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Regulation versus practice

The impact of accessibility on the use of specialist health care in Norway

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The impact of accessibility on the use of specialist health care in Norway

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Summary

In Norway specialized health services are provided both by public hospitals and by privately practicing specialists who have a contract with the public sector. Patients' co-payment is the same irrespective of the type of provider they visit. The ambition of equity in the allocation of medical care is high among all political parties. The instruments for auditing whether these goals are fulfilled are not equally ambitious. The objective of the present study is to explore whether laws and regulations that govern the allocation of specialist health care resources in fact are fulfilled. Panel data from the Survey of Living Conditions are merged with data on capacity and spatial access to primary and specialist care. We find that accessibility and socio-economic variables play a considerable role in determining both the probability of at least one visit and the number of visits to a private specialist. A person with a higher university degree living in a municipality with the highest value of the geographical accessibility index has a 46%-points higher probability of at least one visit to a private specialist compared with a person with junior high living in a municipality with the lowest value of the accessibility index. With regard to visits to a hospital outpatient department these variables are not found to have significant effects.

We conclude that public ambitions and regulations are fulfilled for specialist services provided by public hospitals. With regard to the provision of services provided by publicly financed private specialists we find a discrepancy between public goals and surveyed practice.

1. INTRODUCTION

In publicly financed health service systems the unpredictability of the quality of health care has been well known for a long time. In national health care systems, as in Great Britain and the Nordic countries, people do not have individual contracts that specify what they should expect from their health service. In these countries priority assignment of patients is determined by the parliament in terms of laws and regulations. For instance in Norway, the Act on Patient Rights states that the allocation of health services should be determined by a combination of the seriousness of a patient's illness, the expected health gain of treatment and the health effect relative to the cost of treatment. The Act on Health Enterprises[3] states that the aim of the health enterprises is to provide high quality specialist health care on an equitable basis to patients in need, irrespective of age, sex, place of residence, material resources and ethnic background.

In this paper we use a population-based survey to study to what extent the aim of the health enterprises according to the law is fulfilled. Our data allow us to consider a broad selection of individual patient characteristics since we use Survey of Living Conditions data merged with data on capacity and spatial access to primary and specialist care. Hence, the present study takes account of a full range of factors that could potentially influence the variation in utilization rates between individuals. We distinguish between visits to hospital outpatient departments and visits to private specialists financed by the National Insurance Scheme. We also empirically distinguish between access and utilization.

In a previous study (Iversen and Kopperud, 2003) we find from cross-section data that a person's self-assessed health contributes to the probability of outpatient visits and inpatient stays in the sense that poorer health increases the probability of use. The probability of visits to a private specialist is, however, less influenced by a person's self-assessed health. We also find that geographical access seems to influence the use of private specialists, but not the use of public hospitals. Objections could be raised against

3 Health Enterprises are independent state-owned enterprises responsible for providing hospital services and other specialist health care to the population.

the cross-section data employed in that study. A serious one is the fact that health assessment is carried out at the time a person is interviewed, while the registration of medical care use relates to the twelve months preceding the interview. Hence, a person in good health now may previously have been in poor health and recovered after treatment. This indicates an insignificant relationship between health status and use of specialist care, according to the sequence of data registration. We cannot rule out the possibility that our missing relationship between health and utilization in the private sector is caused by a higher probability of gaining health in the private sector compared with the public sector. A closer study of this question requires panel data where health assessment and health care utilization are registered in an appropriate sequence.

In the study presented in this paper we have access to panel data from the Norwegian Survey of Living Conditions. Hence, we now possess data that show self-assessed health prior to the use of health services. Our main empirical results are that the probability of at least one visit to a hospital outpatient department depends on a patient's self-assessed health as predicted. Again, we find that the geographical access to the hospital does not have any impact on the use of outpatient services. Also, the probability of at least one visit to a private specialist depends on a patient's self-assessed health. In addition, the estimated probability is positively influenced by a person's level of education and geographical access to private specialists. In the concluding remarks we discuss the policy implications of our findings and in particular the need for setting up systems for auditing the implementation of public decisions.

The paper proceeds as follows. Section 2 describes the institutional framework. Section 3 presents the data. In Section 4 the estimation methods and empirical results are presented. Section 5 discusses the policy relevance and possible implications of the study.

2. INSTITUTIONAL FRAMEWORK

Norway has a national health service. The parliament decides the institutional framework with regard to financing, ownership, and allocation of resources to the health sector and within the sector. The data that are used in the present study are from 1998-

2000. During that period each county council is responsible for the financing, planning and provision of specialized health care[4]. Hospitals are financed by a mix of fixed budget and per case funding of outpatient and inpatient treatments. Patient co-payment is requested for outpatient treatment, but not for inpatient stays.

Private specialists also provide specialist health care. About 10 % of physicians engaged in specialist health care are in private practice. The proportion of specialist consultations that is taken care of be the private specialists is not known at the national level, but a rough guess is 20 per cent. Since 1 July 1998, funding from the National Insurance Scheme requires that a privately practicing physician has a contract with a county council (after 1 January 2002 with an appropriate regional health enterprise). The practice income of a contract physician is partly from a practice allowance and partly from a fee-for-service component, where a patient co-payment is included. About two third of a contract specialist's practice income is expected to come from public funding. The patient's co-payment is independent of whether he is treated at a hospital outpatient department or by a contract specialist, and was about 20 USD per consultation at the time of data collection. Specialists without a contract are mainly located in the biggest cities and receive their total practice income directly from their patients. Hence, patients are likely to pay a considerably higher co-payment per consultation to a specialist without a contract compared with a hospital outpatient department or with a contract specialist. Although the exact number of specialists without a contract is not known, they are a tiny proportion of the total number of practicing physician specialists.

Table 1 shows the distribution of contracts with private specialists and the distribution of population according to regional health enterprises.

(Table 1)

From Table 1 we see that the centrally located enterprise Health East has just below one half of the total number of contracts and are responsible for specialist services to just above 1/3 of the country's population. On the other hand, Health North has 6% of the

[4] From 1 January 2002 the state took over the ownership of hospitals and other specialist health services and thereby the responsibility for providing specialized health care to all Norwegian residents through the establishment of five regional health enterprises.

total number of contracts and is responsible for 10% of the county's population. Hence, with a skewed distribution of specialist contracts towards urban parts of the country, we suspect that also the use of the specialists' services is skewed towards patients living in urban areas. However, we cannot rule out the possibility that patients living in rural areas are traveling to urban areas to see a specialist and hence, evening out the distribution of actual use of services according to patients' municipality of residence. Nor can we rule out the possibility that patients living in rural areas are more likely to visit a hospital outpatient department, and hence even out the total use of specialist services between urban and rural areas. Accordingly, in order to study whether the laws that prescribe the allocation of health services are fulfilled, we need to analyze data on the population's actual use of health services.

The observed utilization pattern of specialist services is a result of an interaction between several decision-makers with separate objectives and constraints. Figure 1 depicts the main flow of patients.

(Figure 1)

For non-emergency care, an individual with symptoms of a disease usually visits a general practitioner (GP). GPs are either employed by or have a contract with a municipality, the lowest level of government. GPs are located in their own offices, and the distance to a private specialist or a hospital may well be long in remote areas of the country. According to Figure 1, the GP may treat the patient himself or send a referral to a private specialist, a hospital outpatient department or admit the patient to an inpatient stay. The patient may also contact a specialist directly, since the role of the GP as a gatekeeper is not strictly adhered to. After treatment in the specialist sector, the patient may be referred back to general practice or to self-care.

Hence, there are four decision-makers determining a patient's use of specialist care: the patient himself, his GP, the private specialist and doctors at the public hospital. They have their specific preferences and constraints. The patient is assumed to have a preference for his own health, income and leisure, as standard in the health economics literature. Important constraints are time and income constraints and the production function for health. The GP is assumed to have preferences for his patients' health, and

his own income and effort (negative). He is also constrained by his budget, where income and cost components depend on the remuneration system imposed, and his time constraint. His decision variables are the kind of treatment he should initiate for each of his patients, including whether he should refer the patient to a private specialist or a hospital. We assume that the private specialist has the same kind of preferences as the general practitioner. Also for him the decision variables are the kind of treatment he should initiate for his patients, including whether he should refer a patient to a hospital or recommend further treatment in general practice. At the hospital level, physicians are salaried. Hence, their income is independent of the clinical decisions they make, although income and costs for the hospital may be affected. We assume that salaried hospital doctors have preferences for patients' health and own effort (negative) and that their decisions are compatible with the hospital's budget constraint. Visits to a hospital outpatient department and inpatient stays are rationed in the sense that a patient usually needs a referral to gain access to these services. A referral usually precedes a consultation with a private specialist too, but for some conditions a referral is not required. Some diagnostic and curative services are only provided by hospitals. The crucial decision variable for a hospital consultant is the kind of treatment that should be prescribed for each of the patients who are referred to the hospital. Alternative decisions are to admit the patient immediately as an inpatient or outpatient, put him on a waiting list or refer the patient back to general practice.

We highlight three groups of variables that contribute to whether a patient ends up with a consultation in private or specialist care or is treated by the GP he initially contacted.

The patient's health and type of medical problem

According to the Act on Patient Rights, the GP should consider the seriousness of the patient's illness, the expected health gain from further examination and treatment and the expected health effect relative to the cost of treatment when he/she decides on means of treatment. The GP's consideration of the patient's health status and potential for improvement is therefore crucial.

Capacity in general practice

We suggest that GPs are more inclined to refer patients to special health care the lower physician density in general practice in a local area is. The reason is that a low

physician density implies a high opportunity cost of providing services in terms of fewer patients that can be seen.

Capacity, organization and remuneration in the specialist sector

A low capacity in the specialist sector may imply a long waiting time for the patient or a high probability of having a referral rejected. A patient may therefore be better off by staying with the GP. Long travelling distances for seeing the specialist points in the same direction. Our data do not contain information about referrals. Hence, we cannot distinguish between contacts with and without referrals in the empirical section.

Since rationing[5] occurs to a greater extent in hospitals than in private practice, we would expect that patients' health status on average is better in private practice than in public hospitals. On the other hand, if GPs are worried about the waiting time patients may experience in hospitals, they may be likely to refer even patients with poor health to private specialists. A priori we therefore cannot conclude whether patients' health is expected to be better in private practice than in hospital outpatient departments. For both types of providers we can, however, predict that a decline in a person's health status should increase the likelihood of a visit if providers adhere to the national guidelines of prioritization.

3. DATA AND DESCRIPTIVE STATISTICS

Our data set is obtained by merging data from three different sources. The main file is from the Survey of Living Conditions conducted by Statistics Norway and consists of panel data for the years 1998-2000. The panel contains 5308 respondents from the Norwegian population, aged 16 and older. The sample is representative with respect to sex, age, marital status and geographical region. When a person drops out of the panel, another person from the population replaces him or her. Hence, the total panel is not represented in every year. In our analysis there are observations in terms of interview data and register data of 3501 individuals. In addition to health-related information, the survey also includes information on various living conditions, education, income,

[5] By rationing we mean that some patients are turned down or offered a very long wait.

employment, etc.

The second source is the Commune Database, which contains statistics since 1769 for all 435 municipalities in Norway. The database covers demographic and occupational information, welfare-related statistics and data on provision of public services. More than 190 000 variables are available for each municipal unit.

The third data source is an index that describes the accessibility of specialized health care in Norway at the municipal level (Kopperud, 2002). The construction of this index is inspired by the work of Carr-Hill et al. (1994). The specialist care included is hospitals (outpatient and inpatient care) and privately practicing physician specialists with a contract with a county council. The index measures the availability of specialized health care in each municipality within each of the five health regions. Three elements are incorporated in the index: the capacity of the specialized health care in each municipality where the service is provided, the distance from a municipality to be served to the municipality where the service is provided, and a discount factor that converts the distance to estimated access. The capacity is measured along three dimensions: hospital beds, hospital physicians and private specialists.

The joint accessibility A_{ikr} for the residents in municipality i in county k in region r is:

$$A_{ikr} = c\left[\frac{1}{P_k}\sum_{j=1}^{n_k} S_j^{(1)} f\left(d_{ij}\right) + \frac{1}{P_r}\sum_{j=1}^{n_r} S_j^{(2)} f\left(d_{ij}\right) + \frac{1}{P}\sum_{j=1}^{435} S_j^{(3)} f\left(d_{ij}\right)\right]$$

where P_k is the population in county k, P_r is the population in region r, and P is the total population in Norway. There are n_k municipalities in county k, n_r municipalities in region r and 435 municipalities in Norway, where $n_k < n_r < 435$. $S_j^{(1)}$ is the capacity of the county level specialist health care in municipality j. $S_j^{(2)}$ is the capacity of the regional level specialist health care in municipality j. $S_j^{(3)}$ is the capacity of the national level specialist health care in municipality j. Capacity is measured along one of the dimensions hospital beds, hospital physicians and private specialists, all per capita at the relevant geographical level. d_{ij} is the distance between a municipality j with a health

care facility, and the municipality i to be served. $f\left(d_{ij}\right)$ expresses the effect of distance on access. Distance is measured in travel time by car from one municipal center to another[6]. Since in fact faster modes of transportation are used for longer distances (airplanes), access is assumed to decline with distance at an increasing rate (negative first order derivative and positive second order derivative) [7]. c is a constant. The accessibility index is further described in the Appendix. We emphasize that there is no obvious choice of the functional form of $f\left(d_{ij}\right)$. Hence, we have tried various specifications of the functional form of $f\left(d_{ij}\right)$ that satisfy the conditions of negative first order derivative and positive second order derivative. Our results seem to be robust with regard to the choice of parameter values.

(Table 2)

Table 2 shows the three estimated measures of the accessibility of specialized health care: one estimated accessibility index for *hospital beds*, one for *hospital physicians* and one for *privately practicing specialists*. In our sample, the access to specialized health care is on average higher than for the average municipality in the country, normalized to zero. The reason is that although our sample is representative of the population, it may not be representative of the municipalities. Smaller municipalities with relatively poor access are likely to be underrepresented in the sample. The index is on average 1.7 for access to *hospital beds*, 1.9 to *physicians in hospitals*, and 2.3 to *private specialists*. The accessibility index for those who have *visited a private specialist* is higher according to all dimensions compared with the group who has visited a hospital outpatient department.

Utilization

Data on utilization of health care are the figures provided by the respondents of the

[6] InfoMap Norge AS provided the distance matrix. We have also used an alternative matrix with distance measured in kilometers. Our results turn out not to be sensitive to the choice made.

[7] This means that the first order derivative is negative $f'\left(d_{ij}\right) < 0$, and the second order derivative is positive: $f''\left(d_{ij}\right) > 0$.

Survey of Living Conditions. We consider two measures of utilization of specialist care: *visits to privately practicing specialists*[8] *and hospital outpatient visits*. During the last 12 months, 17% of the sample has had one or more *visits to a private specialist while 19*% of the sample has had at least one *outpatient hospital visit*. Among those who had at least one visit to a private specialist, the average number of visits is 2.34, respectively 2.58 for visits to a hospital outpatient department. The distribution is skewed to the right (skewness=13.7 and 11.9, respectively). A rather small proportion of the sample consumes a large number of health services. Our data do not contain the number of hospital inpatient stays during the observation period.

The density of general practitioners at the municipal level is measured by the ratio *GPs per 10,000 residents*, and is a measure of the capacity in primary care in the residential municipality. The average *GP ratio* is 7.79 per 10,000 residents. 24% of the respondents have a regular health center and 60% have a *personal GP*.

Because of the long recall period (12 months), the reported number of visits may contain recall bias. In addition, the data contain no information on the total number of visits according to completed illness spells. It is likely that the data include incomplete spells. Some of the visits may be the result of an illness spell that started before the observation period, and counts may therefore be misinterpreted as first contacts. Some of the illness episodes may also continue after the observation period. As a result, the distribution of the number of visits may be mixed with left, right and no truncation. Furthermore, contacts during the observation period may also be the result of several illness episodes and accordingly several first contacts.

Health status

The indicator of health care need is *self-assessed health* and *chronic illnesses*[9]. *Self-assessed health* is measured as a five-point health status scale: *very good*, *good*, *fair*, *bad* and *very bad*. In the whole sample, 76% state that they have *very good* or *good* health, although 31% report that they suffer from a *chronic illness*.

[8] These physicians are privately practicing and may or may not have a contract with the county council that entitles them to a practice allowance.

[9] Due to insufficient data we do not take the capacity to benefit into consideration, and in general expose ourselves to criticism raised, for instance, by Goddard and Smith (2001).

Socio-demographic characteristics

The sample is made up of 52% women, and the average age is 44.6 years. 26% of the sample has a university degree, and the average household income is NOK 338,000[10].

4. ESTIMATION METHODS AND RESULTS

First, we estimate *the probability of at least one contact* for each type of specialized health care: *visits to private specialists and hospital outpatient visits.* Next, we examine what determines *the number of visits* to private specialists and hospital outpatient departments, respectively.

In the literature it is usual to distinguish between the first contact during an episode of illness and subsequent contacts. While the patient initiates the first contact, the physician (agent) in agreement with the patient (principal) initiates subsequent contacts. Hence, there may be different types of factors that influence the first contact compared with subsequent contacts. Recent contributions to the literature have aimed at distinguishing between the two kinds of decisions in the estimation procedure. As a consequence of the rejection of the single spell assumption in our data set, we are not able to distinguish between the contact decision and the follow-up decision in our analysis. Hence, our data do not allow us to interpret the first contact as the patient's decision and subsequent contacts as a provider's decision. The analysis is therefore confined to estimating the factors that influence the utilization of specialist services without distinguishing between patients' and providers' decisions. We use the software Limdep 8.0 in estimating the models.

When examining the factors that contribute to at least one contact, we consider a discrete dependent variable, Y, that shows whether an individual is a "non-user" ($Y = 0$), a "user of private specialist services" ($Y = 1$), a "user of public hospital outpatient services" ($Y = 2$) or a "user of both types of specialist services" ($Y = 3$). Assuming a logistically distributed error term, the probability of being a "user of type j"

[10] 1 USD is approximately NOK 6.50

is $\text{Prob}(Y = j) = \frac{e^{x\beta_j}}{1 + \sum_{m=1}^{3} e^{x\beta_m}}$, where vector *x* contains explanatory variables, β_j (j=1,2,3) are coefficients to be estimated, and j=0 is the reference. The estimated βs are found from the maximization of the log likelihood function.

The multinomial logit model relies on the Independent of irrelevant alternatives (IIA) condition. To check whether this condition is fulfilled we have also estimated the model when one option of specialist care is removed (for instance receiving care from both hospitals and private specialists). The estimated coefficients of the remaining options are robust with regard to this removal. Hence, we conclude that the IIA condition is fulfilled.

The dependent variable in the second part of the analysis measures *the number of visits to a privately practicing physician during the last 12 months*, and *the number of hospital outpatient visits during the last 12 months*[11]. Count data regression models (Cameron and Trivedi, 1998) are used since the dependent variable is measured as non-negative integer counts. We start with the standard Poisson distribution. An important property of the Poisson model is that the mean equals the variance. This assumption is sometimes too restrictive (Mullahy, 1997). We see from Table 2 that in our case the variance exceeds the mean to a considerable extent. Hence, the negative binomial model, which allows for over-dispersion, i.e. the variance to differ from the mean (Cameron and Trivedi, 1998), is also estimated. We test the Poisson models for over-dispersion according to Cameron and Trivedi (1990). The loglikelihood ratio when testing the negative binomial (NB) model against the Poisson model, is 1672.97 (*the number of visits to a privately practicing physician during the last 12 months*) and 2915.83 (*the number of hospital outpatient visits during the last 12 months*). The NB models increase the log likelihood significantly, and this leads to rejection of the Poisson models. The over-dispersion parameter *alpha* in the negative binomial models is positive and significant for both models. Hence, there is strong evidence of over-dispersion and we continue with the NB models.

[11] In the analysis of visits to private specialists we omitted an individual with 97 visits, and in the analysis of visits to hospitals we omitted an individual with 99 visits. We have reasons to believe that these figures are not real. If the individual with 97 visits is included in the analysis of visits to private specialists, the significant effect of accessibility on the number of visits disappears.

The results of the estimated models are shown in Table 3[12]. We focus on the effect of self-assessed health, socio-demographic characteristics and access to health care on the use of specialist health care. The individuals' self-assessed health is a dummy variable for each of the health conditions *very good*, *good and fair*. We further add a dummy variable for *chronic illness*. We have dummy variables for being a *man*, for age groups: 31-50, 51-70 and over 70, and for education: high school, low university and high university degree. There is a dummy variable for individuals who have a *personal GP,* and individuals who have a *regular health center*. There are variables describing *access to GPs* and *to specialized health care*[13]. In the model, the reference individual has *very bad or bad self-assessed health*, does not have a *chronic illness,* is a female between 16-30 years of age, with highest degree from junior high, and does not have a *personal GP* or attend a *regular health center*.

(Table 3)

Table 3 shows the marginal effects of the explanatory variables. We see that the perceived health states *very good*, *good* and *fair* are found to negatively influence *the use of private specialists* and *hospital outpatient departments* at a statistically significant level compared with *bad or very bad health*. Also, *chronic illness* contributes positively to both types of visits.

Being a *man* affects the probability of a visit negatively, while a higher degree contributes positively to a visit to a private specialist compared to junior high as highest degree. Having a high university degree increases the probability of at least one visit to a private specialist by 11 %-points at the margin compared with junior high as the highest degree. There is no effect of education on the occurrence of visits to public hospitals. Also household income has a positive impact on the use of private specialists,

[12] The estimated model contains all four alternatives with (Y=0) as a reference. Table 3 only exhibits the effects on utilization of private specialists (Y=1) and hospital outpatient departments (Y=2).

[13] I.e. access to hospital beds, access to hospital physicians and access to private specialists. See Appendix for details.

but not on the use of hospitals. The age effect is more uniform for hospitals than for private specialists in the sense that the oldest age group both has the highest probability of a visit and the highest number of visits.

Individuals with a *personal GP* have a significantly (1%) higher probability of a visit to a *hospital outpatient department*. We also find that the number of *hospital outpatient visits* increases with a personal GP (significant at 1%), and with having a regular health center (significant at 5%). These effects of an individual's relations to primary care physicians are not found for the number of visits to private specialists.

The higher the *GP per resident* ratio is, the lower are the probability of a visit and the number of *visits to a private specialist* (significant at 1%). These effects are not found for visits to hospital outpatient departments, and indicate that private specialists function as an alternative to primary care physicians.

While there is no effect of accessibility on the probability of a visit to the hospital outpatient department, there is a positive impact of the *accessibility index for private specialist* on the probability of a *visit to a private specialist*. At the margin an increase of one point increases the probability of a visit by 1.2 %-points. This implies that other things equal, the probability of at least one visit is 10-15 %-points higher if you live in an urban area compared with the remote areas of the country. The effect of accessibility is also valid for the number of visits.

In sum, we could say that accessibility and socio-economic variables play a considerable role in determining the probability of at least one visit and the number of visits to a private specialist. A person with fair health and a higher degree of university education living in a municipality with the highest value of the accessibility index has in fact 46%-points higher probability of at least one visit to a private specialist than a person with fair health and junior high living in a municipality with the lowest value of the accessibility index. With regard to visits to a hospital outpatient department these types of variables are not found to have significant effects.

An interesting question is whether there is an effect of the interaction between access and a patient's health status. Another candidate is an interaction between health status

and education. We included these interaction variables without finding statistically significant effects. Hence, we dropped the interaction effects among the results displayed in Table 3.

It should be mentioned that the predictive power of the model is moderate. Based on a threshold probability of 0.31 (the proportion of the sample who report any visit to specialist health care), 1634 of 2427 non-users and 648 of 1074 users of any specialist service are correctly predicted. This result corresponds to a positive predicted value of 0.45 and a negative predicted value of 0.79.

Visits to private specialists are registered for the two subsequent years 1999 and 2000. Panel data may improve the estimation by increasing the number of observations per individual. Because of unobserved heterogeneity error terms are likely to be correlated over time. Unobserved heterogeneity could be handled also for models with discrete dependent variables (Green, 2003, 698). In this paper we have chosen a technically less complicated procedure. We have simply calculated the means of the dependent variable and the independent variables over the two years for each individual. Hence, the dependent variable indicating whether an individual has visited a private specialist now has three possible values: not visited, visited in one of the years and visited both years. This variable may be interpreted as observations, y_i, of a latent continuous variable $y_i^* = \beta' x_i + \varepsilon_i$ with $\varepsilon_i \sim N(0,1)$, and

$$\begin{aligned} y_i = 0 \quad & if \ y_i^* \le \mu_0, \\ 1 \quad & if \ \mu_0 < y_i^* \le \mu_1, \\ 2 \quad & if \ y_i^* > \mu_1. \end{aligned}$$

where μ_0 and μ_1 are threshold parameters to be estimated.

Table 4 shows the results of the estimation of this ordered probit model. The sign of the statistically significant variables are similar to what we found when only the last period was considered separately (Table 3).

(Table 4)

Table 4 also shows the effect of independent variables on the average annual number of visits during the last two years. Since this variable is considerably skewed to the right, a logarithmic transformation of the dependent variable is done and heteroscedasticity robust (White) estimators are obtained. The estimation produces statistically significant effects similar to the effects estimated with data only from year 2000 survey (Table 3)[14].

5. POLICY IMPLICATIONS

The motivation for this study has been to explore whether the laws and regulations that govern the allocation of health care resources are fulfilled. In Norway the ambitions of all political parties are high in this field, as seen by the laws approved by the parliament and described in the introductory section of this paper. In particular, an individual's use of specialist health services should depend on the individual's need and should not depend on age, sex, income, municipality of residence etc. Since politicians are often reluctant to give verifiable commitments, the instruments for auditing whether these goals are fulfilled are not equally ambitious. This is due both to the chance of alienating voters and to the chance of being held liable for broken promises. For instance, the Act on Patient Rights states that a patient has a right to treatment only if the expected health gain from treatment is reasonable compared with the cost of treatment. In order to judge whether a patient in fact has a right to be treated, we need to know what a reasonable relationship between effect and cost is. So far, no politician has been willing to be precise on this matter. On the contrary, politicians who approved the law label decision-makers who ask for an upper limit as cold and cynical.

As a result, reluctance to give commitments spills over to reluctance to initiate studies of whether laws and regulations are implemented. Since equity is a relative concept, an individual complaint is insufficient evidence to conclude that a system is inequitable according to its own standard of equity. Hence, auditing requires systematic collection of data from hospital files and population surveys.

[14] Care should be taken when considering the magnitude of the effects on the unlogged dependent variable, see Manning (1998).

In this paper we have used a data set constructed to shed light on whether laws and regulations in fact are implemented. This data set is made by merging survey data with data on geographical access to primary care and specialist care. We found that the use of hospital outpatient clinics was closely related to a person's self-assessed health in the sense that poor health is likely to increase the use of hospital outpatient services. We found no effect of the access to specialist health care depending on a person's municipality of residence. On the other hand, the use of private specialists was positively related to the geographical access to the specialists. Also a person's level of education contributed positively to the use of private specialist services.

For both types of services, an individual's age and sex contributed to the use of specialist services. That men use health services to a lesser extent than women is well known from other studies (for instance, Elstad, 1991). That age has an effect in addition to self-assessed health may indicate that people's perception of good health is influenced by their age. The effect of a personal GP might have been positive or negative depending on whether the GP's role as his patient's agent dominates the gatekeeper role. The positive effect on the use of hospital outpatient services means that the role as the patient's agent dominates. This result corresponds to the findings in a recent Norwegian study (Carlsen and Norheim, 2003). It may also be that people in poor health to a greater extent have a personal GP compared with people in good health. Hence, health status and having a regular GP are likely to be correlated. We have therefore done sensitivity analysis. It turns out that the coefficients are stable irrespective of whether the regular GP variable is included or not.

Our study adds to the literature of whether persons in equal need of treatment receive similar treatment regardless of their income, as reviewed by Wagstaff and van Doorslaer (2000). They conclude that there is growing evidence that, in the US, the distribution of health care by income is not consistent with health care being allocated according to need. There is some evidence that pro-poor inequities in inpatient care are compensating for pro-rich inequities in specialist and outpatient care. Within the EU countries Wagstaff and van Doorslaer do not find a straightforward link between the features of the system and the degree of inequity.

In short, the results of our study show that public ambitions and regulations seem to be fulfilled for the specialist services provided by the public hospitals. With regard to the provision of services provided by publicly financed private specialists we find a discrepancy between the public goals and the actual characteristics of the patients treated. In contrast to what the Act on Health Enterprises prescribes, the use of private specialists depends on education and municipality of residence.

These findings have implications both for the regional health enterprises and for the institutions responsible for auditing the implementation and maintenance of public policy. The office of the Auditor General of Norway is the controlling agency of the Norwegian Parliament, and hence, the institution that is expected to verify whether laws and regulations are adhered to. Since the present study is rather broad, a follow-up could be a study of patient flows with more detailed information on activities and the composition of patients. If such a study confirms our results, the regional health enterprises are obliged to decentralize the location of private specialists or to make it less costly for patients in rural areas to visit private specialists. Another possible action would be to make the policy goals less ambitious with regard to equity. This alternative requires the parliament's approval and is for obvious reasons not politically attractive, in particular in a country where rural interests have a strong impact on political decision-making.

REFERENCES

Cameron, A. C., Trivedi, P. K., 1998. Regression analysis of count data. Cambridge: Cambridge University Press.

Cameron, A. C., Trivedi, P. K., 1990. Regression based tests for overdispersion in the Poisson model. Journal of Econometrics 46, 347-364.

Carlsen, B., Norheim, O. F., 2003. Introduction of the patient-list system in general practice. Changes in Norwegian physicians' perception of their gatekeeper role. Scandinavian Journal of Primary Health Care 21, 209-213.

Carr-Hill, R. A., Hardmann, G., Martin, S., Peacock, S., Sheldon, T. A., Smith, P., 1994. A formula for distributing NHS revenues based on small area use of hospital beds. University of York: Centre for Health Economics.

Elstad, J. I., 1991. Flere leger, større bruk? Artikler om bruk av allmennlegetjenester.

INAS- Rapport 1991:11. Oslo: Institutt for sosialforskning.

Greene, W. H., 2003. Econometric analysis. New Jersey: Prentice Hall.

Goddard, M., Smith, P., 2001. Equity of access to health care services Theory and evidence from the UK. Social Science and Medicine 53, 1149-1162.

Hagget, D., Cliff, A. D., Frey, A., 1977. Locational models. London: Edward Arnold.

Iversen, T., Kopperud, G S., 2003. The impact of accessibility on the use of specialist health care in Norway. Health Care Management Science 6, 249-261.

Kopperud, G. S. 2002. Beregning av tilgjengelighetsindeks til spesialisthelsetjenester på kommunenivå. HERO Working paper 14/2002. Oslo: University of Oslo.

Manning, W. G., 1998. The logged dependent variable, heteroscedasticity, and the transformation problem. Journal of Health Economics 17, 283-295.

Mullahy, J., 1997. Heterogeneity, excess zeros, and the structure of count data models. Journal of Applied Econometrics 12, 337-350.

Wagstaff, A., Doorslaer, E., 2000. "Equity in health care finance and delivery." In Handbook of health economics, edited by A. J. Culyer and J. P. Newhouse, pp. 1803-1862. Amsterdam: Elsevier.

Wilson, G. A., 1974. Urban and regional models in geography and planning. Chichester: Wiley.

Table 1: Distribution of contracts with private specialists 2002 and distribution of population according to regional health enterprise.

	Health East	Health South	Health West	Health Middle	Health North	Sum
Distribution of private specialists	48 %	18 %	17 %	10 %	6 %	100 %
Distribution of population	36 %	20 %	20 %	14 %	10 %	100 %

Table 2: Descriptive statistics - mean (standard deviation) of the variables.

Variable	Definition	Private specialist visits N=589 (17%)	Hospital outpatient visits N=667 (19%)	The whole sample N=3501
Very good health	=1 Very good health	0.19	0.17	0.26
Good health	=1 Good health	0.46	0.41	0.50
Fair health	=1 Fair health	0.23	0.27	0.17
Bad or very bad health	=1 Bad or very bad health	0.12	0.15	0.07
Chronic illness	=1 if the person has a chronic illness	0.46	0.49	0.31
Man	=1 if man	0.38	0.39	0.48
Age	The respondent's age	47.1 (16.5)	48.4 (16.5)	44.6 (16.6)
Junior high	=1 if highest education is junior high	0.16	0.21	0.18
High school	=1 if highest education is high school	0.57	0.56	0.56
University low	=1 if university degree after 3 years	0.21	0.21	0.21
University high	=1 if university degree after 5 years or more	0.06	0.03	0.05
Household income	Household income in NOK 100,000	3.86 (7.93)	3.35 (2.71)	3.38 (3.85)
GPs per 10,000 residents	No. of GPs per 10,000 residents in the municipality	7.71 (1.53)	7.81 (1.69)	7.79 (1.67)
Personal GP	=1 if the individual consider himself to have a personal GP.	0.68	0.69	0.60
Regular health center	=1 if individual sees a regular health center	0.21	0.23	0.24
Hospital outpatient visits	=1 if individual has been at hospital for outpatient visits during the last 12 months	0.31	1	0.19
Number of hospital outpatient visits	The number of hospital outpatient visits during the last 12 months.	0.69 (2.16)	2.58 (6.35)	0.49 (2.95)
Visits to a private specialist	=1 if individual has had at least one visit to a private specialist during the last 12 months	1	0.27	0.17
Number of visits to private specialists	The number of visits to privately specialists during the last 12 months	2.34 (4.89)	0.68 (2.33)	0.39 (2.19)
Access to hospital beds	Accessibility index estimated for hospital beds	1.83 (2.43)	1.52 (2.25)	1.68 (2.37)
Access to hospital physician	Accessibility index estimated for hospital physicians	2.10 (2.84)	1.70 (2.58)	1.90 (2.73)
Access to private specialists	Accessibility index estimated for private specialists	2.70 (3.57)	2.03 (3.19)	2.31 (3.42)

Table 3: The estimated marginal effect of independent variables (t-values) on use of private specialists and hospital outpatient departments during last 12 months

Variables	Multinomial logit model: Probability of at least one visit		Negative binomial model: Number of visits	
	Private specialists	Hospital outpatient	Private specialists	Hospital outpatient
Constant	-0.06 (-1.5)	-0.17** (-4.1)	0.11 (1.0)	-0.13 (-1.2)
Very good health	-0.08** (-3.4)	-0.13** (-5.7)	-0.41** (-6.7)	-0.61** (-5.7)
Good health	-0.05* (-2.2)	-0.11** (-5.4)	-0.30** (-5.6)	-0.49** (-7.8)
Fair health	-0.05* (-2.2)	-0.06** (-2.9)	-0.16** (-2.9)	-0.27** (-4.4)
Chronic illness	0.05** (3.9)	0.06** (4.4)	0.13** (4.2)	0.20** (5.5)
Man	-0.05** (-4.6)	-0.04** (-3.4)	-0.20** (-6.8)	-0.11** (-3.4)
High school	0.04* (2.4)	0.004 (0.3)	0.06 (1.4)	0.03 (0.8)
University low	0.04* (2.2)	0.02 (1.1)	0.03 (0.6)	0.05 (0.9)
University high	0.11** (4.5)	-0.03 (-0.8)	0.16** (2.3)	-0.05 (-0.5)
Age:31-50	0.001 (0.1)	0.04* (2.6)	-0.04 (-1.1)	0.12** (2.7)
Age: 51-70	0.04* (2.5)	0.05* (2.5)	0.03 (0.7)	0.12* (2.5)
Age: 70<	0.02 (1.1)	0.06** (2.9)	-0.02 (-0.3)	0.22** (3.6)
Household income in in NOK 100,000	0.005** (2.9)	0.004 (1.5)	0.02** (2.9)	0.01 (0.8)
GPs per 10,000 residents	-0.02** (-3.9)	0.003 (0.8)	-0.03** (-3.3)	-0.01 (-0.6)
Personal GP	0.03 (1.8)	0.07** (3.2)	0.01 (0.1)	0.16** (3.1)
Regular health center	0.02 (1.2)	0.07** (3.2)	0.001 (0.01)	0.12* (2.0)
Access to private specialists	0.07** (3.2)	-0.005 (-1.1)	0.03** (2.7)	0.003 (0.3)
Access to hospital physician	-0.01 (-0.6)	-0.01 (-0.6)	0.05 (1.2)	-0.03 (-0.6)
Access to hospital beds	0.01 (0.8)	0.01 (0.8)	-0.07 (-1.77)	0.02 (0.50)
Alpha			4.93** (13.93)	4.60** (15.31)
Log likelihood	-3033.545		-2316.448	-2585.78
-2(loglikelihood^{Poisson}-loglikelihood$^{neg.\ binomial}$)			1672.97**	2915.83**
N	3501		3500	3501

*, (**) indicates that the estimated parameter is significantly different from zero at the 5, (1) % level with a two-tailed test.

Table 4: The estimated effect of independent variables (t-values) on the use of private specialists during the last 12 months based on 1999 and 2000 surveys.

Variables	Ordered probit model: No visits, visit in one of the two years, visits in both years	Log Number of visits (heteroscedasticity robust estimates)
Constant	-0.30* (-2.2)	-7.26** (-11.3)
Very good health	-0.86** (-10.6)	-5.28** (-11.4)
Good health	-0.65** (-8.7)	-4.44** (-9.9)
Fair health	-0.38** (-4.4)	-3.23** (-6.4)
Man	-0.20** (-6.3)	-0.85** (-5.3)
High school	0.14** (2.9)	0.56* (2.5)
University low	0.25** (4.6)	1.18** (4.4)
University high	0.43** (5.1)	1.84** (4.3)
Age: 31-50	-0.01 (-0.2)	-0.23 (-1.1)
Age: 51-70	0.15** (3.0)	0.43 (1.8)
Age: 70<	0.11 (1.6)	0.23 (0.7)
Household income in in NOK 100,000	0.02** (5.2)	0.13** (6.7)
GPs per 10,000 residents	-0.02 (-1.5)	-0.06 (-1.3)
Personal GP	0.43** (7.3)	1.99** (8.1)
Regular health center	0.18** (2.7)	0.81** (2.9)
Access to private specialists	0.08** (6.8)	0.39** (6.8)
Access to hospital physician	-0.08 (-1.8)	-0.33 (-1.5)
Access to hospital beds	0.02 (0.48)	0.03 (0.14)
μ_1	1.02** (43.38)	
Log likelihood	-4854.41	
R^2		0.07
N	6466	6466

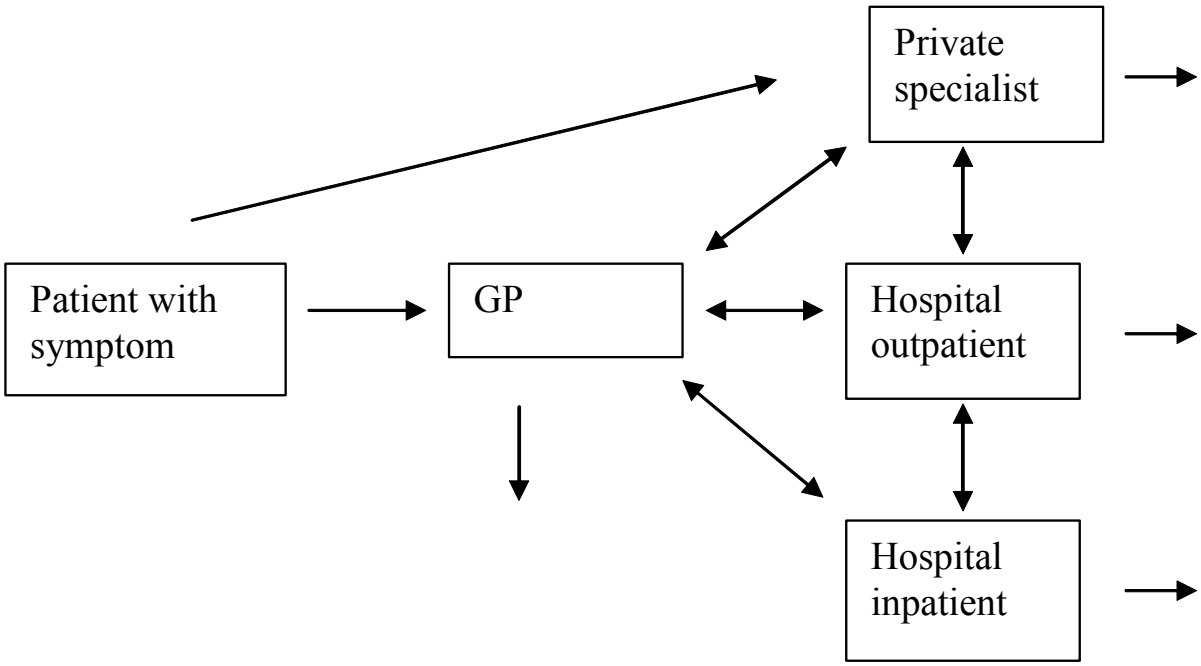

Figure 1 Patient flows

Appendix: Measuring accessibility

Norwegian health policy aims at providing equal access to health care, independent of economic status or geographical location. When examining variations in the utilization of specialist health care, we needed a measure of the perceived access to specialized health care. The perceived access to health care is estimated at the municipality level. As indicators of health service provision we used the number of effective beds available in hospitals, the number of physician man-years in hospitals, and the number of man-years of privately practicing specialists in an office setting. Since the perceived accessibility is estimated according to the number of beds and man-years, the index is intended to capture the capacity and not the actual need in the population.

An indicator of access to specialist health care at municipality level should contain both a measure of the capacity in the municipality in question, a measure of the supply in nearby municipalities, and the traveling distance to health care. Wilson (1974) described a spatial interaction model in developing a measure of the perceived accessibility: $T_{ij} = gP_iS_jf\left(c_{ij}\right)$, where T_{ij} is the number of health care interactions between residential zone i and destination j. P_i measures the effective population in zone i and S_j measures the attractiveness of destination j. c_{ij} is a measure of the distance between residential zone i and destination j. $f\left(\cdot\right)$ is a distance decay function and g is a gravitational constant. Our estimation of the perceived accessibility index is based on Wilson (1974).

In order to estimate the perceived accessibility of specialized health care for each municipality (j ; $j = 1,2,...,435.$), we first need to calculate the size of the capacity in each municipality. The health care supplied in Norwegian hospitals can roughly be divided in three: capacity at county level, capacity at regional level and capacity at national level. $S_j^{(1)}$ is the capacity of health care at the county level estimated for each municipality (j). $S_j^{(2)}$ is a measure of the capacity at the health region level, estimated for each municipality (j). Finally, $S_j^{(3)}$ measures the capacity at the national level

estimated for every municipality j in Norway. We also have to take account of the size of the population the capacity is expected to serve. Therefore, we divided $S_j^{(1)}$ by P_k, the population in county k, $S_j^{(2)}$ by P_r, the population in region r, and $S_j^{(3)}$ by P, the total population in Norway, and obtained the estimated ratio "capacity per head".

A distance measure was also needed when modeling the attractiveness of health care. InfoMap Norge AS calculated the distance (c_{ij}) between residential zone i and destination j, measured as travel time by car. $f\left(c_{ij}\right)$ expresses the effect of distance on access. The first order derivative is assumed to be negative $f'\left(c_{ij}\right)<0$, and the second order derivative is positive: $f''\left(c_{ij}\right)>0$. We found it troublesome to choose the actual decay function $f\left(\cdot\right)$ to be used . Haggett, Cliff and Frey (1974) describe among others the possible functional form: $f\left(c\right)=e^{-\beta c^{\alpha}}$, where c is the estimated distance, and α and β are parameters to be estimated. With high values of β we will obtain high elasticity with respect to distance, while low values of β will give higher weights to longer distances. The chosen values of the two parameters are $\alpha=0$ and $\beta=0.2$, and equal to the assumptions in Carr-Hill et al. (1994). Hence, we assume $f\left(c_{ij}\right)=e^{-0,2c_{ij}}$, where $\frac{\partial f\left(d_{ij}\right)}{\partial d_{ij}}=-0,2e^{-0,2d_{ij}}<0$ and $\frac{\partial^2 f\left(d_{ij}\right)}{\partial d_{ij}}=0,04e^{-0,2d_{ij}}>0$.

The joint accessibility A_{ikr} for the residents in municipality i in county k in region r can now be expressed as:

$$A_{ikr}=c\left[\frac{1}{P_k}\sum_{j=1}^{n_k}S_j^{(1)}\ f\left(d_{ij}\right)+\frac{1}{P_r}\sum_{j=1}^{n_r}S_j^{(2)}f\left(d_{ij}\right)+\frac{1}{P}\sum_{j=1}^{435}S_j^{(3)}f\left(d_{ij}\right)\right].$$

According to Kopperud (2002) the accessibility index shows that access to health care is superior in high population density areas.

The index is standardized with mean 0 and standard deviation 1, and is interpreted as the number of standard deviations from the mean. Comparing the perceived

accessibility measured as physician man-years in hospitals, we find that the cities of Oslo, Tromsø and Trondheim are the three municipalities with the best-perceived accessibility. Compared with the average municipality, Oslo has 2.9 standard deviations better access to specialized care. The population density is 1192.5 persons per km^2 in Oslo. The estimated accessibility is 2.6 for Tromsø and 2.5 for Trondheim. The index ranges from the capital Oslo, with the best-perceived access to hospital care, to Loppa, a municipality far north in Finnmark County where the population density is only 2.1 persons per km^2. Loppa has a perceived access to hospital care that is 2.7 standard deviations lower than the average accessibility in Norway. The perceived access to specialized care in hospitals, measured as the number of hospital beds, is best for Trondheim, Skien and Førde. The index is respectively 2.1, 2.0 and 1.9. Again, Loppa is the municipality with the lowest perceived accessibility. The estimated accessibility in Loppa is 2.8 standard deviations lower than the average accessibility. The third accessibility index measures access to private specialist care in an office setting. Oslo obtained the best-perceived access to private specialized health care. The estimated accessibility is 6.3 standard deviations higher than the average accessibility. The estimated accessibility for both Tønsberg and Bærum is 2.1. The worst perceived access to specialized health care is again estimated for a municipality in Finnmark County, this time Hasvik. The estimated accessibility in Hasvik, with a population density at 2.2 persons per km^2, is 1.5 standard deviations below the average municipality accessibility.