics than the variations in other questions.

The variable *facisani* differs from the others in that adjusted R-squared increases the most when hospital dummies are added to the equation. Since the questions concern hospitals' facilities and sanitary conditions this is not very surprising. This is also the variable where patient characteristics explain the least and where the inclusion of readmissions and waiting time doubles the share of variation explained.[15]

The change in adjusted R-squared from model 1 to model 3 suggests that hospital specific factors matter for patients' experiences. Adjusted R-squared increases with one to two percentage points, three for the variable *org*. The two variables used here to capture quality at hospital level, the readmission rate and the mean waiting time, stand for approximately half of this increase. For the variable *info* they actually explain more than do the hospital dummies. Unfortunately the results say little about what kind of quality patients appreciate. It is therefore hard to make recommendations as to what hospitals might do to improve the quality aspects that patients appreciate.

Although readmissions add little to the share of variation in patients' experiences, it significantly affects patient satisfaction according to the regression results. The regression results suggest that hospitals with lower readmission rates are perceived as having a higher level of quality than hospitals with high readmission rates. The adjusted R-squared for model 3 suggests that there are other, more important hospital factors that matter for patients' experiences. In order to capture more of the variation explained by hospital specific factors, more precise measures than readmissions and waiting time are needed. Over time this will be possible as more data are gathered on the national health quality indicators.

5.6 The effect of a one standard deviation change in four explanatory variables on patient satisfaction with hospital care

Using the regression results from table 4 and the mean of the explanatory variables I calculated the predicted satisfaction with care for men whose first language is Scandinavian from the age 15 to 98. This level of satisfaction is presented by the lowest of the four curves in figure 3. I then let the four variables for health, admissions, education, and readmissions change with one standard deviation in order to see which of the changes had the greatest effect on the level of satisfaction. I only looked at changes that have a positive effect on

[15] When only waiting time is used in addition to patient characteristics adjusted R-squared is 3.84 %.

patient satisfaction, i.e. a decrease in the number of admissions, the education level, and the readmission rate and an increase in the perception of one's health status.

Figure 3: The effect of a one standard deviation change in four explanatory variables on patient satisfaction with care

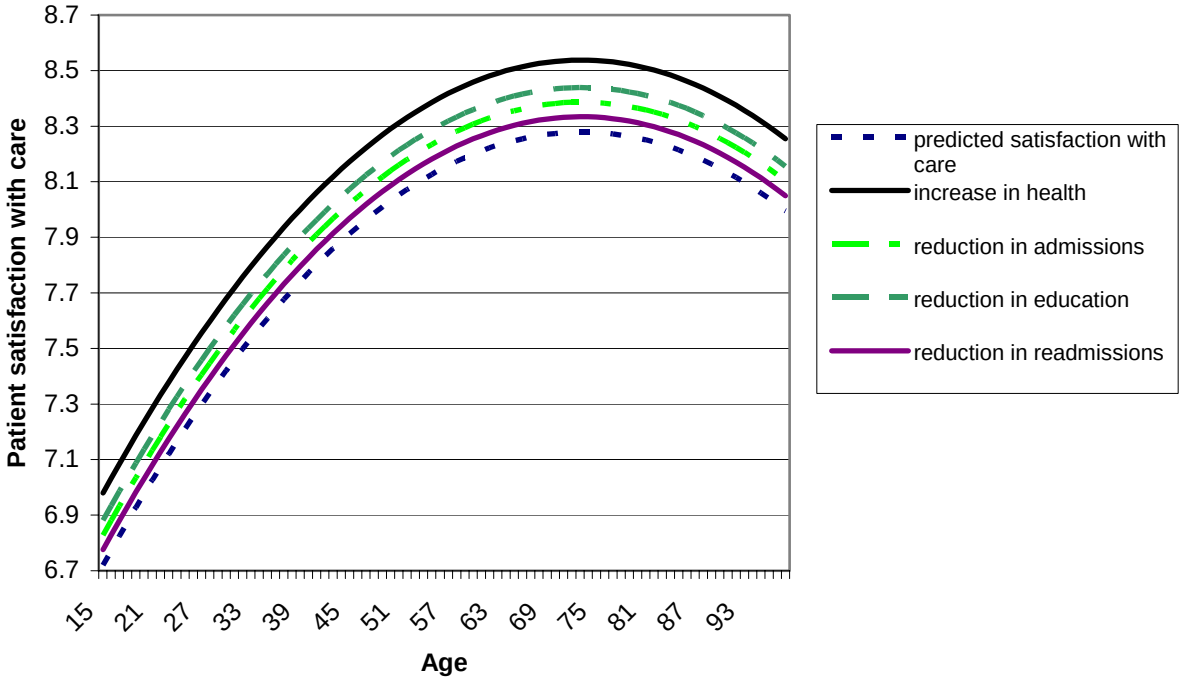


Figure 3 shows the effect of a one standard deviation change in the health status, the number of admissions, the education level, or the readmission rate on the predicted satisfaction with care. The calculations are done for men whose first language is Scandinavian. A change in one's health status has the greatest impact on one's level of satisfaction. A change in the readmission rate has the least effect.

From figure 3 it is clear that patient characteristics have a greater effect on patient satisfaction than what the readmission rate has. A reduction in the readmission rate has the least effect on patient satisfaction. The effect is larger for a reduction in the number of admissions or in one's level of education. But an improvement in one's health status has the greatest impact on patients' level of satisfaction. The effect on women's level of satisfaction was identical but their levels are scaled down by subtracting the gender coefficient.

Table 7 presents results similar to the ones presented in figure 1, i.e. the calculation technique is the same but is done for the variable *content* and only for the age levels 25, 45, and 65. The idea was to have one patient from each generation and to show results for men and women. Also for this variable, a one standard deviation change in the readmission rate has the least effect on patients' level of satisfaction. Women's satisfaction with hospital

services is slightly lower than that of the men in the sample but the differences between men and women within age groups are quite small.

Table 7: The effect of one standard deviation change in four explanatory variables on the variable content

	Predicted values, content	*Standard deviation reduction in readmissions*	*Standard deviation increase in health*	*Standard deviation reduction in admissions*	*Standard deviation reduction in education*
age 25 men	7.45	7.49	7.82	7.59	7.57
women	7.44	7.49	7.82	7.59	7.56
age 45 men	7.93	7.97	8.30	8.07	8.05
women	7.92	7.97	8.29	8.07	8.04
age 65 men	8.24	8.29	8.61	8.39	8.36
women	8.24	8.29	8.61	8.39	8.36

The effect of one standard deviation change in the readmission rate, health status, number of previous admissions, and the level of higher education, respectively, on the category variable *content*.

The effect of one standard deviation change in health is greatest also for the *content* variable. Readmissions again have the least effect. The education effect is less for those aged 65, perhaps because few of them have higher education. The negative correlation between age and education suggests that younger patients have a higher level of education. The correlation coefficient is small, however, only -0.15. These results should therefore not be given too much weight.

5.7 Cross-effect between age and readmissions

All of the above results have shown that there are significant differences between age levels and age groups when it comes to patients' experiences with hospital services. The results from the basic regression model, presented in table 4, show that patient satisfaction increases with age but the effect is decreasing. I wanted to do a more thorough investigation of a possible relation between different age levels and the readmission rate. Using cross-effects between age and the readmission rate allows for a better understanding of how patients of different age are affected by the readmission rate. I chose not to do this for the waiting time variable as its effect on patient satisfaction for the most part was insignificant. The model I use in this part is given by equations (4.1) to (4.3) on the next page.

(4.1) $$care = \alpha + \beta_1 age + \beta_2 agesq + \beta_3 gender + \beta_4 health + \beta_5 edu + \beta_6 adm + \beta_7 notscand + \lambda_1 waiting + \lambda_2 readm + \varepsilon$$

(4.2) $$care = \alpha + \beta_1 age + \beta_2 agesq + \beta_3 gender + \beta_4 health + \beta_5 edu + \beta_6 adm + \beta_7 notscand + \lambda_1 waiting + \lambda_2 readm + \lambda_3 agr + \varepsilon$$

(4.3) $$care = \alpha + \beta_1 age + \beta_2 agesq + \beta_3 gender + \beta_4 health + \beta_5 edu + \beta_6 adm + \beta_7 notscand + \lambda_1 waiting + \lambda_2 readm + \lambda_3 agr + \lambda_4 ag^2 r + \varepsilon$$

The model given by equation (4.1) is identical to basic regression model. I will call this model 1. The dependent variable *care* is the category variable from table 1. It represents patient satisfaction with the care they receive. I used only one of the category variables in order to limit the number of regressions. The results for the different category variables are quite similar and I found *care* to be a representative variable.

The second equation, model 2, includes the new variable *agr* which is the product of age (*ag*) and the readmission rate (*r*). According to the previous results, patient satisfaction increased with age but the effect was decreasing. In order to see how the effect of the readmission rate changes as age changes, the next equation, model 3, includes a term where the readmission rate is multiplied with age squared (ag^2r). The regression results are presented in table 8 on the next page.

The results for the model 1 are, of course, identical to the ones presented in table 4. When controlling for age and age squared the readmission rate has a significant and negative effect on the dependent variable *care*. When a cross-effect between the readmission rate and age is included the effect of readmissions is distributed over two estimated parameters, reducing the significance of each parameter. The readmission coefficient is significant at a 5 % level. The coefficient for the cross-effects variable is positive but less than zero and significant only at a 10 % level.

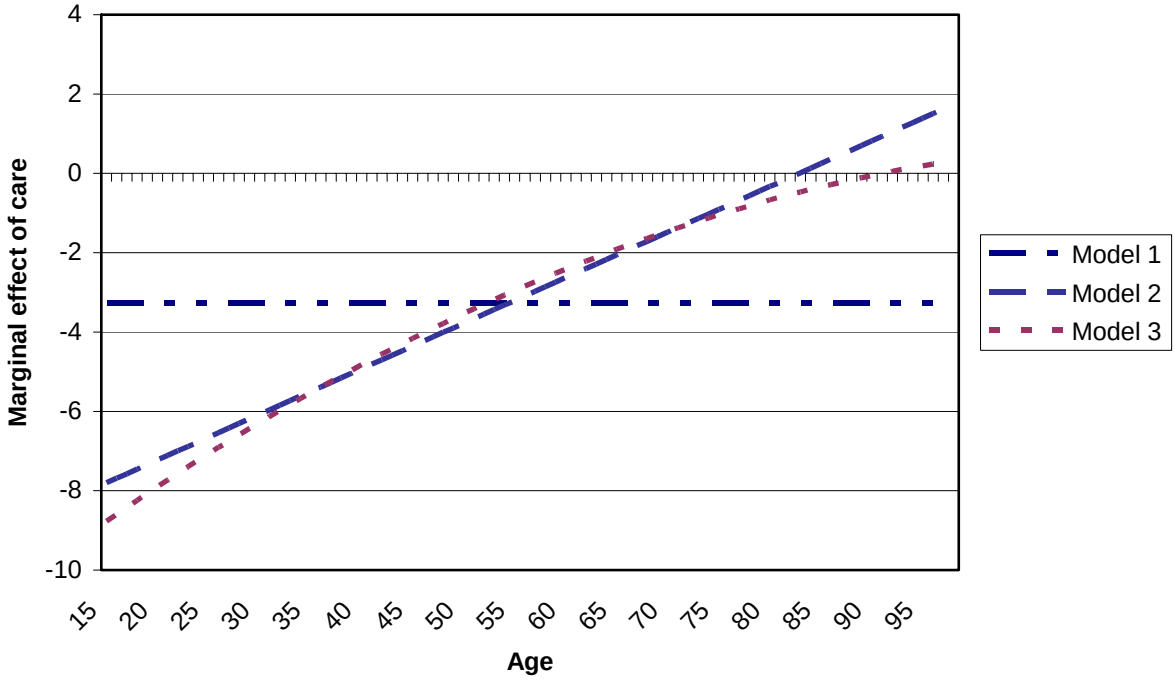
In model 3, when adding a cross-effect between the readmission rate and age squared, the coefficients for the readmission rate and the cross-effects variables, estimated separately, are not significant even at a 10 % level. The reason is that the effect of readmissions on patient satisfaction with care is now distributed over three estimated parameters.

Table 8: Regression results for models 1 to 3, given by equations 4.1 – 4.3, for the variable care			
	Model 1	***Model 2***	***Model 3***
constant	5.7982***	6.2136***	6.3612***
	(0.24174)	(0.34026)	(0.69514)
age	0.0674***	0.0601***	0.0538**
	(0.00591)	(0.00726)	(0.02652)
agesq	-0.0005***	-0.0005***	-0.0004*
	(0.00005)	(0.00005)	(0.00025)
gender	0.0734*	0.0731*	0.0728*
	(0.03885)	(0.03884)	(0.03887)
health	-0.2360***	0.2373***	0.2373***
	(0.02035)	(0.02036)	(0.02036)
edu	-0.0482***	-0.0485***	-0.0485***
	(0.00611)	(0.00611)	(0.00611)
adm	-0.1011***	-0.1015***	-0.1015***
	(0.01991)	(0.01991)	(0.01992)
notscand	-0.1741**	-0.1727**	-0.1728**
	(0.07974)	(0.07973)	(0.07974)
waiting	0.0009	0.0009	0.0009
	(0.00069)	(0.00069)	(0.00069)
readm	-3.2769***	-9.5266**	-11.6449
	(1.19312)	(3.79573)	(9.4917)
agr		0.1149*	0.2039
		(0.06624)	(0.37150)
ag^2r			-0.0008
			(0.00343)
Adj R-sq	0.0764	0.0767	0.0781
No. of obs	6638	6638	6638
Prob > F	0.0000	0.0000	0.0000
*$p < 0.01$ = *** $p < 0.05$ = ** $p < 0.10$ = ****			

5.8 A graphic presentation of the marginal effect of the readmission rate

Figure 4 shows how the marginal effect of readmissions changes with age. The horizontal line is given by the readmission coefficient from model 1 which is independent of age. The marginal effect from model 2 is given by the linearly increasing line which intercepts the x-axis at the age 85. Model 3 has a slight curvature. It supports the results given by model 2; as age increases the negative effect of readmissions on patient satisfaction decreases.

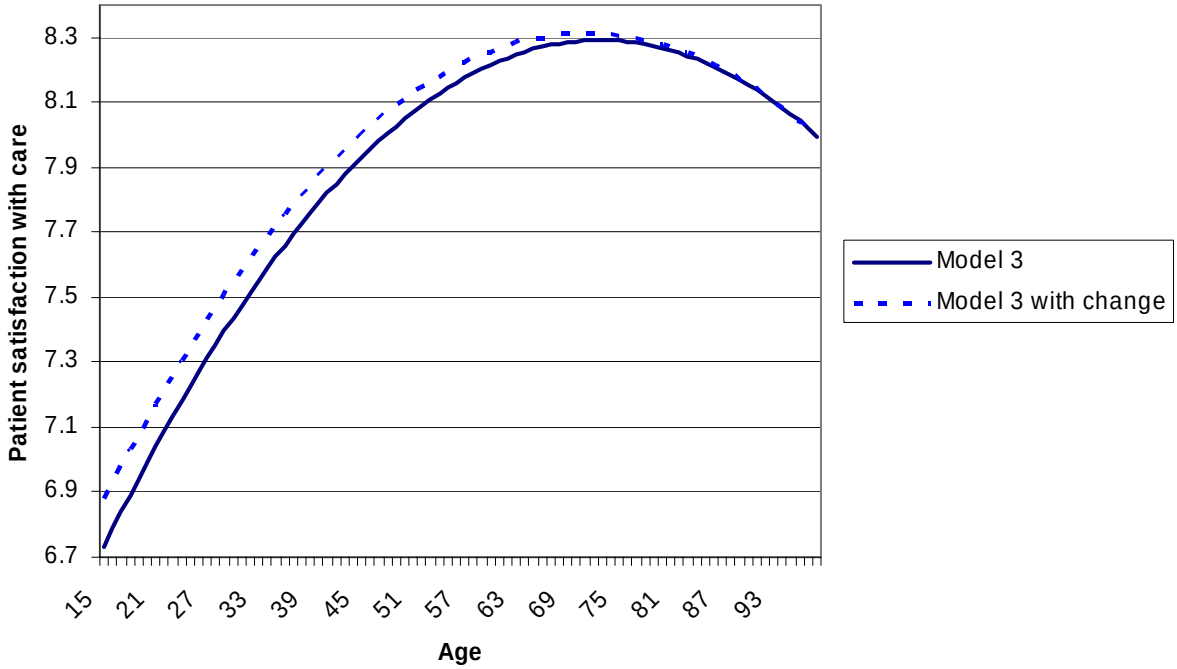
Figure 4: The marginal effect of the readmission rate for different age levels on patient satisfaction with hospital care.



I also wanted to see the effect of a decrease of one standard deviation in the readmission rate on patient satisfaction with care. The procedure is the same as the one used in part 5.6. I have calculated a predicted satisfaction level for male patients whose first language is Scandinavian using the regression results from table 8 for model 3 and the mean value of the variables health, education, admissions, waiting time, and the readmission rate. This is the line called “Model 3” in figure 5 on the next page. I then subtracted one standard deviation from the readmission rate. This is the line “Model 3 with change”. The effect on model 2 was almost identical to the effect on model 3. I chose model three since this model has the highest adjusted R-squared indicating that it provides the best fit of the data. According to the adjusted R-squared the models increase their fit of the data when the cross-effects variables are included.

The effect of a one standard deviation decrease in the readmission rate was greatest for the youngest patients and slowly decreasing with age. From the age of 73 and onwards the effect is close to zero. Patients in the age group 15 to 60 are more sensitive to changes in the readmission rate and thus to changes in the level of medical quality, if the readmission rate does in fact reflect medical quality at a previous admission.

Figure 5: The effect of one standard deviation change in the readmission rate on men's satisfaction with care.



The effect of a one standard deviation decrease in the readmission rate was greatest for the youngest patients and slowly decreasing with age. From the age of 73 and onwards the effect is close to zero.

5.9 Summing up the results

My main empirical finding is that hospitals' readmission rates have a negative and significant effect on inpatients' experiences. Patients admitted to hospitals with low readmission rates are more content with the care, treatment, and information they receive from hospital personnel. They are also more content with hospital facilities and sanitary conditions and organization of hospital staff.

The results for waiting time were more ambiguous. Patients' impression of hospitals' facilities and sanitary conditions was better at hospitals with longer waiting time. It may be that other quality aspects are better at these hospitals, and that these other aspects are more important for patient satisfaction.

Only one of the category variables, the one called *info2*, showed a positive effect of readmissions but the result was not significant. When asked whether they had any unanswered questions about new medication and possible effects and side-effects, patients' responses were not affected by the hospitals' readmission rate.

The results showed that younger patients were in general less content than older patients. The positive effect of age, however, is decreasing. When checking for possible cross-effects between age and the readmission rate I found that younger patients respond more negatively to a given readmission rate. A reduction in the readmission rate by one standard deviation increased the level of satisfaction for the youngest patients from 6.78 to 7.13 on a scale of 1 to 10 where 10 is best. For patients aged 60 years there was no effect on the satisfaction level of a change in the readmission rate.

6. What could be gained with better data?

6.1 Patient identification

There is an ongoing debate concerning whether or not NPR should be established as a personal health data filing system, i.e. a register that allows for personal identification.[16] The Personal Health Data Filing System Act lists six registries for which this is allowed.[17] This act states that using data from the listed registries, "the name, personal identity number, and other characteristics that directly identify a natural person may be processed without the consent of the data subject" (quoted from section 8 in the Act).

The Patient Registries in Sweden, Finland, and Denmark allow for such personal identification in their health registries. A report published by Socialstyrelsens Epidemiologiska Centrum (2002) provides an insight into the many advantages of a personal health data filing system.[18] It underlines that this information may only be used for research and never in a way which may harm an individual. A report published by the Directorate for Health and Social Affairs[19] (2004) argues in favour of establishing NPR as a register that allows for personal identification (SHD Divisjon for sosial- og helsetjenester 2004). With such a register, one could use patients' actual waiting time and whether they have been readmitted or not when investigating patients' experiences.

If one were to say something about the effect of the treatment in the longer term, one would have to follow patients over a longer period of time. This could be quite resource-demanding. However, a patent register where one can follow patients over time would provide useful insight into both the short- and long-term outcome of a treatment.

[16] This is called "personentydig register" in Norwegian. This term refers to both a registry with direct identification and one in which pseudonyms are used.
[17] The Causes of Death Registry, the Cancer Registry, the Medical Birth Registry, the System of Surveillance of Infectious Diseases, the Central Tuberculosis Surveillance Registry, and the System for Immunization, Surveillance, and Control.
[18] It was available for download at http://www.socialstyrelsen.se in May 2005. A newer version, published in 2005, is now available.
[19] Sosial- og helsedirektoratet in Norwegian

6.2 Medical quality is not perfectly observable

How can one know whether a patient is given the right treatment? Patients are grouped according to an international statistical classification, the International Classification of Diseases, known as ICD-10. This classification is used together with cost weights that reflect the amount of resources needed in order to treat patients in each particular diagnosis group. The classification with cost weights is known as Diagnosis Related Groups (DRG). Patients are categorized according to the DRG they belong to when registered in NPR.

Knowing which DRG the patients in the patient survey belong to would provide useful information as to the type of treatment they received and thus the probability of being readmitted. One could also control for hospitals' case-mix in order to control for differences in waiting time.

With a register that allows for personal identification one could map the effect of different treatments over time. If a patient is admitted twice with the same DRG it might be because the treatment he received at the first admission did not have full effect. This would also allow for a mapping of how previous treatments may affect the outcome of a treatment the patient receives at a later point in time.

6.3 Future implications of the National Health Quality Indicators

Over time there will be a large amount of data on each of the national health quality indicators. It may resemble a world with full information where the quality aspects of each hospital are known to the government and the public.

In a world with full information the government has detailed information on the performance of every hospital. Both the level of activity and the quality of each hospital service is known. This does not mean that quality indicators are superfluous. I assume that with full information there would be a complete set of data on each indicator at hospital level. This could be used to compare hospitals and discover why quality varies between institutions. The government would be able to allocate resources to hospitals in accordance with their performance and the type and amount of resources they need.

In an article on hospital payment schemes, Chalkley and Malcomson (2000) show that cost compensation may be needed in order to reach a target quality level, set by the government. They assume high quality services are more costly to produce. Without compensation, the actual level of quality on hospital services will fall below the government's target level.

Determining the size of such compensation may prove difficult if the actual cost of producing high quality is unobservable, as is often assumed. An alternative presented by the authors is to let consumers choose health service provider based on the quality of these services. In order to make this choice consumers need information on the quality level of services produced by different providers. This type of information is available in Norway today with the information service Free Hospital Choice Norway. It is designed to provide patients that need treatment with the information necessary to make a qualified choice of which hospital they want to be treated at.

According to Hirschman (1970) consumer sovereignty consists of the ability to *voice* and the ability to *exit*. A consumer can voice if he is capable of letting the producer know he is not content with a service or product. He can exit by changing supplier.

Eika (2003) argues that consumer sovereignty, when it comes to health services, is severely restricted. She particularly points to how high moving costs may restrict the ability to exit. With one supplier or excess demand, the exit option may be altogether eliminated. With reduced possibility to exit, consumers' ability to voice is also limited. If there is no alternative supplier, the existing supplier lacks incentives to adhere to the complaints. There are even examples of retaliation towards service recipients that voice complaints when they have no option to exit.

The information service Free Hospital Choice, partly designed to empower Norwegian citizens, can thus be viewed as a means to increase consumer sovereignty in the hospital market. The publication of data on hospital performance is also meant to increase competition between hospitals, inspiring them to strive for improved quality in treatment. Hospitals' incentives to perform are strengthened when there is free hospital choice.

With free hospital choice consumers can choose hospitals according to their scores on the national health quality indicators. The web pages for free hospital choice Norway also contain hospitals' results from patient surveys, similar to the one used for patients' experiences in this thesis. Rational consumers can then compare the objective indicators to other patients' individual evaluations. If they see that patients are content despite long waiting time a rational consumer may disregard long waiting time. The rational consumer may even conclude that hospitals with long waiting lists have more patients because other aspects of their services are of a higher quality than other hospitals' services.

6.4 Readmissions and quality

Heggestad (2002) found in her study of elderly patients' probability of readmission that increasing costs does not necessarily increase quality. She found no statistically significant relation between higher costs and reduced probability of readmission. Hospitals faced with demands to increase productivity may respond by reducing the length of stay. According to Heggestad's study this may increase the probability of being readmitted but cannot be compensated by an increase in costs. What she did find was that a lower patient/staff ratio could increase the intensity of care which then could reduce the possibility of being readmitted. This might mean increasing costs but she claims that through better organization of hospital staff and resources the intensity of care can be increased for a given patient/staff ratio.

The policy implication that Heggestad draws from this study, is that increasing costs per admission is not enough to increase patient care. Increasing hospital staff was shown to have a positive effect on patient care. However, facing demands for increased efficiency hospitals might do better with a reorganization of existing personnel, with more efficient use of time and improved coordination of tasks. Readmissions that could be avoided are costly because they claim resources that could have been used elsewhere in the hospital. A reorganization that reduces the probability of readmissions without increasing costs to personnel may therefore contribute to reducing hospital costs.

6.5 Standicator measures and quasi-quality

During the 1990s the interest for quality of health services in Europe increased. This led to a need for a standardization of the concept of and measures for quality. Slagsvold (1997) is concerned with the effect of such standardized measures. She terms them "standicator measures", combining the words standard and indicator. She evaluated nine nursing homes using standicator and observational scores. Observational scores refer to clients' and staffs' observable behaviour and institutions' social "atmosphere". She found that "homes rated as good with the standicator measure might be said to have quasi-quality: they just *seemed* good" (Slagsvold 1997, p. 299). On the other hand, homes that rated highly among its residents came out poorly when standicator measures were used. An example of the latter was private rooms for all residents. One nursing home she visited did not provide its resident with this privacy. When speaking to the residents, she found that they preferred sharing their room with somebody else; they appreciated the company. Despite the residents' expressions of contentment the government decided to shut down the nursing home in question.

Slagsvold argues that the way standicator measures are registered and quantified makes it easy for institutions to manipulate them. This is an argument against the use of standardized measures as a means to compare institutions that provide health care services and for the use of observational scores.

According to Slagsvold's definition, the two objective quality indicators used in this thesis, readmission rates and waiting time must be regarded as standicator measures. The questions from the patient surveys, on the other hand, can be regarded as observational scores. They concern patients' perception of health personnel's behaviour and observational aspects of the hospital the patients are admitted to.

Using Slagsvold's terminology, the aim of my thesis was to investigate the relationship between two standicator measures and seven observational scores, i.e. the seven category variables used to represent patients' experiences. The results show that there is a significant relationship between one of these measures, the readmission rate, and what patients observe. Slagsvold is concerned about the lack of validity of standicator measures and their effect on the actual level of quality in health care institutions. Maybe my approach can shed new light on which standicator, or standardized, measures can be used to say something about quality of health services.

7. Conclusions and summing up

Using a simple regression model I have investigated the relationship between patients' experiences during a hospital admission and two hospital specific factors. These two factors were hospitals' readmission rates and mean waiting time. They were used as approximations to objective indicators of hospital level quality. The data on these two variables were provided by SINTEF Health who runs the Norwegian Patient Register. The register is owned by the Directorate of Health and Social Affairs.

The data on patient satisfaction with hospital services were taken from an anonymous survey among patients admitted to somatic hospitals. They received the surveys two to three weeks after discharge. The response rate was approximately 50 %. The questions in the survey concerned issues such as health personnel's ability to convey and receive relevant information, as well as provide care, treatment, and pain relief. There were also questions on patients' impression of hospital equipment, general standard, and facilities and sanitary conditions.

The survey consisted of 50 questions that I grouped into seven category variables, according to the type of service the different questions concerned. These categories were *content*, *info*, *info2*, *facisani*, *care*, *org*, and *improve*. Patients were also asked about their gender, age, health status, education level, number of admissions last two years, and whether their first language was Scandinavian. I was thus able to control for these characteristics.

My main empirical finding was that hospitals' readmission rates have a negative and significant impact on patients' experiences. The empirical results support the hypothesis that hospitals' readmission rates, used as an indicator of medical quality at hospital level, affect patients' satisfaction with the hospital services they receive. One may question the validity of the OLS results since data on two different levels are used. However, there are also arguments against using alternative approaches at least until better data on hospital specific factors are available.

Hospitals' mean waiting, used as an indicator of service quality, was only significant for the category variable *facisani*, where it had a positive effect. The reason for these results may be that there is a trade-off between medical and service quality and that once admitted patients care more about the medical quality of the treatment than they do about the waiting

time prior to the admission. Hospitals that prioritize medical rather than service quality may therefore be rated higher by patients admitted to these hospitals.

The positive results for the waiting variable on the *facisani* variable are probably caused by some underlying factor that affects both waiting time and these conditions. In order to detect such underlying factors a closer inspection of hospitals' waiting time and other hospital specific factors is needed.

Patients' age, health status, number of previous admissions, and education level significantly affected their satisfaction with hospital services. The age effect was positive but decreasing. Patient satisfaction decreased with the number of admissions and with patients' education level. Patients' health status, however, had a positive effect on their satisfaction with health services.

Patient characteristics explained the main share of the variation in patients' experiences. Including dummies for hospitals increased the share of variation explained indicating that there are hospital specific factors present that affect patient satisfaction. Of this increase readmissions and waiting time explained a small part. These indicators of hospital service quality are perhaps too general to explain more of the variation. More precise measures could be to include dummies for whether patients were admitted or not and patients' actual waiting time. In order to do this a patient register that allows for personal identification is needed. The Norwegian Patient Register does not allow for such identification.

Investigating the cross-effect between age and the readmission rate showed that younger patients respond more negatively to a given readmission rate than older patients. A reduction in the readmission rate by one standard deviation had the greatest positive effect on the youngest patients' level of satisfaction. The effect slowly decreased and from the age 73 and onwards the effect was close to zero.

Readmission rates are not included in the eight national health indicators formulated by the Directorate for Health and Social Affairs. There has been some debate concerning the validity of readmission rates as quality indicators. According to the OLS regression results patients admitted to somatic hospitals with low readmission rates are more content with the care, treatment, and information they receive. I hope that this thesis may pave the way for further investigation of the use and usefulness of readmissions as indicators of the quality of hospital services.

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