Gatekeeping and Access to Health Care

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Abstract

The focus of this paper is on the relationship between capacity in primary care and the use of specialist care. In many health care systems a referral from a primary care physician (general practitioner, GP) is required to gain access to specialist health care. GPs act as gatekeepers to specialist care. Ample capacity in primary care makes it easier for GPs to see patients promptly and to make a qualified distinction between patients who require a referral and patients who could be treated in general practice. A reduced number of referrals may result. But ample capacity in primary care also fosters competition for patients among GPs. When patients more easily can switch physicians, GPs are discouraged from strict gate-keeping. Hence, whether increased capacity in primary care implies more or less use of specialist health care is an important empirical research question. Norway has a decentralized national health service. Primary health care is the responsibility of municipalities, while specialist health care is the responsibility of the state. Each resident is listed with a GP, over 95% of them being self-employed, and having contracts with municipalities. GPs are paid by a combination of capitation payment and fee-for-service. Our data stem from a representative survey of 6000 Norwegian citizens conducted by Statistics Norway. Survey data include socioeconomic characteristics, self-assessed health including number and types of chronic diseases and use of both primary and specialist health services. Survey data are merged with data that show characteristics of the corresponding GP, together with the capacity in primary care and access indicators of specialist care at the municipality level.We estimate models where we analyze the probability of one or more visits to primary and specialist health care providers. The independent variables include characteristics at the patient level, GP level and the municipality level. Since data have a multi-level structure and the dependent variables represent count data with a highly skewed distribution, identifying the ideal model is non trivial. We therefore estimate several models. In the paper we present results from estimation of logit and negative binomial panel data models where we take into account the correlation of error terms within municipalities. Adjusting for self-assessed health and socioeconomic characteristics, we find that increased capacity in primary care increases or has no impact on the probability of visiting physician specialists. Furthermore, we find that improved access to specialist health care is associated with more visits to both GPs and private specialists. Interpretations and policy implications: Increased capacity in primary health care increases competition for patients among GPs and discourages gate-keeping to specialist health care. Increased accessibility to specialist health care makes it more important for patients to visit GPs to obtain a referral. Hence, also the number of visits to GPs may increase. The policy lesson from this study is that abundant capacity in primary care need not be a sufficient condition for effective gate-keeping. We suggest that a successful shift of tasks and responsibilities from specialist health care to primary care requires a policy of medical guidelines and integrated care.

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1 Introduction

In 2009, the Norwegian government presented a major proposal for reforming the Norwegian health care sector (Report No. 47 (2008–2009)). The coordination reform proposal was motivated by evidence of insufficient quality of care for patients with chronic diseases, combined with a worrying increase in present and projected hospital costs. The proposed measure suggested a substantial increase in primary care resources and the number of general practitioners (GPs) in particular to improve the quality of care to chronic patients, and to slow down the cost escalation in hospitals and in the health sector as a whole. Immediately after the proposal was released it became clear that evidence supporting a connection between goals and measures to a large extent was absent. A description of the policy measures needed to recruit the large number of GPs to the rural areas was absent in the proposal; furthermore, there was no evidence of how an increase in the number of GPs would simultaneously stop the cost escalation in the health sector and improve the quality of health care. The Storting (the Norwegian parliament) rejected this part of reform proposal due to its lack of evidence-based health policy.

Hence, research that contributes to evidence based health care reform is much needed in Norway. The focus of this paper is on the relationship between capacity in primary care and the use of specialist care. In many health care systems a referral from a primary care physician (general practitioner, GP) is required to gain access to specialist health care. GPs act as gatekeepers to specialist care. Ample capacity in primary care makes it easier for GPs to see patients promptly and to make a qualified distinction between patients who require a referral and patients who could be treated in general practice. A reduced number of referrals may result. But ample capacity in primary care also fosters competition for patients among GPs. When patients more easily can switch physicians, GPs are discouraged from strict gate-keeping. Hence, whether increased capacity in primary care implies more or less use of specialist health care is an important empirical research question. We are interested in identifying how the capacities of primary care and specialized medicine impact the service provisions of GPs, and their referrals of patients to specialist care.

There is some literature about the relation between the capacity in primary care and the use of specialized health services. Baicker and Chandra (2004) and Chernew et al. (2009) find with data from the US that the composition of physicians matters for medical spending. In their studies the percentage of primary care physicians show a consistent negative association with the level of Medicare reimbursement per beneficiary. Chernew et al. (2009) find no association between the composition of physicians and the growth in Medicare spending. They conclude that although policies that lower spending levels but do not affect spending growth rates may generate important benefits to the health care system, they will not ultimately address the overarching problem of financing health care. Bradley Wright and Ricketts III (2010) study with area level data how the proportion of primary care physicians in an area's physician supply is associated with the number of inpatient admissions and emergency room visits. They find that there is some evidence that a higher concentration of primary care physicians is associated with a decrease in health care utilization, but these findings depend on the level of aggregation. Fortney et al. (2005) make use of a natural experiment in the Department for Veterans Affairs in the US. The number of primary care facilities were increased in some districts and not in others. The authors conduct a difference-in-differences analysis of longitudinal data and use instrumental variables techniques to adjust for the possible endogeneity of primary care encounters. Their main result is that increase in primary care encounters is associated with a decrease in specialty medical encounters and they conclude that primary care is a substitute for specialist health care. With survey data at the individual patient level, Atella and Deb (2008) study whether primary care physicians and public and private sector specialists are substitutes or complements. They estimate a structural simultaneous equation model where visits to one type of physicians are entered as endogenous variables in the explanations of visits to other types of physicians. When unobserved heterogeneity is appropriately accounted for, they find that the three types of physicians are substitutes.

Our paper differs from the previous ones since our hypotheses are derived from a model of general practitioners' referral decisions. In systems where GPs are gate-keepers we believe this approach to be crucial to the explanation of the composition of types of services. When a patient shows up in a GP's office, the GP decides whether to handle the patient by himself or to refer the patient to specialist health care for further diagnostics and treatment. The GP is semi-altruistic in the sense that he both cares about a patient's benefit from treatment and his own net revenue. The weight on a patient's benefit is higher the more competitive environment a GP operates in. This mechanism is discussed by Fang and Rizzo (2009).

The payment system for GPs is assumed to be a mix of fee-for-service and capitation payment. If the GP refers a patient to a salaried hospital physician, there is a probability that the patient will experience a delay because of insufficent capacity. The probability of a delay is taken into account in the GP's referral decision. The GP may also choose to refer a patient to a private specialist, who is paid fee-for-service and accepts all referrals without a delay. We assume that the co-payment a patient would have to pay for specialized health care is the same irrespective of whether the health services are provided by a private or a public specialist. A main result from the model is that the total effect of more intense competition on a GP's referral rate is indeterminate. While increased weight on the altruistic component in his utility function works in the direction of an increased referral rate, the lower number of patients in a GP's practice, lowers the marginal disutility of work and reduces the referral rate. In the empirical part of the paper we test whether or not increased capacity and competition among GPs reduce the number of consultations patients have with physician specialists. We use survey data from Statistics Norway at the individual patient level, and adjust for self-assessed health and socioeconomic status measured by gender, age, income and education. We also account for variation in access to specialist health care among the municipalities with an accessibility index designed for this study. In the empirical model we account for correlated error terms within municipalities and estimate robust standard errors. We find that improved GP capacity at the municipality level either increases or does not impact on the probability that a patient visits a physician specialist. Hence, our results are not supportive to the main assumption that underlies the Norwegian coordination reform.

2 Study setting

Norway has a government structure with three levels; the state, the county councils (18) and the municipalities (430). There is a decentralized national health service. Primary health care is the responsibility of the municipalities. Since 2002, specialist health care is the responsibility of the state. Before 2002, specialist health care was the responsibility of the county councils. Each resident is listed with a GP. Patients may switch GPs twice a year, and approximately three percent of the patients per year switch physicians because of their preference for doing so. Hence, there is a considerable degree of continuity in the relation between GPs and patients. More than 95% of the GPs are self-employed, and contract with a municipality. They are paid by a combination of capitation payment and fee-for-service. While the municipalities pay the capitation fee, the National Insurance Scheme (NIS) pays the fee-for-service component according a fixed fee schedule negotiated between the state and the Norwegian Medical Association. There is also a patient copayment related to the number of consultations and laboratory tests. Copayments by patients, fee-for-service by NIS and capitation payment by the municipalities each amounts to approximately one third of a GP's practice income.

Specialist inpatient care is mainly provided by public hospitals organized in four regional health authorities. Each regional health authority is responsible for several hospitals. Some private non-profit hospitals contract with the regional health authorities and provide acute and elective care on the same terms as public hospitals. Private for-profit hospitals are very few and geographically concentrated around the capital Oslo. The regional health authorities buy some services from private for-profit hospitals. The remaining treatments are paid for by private health insurance or by patients directly.

Specialist outpatient consultations are provided at hospital outpatient departments or by private specialists located outside hospitals. While hospital physicians are salaried, most private specialists contract with a regional health authority. The contracts provide them with an annual practice allowance from the regional health authority and fee-for-service income from the NIS. Patient copayment is equal irrespective of whether the visit is to a hospital outpatient department or to a private specialist who contracts with a regional health authority. There are also a small number of private specialists who work without a contract with a regional health authority. They are not entitled to income from the NIS and are paid by private insurance or by patients directly. Private specialists are mainly located in urban areas, often in a municipality where a hospital is located. Dual practice exists to some extent, since some hospital physicians also have a part time contract with a regional health authority as a private specialist. A visit to a hospital specialist or to a specialist who contracts with a regional health authority requires a referral from a general practitioner. The referral is valid for several visits within a year for the same condition.

3 A model of referral

We consider the referral decision of a private, primary care physician, whom we call the General Practitioner (GP). A patient under a GP's care may require secondary care. The GP has to decide between treating the patient himself and referring the patient for secondary care. The GP can either refer the patient to a Public Specialist, or to a Private Specialist; these, respectively, are specialists in the public and private sectors.

3.1 Patient, GP, and Specialists

The patient is fully insured, and delegates treatment decisions to the GP. Let u denote the patient's benefit from the GP's treatment. This benefit varies according to a patient's health status, so it can be any value in an interval $[0, L]$. The GP observes this benefit u before making the referral decision. At the time of referral, the GP does not know how much benefit the patient may obtain from secondary care, but believes that this is a random variable v. To simplify notation, we also let v vary on $[0, L]$, and it has a distribution F, and a density f. We assume that the distribution of v is independent of u; later, we will discuss correlation between u and v. The magnitude of u relative to v measures whether the patient benefits more from primary or secondary care.

Upon seeing the patient, a Specialist learns the value of v, as well as the value of u. Our interpretation is that the GP sends along the patient's medical information to the Specialist, who can infer the benefit u from primary care. We let there be a delay when a patient is referred to the Public Specialist, so the benefit becomes δv, $0 < \delta < 1$, if the patient is treated by the Public Specialist. Most public systems use waiting time as a rationing mechanism. This is true in Norway, and motivates our delay assumption. There is no delay when the patient is referred to the Private Specialist, so if the Private Specialist provides treatment, the patient's benefit is v.

A private physician working in the private sector is paid according a fee-for-service contract with a national insurance system. The private GP has a fee-for-service rate p, while the Private Specialist has a higher fee-for-service rate q. We interpret p and q as unit profits, so that they are net of service costs. It is likely that $p < q$, so a Specialist makes more money than a GP, but we do not need to make such a specific assumption here. The Public Specialist receives a salary. This difference in payments imply different incentives for service provisions.

All physicians are partially altruistic, with preferences that are weighted sums of revenues from treatment and the patient's (expected) benefit. Physicians are often assumed to be partially altruistic in the health economics literature. This assumption is often supported by anecdotal evidence. In standard economic models, a competitive firm acts to maximize consumer surplus while a monopolist acts to maximize profit (subject to a demand function). In imperfect competition, a firm's market power is constrained by its competitors, so its action is somewhere between consumer surplus maximization and monopoly profit maximization.

We combine the standard partial physician altruismIn in the health economics literature, and the standard economic model for firms by letting physician altruism be influenced by the intensity of competition. For our empirical implementation, we hypothesize that a GP's preferences must put a higher weight on the patient's benefit when the GP market is more competitive. We seek to explain variations of referral decisions by variations of market competition.

Unlike many other papers in the literature of referrals, we allow the possibility that a Specialist rejects a referral and sends the patient back to the GP for primary care services. This possibility is especially appropriate when physicians are altruistic.

3.2 The referral process and physician utilities

The referral process is modelled as follows:

Stage 0: The GP observes a value of u. Nature draws the realization of benefits v according to the distribution F.

Stage 1: A patient sees the GP. The GP decides whether to treat the patient, refer the patient to the Private Specialist, or to the Public Specialist.

Stage 2: If the GP has decided to treat the patient, the patient receives benefit u. If the GP has referred the patient, the referred Private or Public Specialist gets to learn both u and v, and decides between treating the patient and sending the patient back to the GP (who then has to treat the patient). If the patient is treated by a Specialist, she receives benefit v, except that she has experienced a delay if the referral has been to the Public Specialist.

The GP's utility is $p + \alpha u$ if he treats the patient; he values profit p from fee-for-service (net) revenue and the patient's benefit at αu, with $\alpha > 0$. If the GP refers the patient to the Private Specialist, and the referral is accepted, then his utility is αv. In this case, the GP no longer receives the fee-for-service payment p, so his utility comes entirely from the patient receiving the benefit v from the Private Specialist. If the GP refers the patient to the Public Specialist, the patient experiences a delay, and the benefit is discounted by a fraction δ, so the GP's utility is $\alpha\delta v$.

The Private Specialist's utility is a weighted sum of the net revenue from providing treatment and the patient's utility. The Private Specialist's utility is $q + \beta v$ if he accepts the referral, where $\beta > 0$ is the altruism weight. If he rejects the referral and sends the patient back to the GP, his utility is βu.

The Public Specialist receives a fixed salary, so his payoff from treating the patient derives entirely from his altruism. We normalize the Public Specialist's salary to 0 and his altruism parameter to 1. Also, by the time he sees the patient, the delay is already a sunk cost, so we write his utility from treating the patient as v, and his utility from sending the patient back to the GP as u.

3.3 Equilibrium decisions by Specialists

In Stage 2 if the Public Specialist gets a patient, he gets to observe the patient's benefits from primary and secondary care. Because he is paid a salary, the Public Specialist acts in the patient's best interest, so he treats the patient if $v > u$, and sends the patient back to the GP otherwise.

The Private Specialist also gets to observe the patient's benefits in Stage 2. Given u and v, if the Private Specialist accepts the referral and provides treatment, his payoff is $q + \beta v$, whereas if he rejects the referral, the patient receives treatment from the GP, and the Private Specialist's payoff is βu. The Private Specialist accepts the referral if $q + \beta v \geq \beta u$, and sends the patient back to the GP otherwise.

The Private Specialist does not act in the patient's best interest. Even when $u > v$, he may not refer the patient back to the GP. He earns a monetary profit q if he treats the patient. Only if the monetary payoff q

is less than the (increment) utility due to altruism, $\beta(u-v)$, will he send the patient back to the GP .

3.4 GP's utilities from treating and referring the patient

We now consider the GP's utilities from his three options in Stage 1. He takes into consideration the best responses of the Private and Public Specialists in Stage 2. First, if the GP treats the patient, his utility is $p+\alpha u$. Second, if the GP refers the patient to the Public Specialist, the referral will be accepted if and only if $v \geq u$. The GP's expected utility from this referral is

$$\int_{v<u} \delta[p+\alpha u]\ \mathrm{d}F(v) + \int_{v\geq u} \delta\alpha v\ \mathrm{d}F(v). \tag{1}$$

Here, the first integral (for $v<u$) corresponds to the Public Specialist rejecting the referral, so the GP's payoff is $p+\alpha u$, and this happens after a delay. The second integral (for $v>u$) corresponds to the Public Specialist accepting the referral, so the GP's payoff is αu, entirely due to altruism, and again this happens after a delay.

Third, if the GP refers the patient to the Private Specialist, the referral will be accepted if and only if $q+\beta v \geq \beta u$. The GP's expected utility from referring the patient to the Private Specialist is

$$\int_{q+\beta v<\beta u} [p+\alpha u]\ \mathrm{d}F(v) + \int_{q+\beta v\geq\beta u} \alpha v\ \mathrm{d}F(v). \tag{2}$$

Here, the first integral (for $q+\beta v<\beta u$) corresponds to the Private Specialist rejecting the referral, so the GP's payoff is $p+\alpha u$. The second integral (for $q+\beta v \geq \beta u$) corresponds to the Private Specialist accepting the referral.

3.5 Equilibrium referrals by the GP

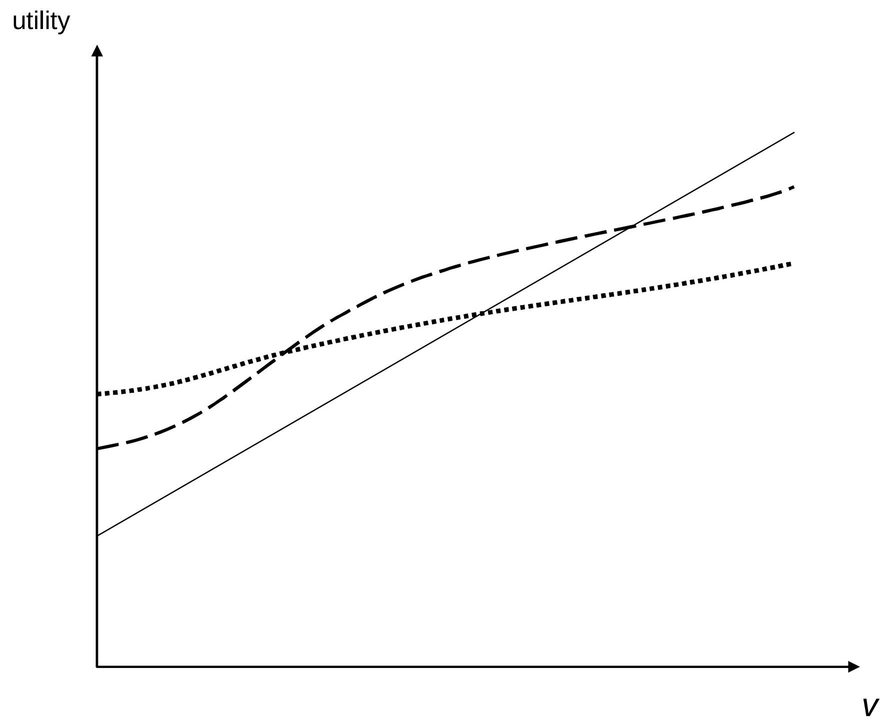
The GP's choice between treating the patient, referring the patient to the Public Specialist, and referring the patient to the Private Specialist is by comparing the treatment payoff $p+\alpha u$, (1), and(2). His choice is guided by two considerations. First, the GP and the Private Specialist are partially altruistic, but the Public Specialist is fully altruistic. Second, referring the patient to the Public Specialist means a delay. The first consideration is in favor of the GP referring the patient to the Public Specialist, but the second is against it.

Suppose that u is large. Here, the GP knows that secondary care is unlikely to be optimal. There is, however, a small chance that v will turn out to be higher than u. Should the GP use a referral to ascertain that indeed $u > v$? While a Specialist will learn about v, that information cannot be obtained without some cost. The Public Specialist is fully altruistic, and will refer the patient back to the GP whenever $v < u$. But a referral to the Public Specialist causes a delay. The Private Specialist is partially altruistic, so v has to be significantly smaller than u for him to reject the referral. These considerations imply that the GP's best strategy is to provide treatment himself.

Next, suppose that u is small. Here, the GP knows that his care is unlikely to be optimal; secondary care will benefit the patient more. The GP's payoff is going to be αv. Now referring the patient to the Public Specialist causes a delay, so the GP's equilibrium choice must be to refer the patient to the Private Specialist.

Finally, for medium values of u, obtaining more information about v is preferred because that information is most likely to make a difference. The GP should make a referral. The costs of referring the patient to the Public Specialist and to the Private Specialist differ. The former is a delay cost. The latter is a misalignment of incentives misalignment because the Private Specialist may keep the patient even when $v < u$. The GP's equilibrium referral decision therefore depends on the discount factor δ, the altruism parameters α and β, as well as the distribution F.

Figure **??** plots the GP's typical utilities from his three choices. The solid line is the GP's utility from treating the patient. The dotted line is the utility from referring the patient to the Private Specialist, while the dashed line is the utility from referring the patient to the Public Specialist. All uitlities are increasing in α. For low values of α, the GP obtains the highest utility from referring the patient to the Private Specialist. For medium values of α, the highest utility is from referring the patient to the Public Specialist, while for high values of α, the highest utility is from the GP treating the patient himself.



GP's utility from treating the patient, and referring the patient to the Public and Private Specialists

3.6 Competition and GP referrals

Competition in the GP market manifests in our model in two ways. First, as we have mentioned above, we interpret altruism as a constraint against a GP's sole pursuit of his self-interest. In a more competitive environment a GP caters more to the patient's needs, and this is identified as an increase in the GP's altruism parameter α.

A second way competition affects equilibrium referral is through its effect on the GP's net revenue p. The effect of competition on p may be complicated. If the total demand for GP services is fixed, then as competition increases, each GP may have less patients. The GP has more leisure, so his disutility from work may decrease. This implies that the net revenue p may increase.

The GP's utility from treating the patient is $p + \alpha u$, and if the GP refers the patient, his utility is either (1), and(2). The GP's payoff from treating the patient differs from referral in two ways. First, the GP may not receive the net revenue p if he refers the patient; conversely, he receives p for sure if he does not.

Therefore, if a more competitive GP market raises p, the GP has less of an incentive to refer. Second, by initiating a referral the GP makes the information about secondary care benefit v available. This may lead to a better treatment for the patient. If competition raises the altruism parameter α, the GP has more of an incentive to refer. These two effects induce opposite incentives for the GP's referral decisions. In sum, the effect of competition on GP's referrals is multifaceted. It remains an empirical issue how an increase in competition among GPs will affect referrals.

4 Data and descriptives

Our data stem from a survey of Norwegian citizens conducted by Statistics Norway in 2008/2009 (Wilhelmsen, 2009). A representative sample of ten thousand non-institutionalized people 16 years or older was drawn. Interviews (personally or by telephone) were achieved with 6465, corresponding to a response rate of 66.8 percent. Compared with the population at large the interviewed sample is somewhat overrepresented by women and people aged 45-66. The survey of living conditions includes socioeconomic characteristics, self-assessed health including number and types of chronic diseases and use of both primary and specialist health services during the previous twelve months. Survey data are merged with data that show characteristics of the respondent's regular GP, together with access to GPs and indicators of access to specialist care measured at the municipality level. Several indicators are candidates for measuring accessibility to general practitioners at the municipality level. The variable #Capacity measures the number of GPs in a municipality who accept new patients on their list. The more GPs who accept new patients, the more choice there is for potential patients and the more competition is it likely to be among GPs to attract patients. The variable #Capacity is strongly correlated with a municipality's population, and perhaps also with a municipality's area. Since travel distance is an obstacle for accessibility, one may argue the proportion of GPs in a municipality who accept new patients, %Capacity, is a better measure. As a compromise, we introduce in the empirical analysis a binary variable, AccessGP , that is equal to one if %Capacity is greater than the median and zero otherwise. We also present results with #Capacity as an indicator of access to general practitioners.

The accessibility to specialist health care is measured by indices calculated in Lafkiri (2010). These indices are an update of the indices presented in Iversen and Kopperud (2005). The indices distinguish between accessibility to hospital care and accessibility to specialist health care provided outside hospitals by private specialists with contracts with the regional health authorities. The index for access to hospital care, Accesshosp, is the capacity in terms of number of physicians per 10,000 inhabitants weighted by the travel time by car from the receiving municipality to the providing municipality. Capacity is measured according to the defined catchment area of a hospital. This means that a municipality is likely to receive hospital services from several hospitals covering the full hierarchy of services. The accessibility to private specialists, Accesspriv, is measured similarly, but now with number of private specialists as the capacity variable.

Table 1 shows descriptives for the sample. We see that 83 percent have visited a GP during the last twelve month. Forty percent have visited specialist health care. Since some patients have visited both private specialists and hospital specialists, the sum of these proportions become higher than 0.40. Eighty percent have very good or good self-assessed health. The remaining 20 percent has neither good nor bad, bad or very bad self-assessed health. Forty percent of the sample have at least one chronic disease. The mean (truncated) gross household income is NOK 640 000. In the estimations in the next section we introduce the binary variable Hinc equal to 1 for individuals with gross household income exceeding the median income. We observe that 35 percent of the sample have education that exceed the high-school level. On average, there are 37.8 GPs who accepts additional patients in the municipalities where the respondents reside. This corresponds to 45 percent of the GPs on average. Since the cut-off point of the indicator AccessGP is the median of %Capacity, the mean of AccessGP is equal to 0.5. The variables Accesshosp and Accesspriv were merged with the data set before they were normalized. Hence, the magnitudes of these variables are hard to interpret. For our purpose it suffices to say that higher values of the indicators mean better accessibility.

Table 1: Descriptives

Variable	Definition	N	Mean	Std.dev.	Min	Max
CONSULT GP	Dummy=1 if visited a GP during previous 12 months	6465	0.83		0	1
#CONSULT GP	No. of GP visits given the no. visits > 0	5327	4.16	5.52	1	130
CONSULT PRIV. SPEC.	Dummy=1 if visited a private specialist during previous 12 months	6465	0.20		0	1
#CONSULT PRIV. SPEC.	No. of visits given the no. visits > 0	1281	2.07	3.95	1	100
CONSULT HOSP. SPEC.	Dummy=1 if visited a hospital specialist during previous 12 months	6465	0.27			
#CONSULT HOSP. SPEC.	No. of visits given the no. visits > 0	1733	2.46	3.49	0	1
CONSULT SPEC. CARE	Dummy=1 if if visited specialist health service during previous 12 months	6465	0.40		0	1
#CONSULT SPEC. CARE	No. visits given the no. visits > 0	2560	2.69	4.28	1	102
MALE	Dummy=1 if male	6465	0.49		0	1
YOUNG	Dummy=1 if 16 years ≤ Age≤ 25 years	6465	0.14		0	1
MIDDLE1	Dummy=1 if 25 years ≤ Age≤ 45 years	6465	0.34		0	1
MIDDLE2	Dummy=1 if 45 years ≤ Age≤67 years	6465	0.37		0	1
OLD	Dummy=1 if 67 years ≤ Age	6465	0.15		0	1
VGOODHEALTH	Dummy=1 if *very good* self-assessed health	6465	0.36		0	1
GOODHEALTH	Dummy=1 if *good* self-assessed health	6465	0.44		0	1
CHRONIC	Dummy=1 if at least one chronic disease	6453	0.40		0	1
INCOME	Gross household income in NOK 1000	6465	640	347	-1 460	1 460
HIGHEDU	Dummy=1 if > 14 years of education	6465	0.35		0	1
Variables at the level of the municipality						
#CAPACITY	No. of GPs who accept new patients	6434	37.8	66.2	0	213
%CAPACITY	Proportion GPs who accept new patients	6434	0.45	0.24	0	1
ACCESSGP	Access indicator: GPs %CAPACITY >50%	6434	0.50		0	1
ACCESSHOSP	Access indicator: hospital physicians	6443	0.00	0.00	0.00	0.01
ACCESSPRIV	Access indicator: private specialists	6443	0.00	0.00	0.00	0.00

5 Estimation and results

We are in particular interested in estimating the impact of capacity in primary care on patients' use of specialist health services. Clustering of data exists. Patients are clustered in GPs and GPs are clustered in municipalities. The number of individuals listed with the same GP and represented in the sample varies between one and 22. The median is two. The number of individuals in the same municipality varies from one to 744. The median is 30. Observations within clusters are likely to be correlated because of unobservable similarities in culture and institutions. Hence, the assumption in ordinary least squares regression of independent error terms is likely to be violated within clusters. We estimate models that allow for error terms within clusters being correlated. In particular, we estimate population-averaged panel-data models with robust standard errors by means of the software Stata 11.

For a patient with a chronic diseases it is sufficient to obtain one referral per year from his or her regular general practitioner. A single referral then opens the gate to several specialist health care visits during a year. Hence, if the referral decision by the GP is a main interest, one could argue in favor focusing on the probability of one or more specialist health care visits. The distinction is then made between individuals with at least one contact with specialist health care during a year and individuals with no contacts at all, and by estimating logit models one may investigate the impact of capacity in the primary care on the probability of one or more specialist health care visits.

In Tables 2 and 3 we present the results from estimation of logit models. Coefficients are estimated marginal effects. We present the results from four different logit regressions, where we have estimated the probability of having *one or more* visits to different types of providers in primary and secondary care, during a 12 month period. The results presented in columns 2 and 3 are the estimated marginal effects on the probability of having one or more consultations with a GP. Columns 4 and 5 report the estimated marginal effects of the explanatory variables on the probability of having one or more consultations with a private specialist. In columns 6 and 7 we present the estimated marginal effects on the probability of having one or more consultations with a specialist in a hospital outpatient department. In the last two columns we have estimated the marginal effects on the probability of having one or more consultations with *either* private specialist *or* a specialist in a hospital outpatient department. We adjust for the effects of gender, age, socio-economic status and self-assessed health. These effects are all as expected from previous studies. In particular, we see that the estimated marginal effect of being a female is positive across all types of providers. With regard to the different age categories, the marginal effect on the probabilities of *at least one visit* shows differences across providers. Senior citizens appear to have greater probabilities of consulting a GP or a private specialist compared to younger individuals. However, this appears not to be the case with regard to visits to specialists at the hospital out-patient department. As expected, our results support the hypothesis that individuals with *good* or *very good* self-assessed health have a smaller probability of consulting both primary care and secondary care providers. A similar result applies with regard to the prevalence of chronic diseases. Individuals with many years of schooling have a different contact pattern than individuals with few years of schooling. Higher education seems to switch the contact pattern in the direction of specialist health care. A high household income adds to the probability of consulting a private specialist, while there is no effect of Highinc on the probability of consulting a specialist in a hospital out-patient department. The key question addressed in this paper is whether capacity and accessibility in primary care influences referrals and utilization of secondary care services. We observe that our indicator of capacity in general practice, AccessGP, has a positive effect on the probability of consultations with both private specialists and specialists in hospitals' out-patient departments. These results remain valid when controlling for the accessibility to specialist care as measured by our indicators Accesspriv and Accesshosp. But interestingly, we see that improved GP accessibility does not seem to have an impact on the probability of visiting a GP. On the other hand, improved access to specialist health care has a positive effect on the probability of visiting a GP. With improved access to specialist health care it becomes more important to visit one's regular GP to acquire a referral. We also see that improved access to private specialists increases the probability of a visit to a private specialist and likewise improved access to hospital physicians increases the probability of a visit to the hospital outpatient department.

The difference between the results presented in Table 2 and Table 3 is that different indicators for capacity in primary care are used: In Table 2 we use the indicator AccessGP , while in Table 3 we use #Capacity as indicator of primary care capacity. While the effects of the control variables are robust with regard to the choice of capacity indicator, the effects of capacity in primary care and access to specialist care are not. Contrary to Table 2 we are now unable to identify an effect of capacity in primary care on the probability of a consultation with all types of specialists. There is still positive effects of access to private specialists on both the probability of visiting a GP and on the probability of visiting a private specialist.

Not all consultations a patient might have with specialist health care during a year is necessarily related to the same disease. In that case several referrals are likely to be made during a year, and one may claim that the logit model is too restrictive. Since the number of referrals during a year is a count variable and the Poisson model is rejected, the negative binomial model is a candidate for modeling the effects of capacity in primary care on the number of visits to specialist health care. Tables 4 and 5 show the results of the estimations of population average panel data models with robust standard errors for the two alternative indicators of capacity in primary care. Results are shown in terms of marginal effects. From Table 4 we see that AccessGP has no effect neither on the number of visits to primary care nor to specialist care. Still, the level of access to private specialists has a positive impact on both the number of visits to primary care physicians and to private specialist physicians. Table 5 shows the results of the regressions when the capacity measure in primary care is changed to #Capacity. We see that the level of capacity in primary care now has a positive impact on the the number of consultations with private specialists.

Table 2: Results from logit regression

Population average panel data model allowing for correlated error terms within municipality. Reported standard errors are robust, adjusted for municipality clusters. No. of observations, N=6431.

	Dependent variable							
	Consult GP		**Consult Priv. Spec.**		**Consult Hosp. Spec.**		**Consult Spec. Care**	
Variable	**Marg. Eff.†**	**Std. Err.†**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**
Male	-0.08***	0.01	-0.08***	0.01	-0.05***	0.01	-0.11***	0.01
Young	-0.02	0.01	-0.05***	0.02	-0.01	0.02	-0.04**	0.02
Middle2	0.01	0.01	0.02	0.01	0.03*	0.02	0.05***	0.02
Old	0.04***	0.01	0.05***	0.02	0.03	0.02	0.08***	0.02
Vgoodhealth	-0.13***	0.02	-0.06***	0.01	-0.17***	0.02	-0.19***	0.02
Goodhealth	-0.08***	0.02	-0.03**	0.01	-0.11***	0.02	-0.11***	0.02
chronic	0.10***	0.01	0.06***	0.01	0.13***	0.01	0.17***	0.01
Highinc	0.01	0.01	0.03**	0.01	0.01	0.01	0.04**	0.01
Highedu	-0.02***	0.01	0.03***	0.01	0.03***	0.01	0.04***	0.01
AccessGP	-0.01	0.01	0.02*	0.01	0.03*	0.01	0.03**	0.02
Accesspriv	372.43***	110.30	661.79***	101.73	-	-	89.70	166.38
Accesshosp	8.71***	2.60	-	-	-8.20*	4.74	-0.46	4.37
No. of obs. per municipality	min=1 average=36.3 max=744							

† Marginal effects are computed at the means of the estimation sample. For dummy variables the marginal effect is for discrete change of dummy variable from 0 to 1. * Estimate is statistically different from zero at 10% level in a two-sided test. ** Estimate is statistically different from zero at 5% level in a two-sided test. *** Estimate is statistically different from zero at 1% level in a two-sided test.

Table 3: Results from logit regression

Population average panel data model allowing for correlated error terms within municipality. Reported standard errors are robust, adjusted for municipality clusters. No. of observations, N=6431.

	Dependent variable							
	Consult GP		**Consult Priv. Spec.**		**Consult Hosp. Spec.**		**Consult Spec. Care**	
Variable	**Marg. Eff.†**	**Std. Err.†**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**
Male	-0.08***	0.01	-0.08***	0.01	-0.05***	0.01	-0.11***	0.01
Young	-0.02	0.01	-0.05***	0.02	-0.01*	0.02	-0.04*	0.02
Middle2	0.01	0.01	0.02	0.01	0.03	0.02	0.05***	0.02
Old	0.04***	0.01	0.06***	0.02	0.03	0.02	0.08***	0.02
Vgoodhealth	-0.13***	0.02	-0.06***	0.01	-0.17***	0.02	-0.19***	0.02
Goodhealth	-0.08***	0.02	-0.03**	0.01	-0.11***	0.02	-0.11***	0.02
chronic	0.10***	0.01	0.06***	0.01	0.13***	0.01	0.17***	0.01
Highinc	0.01	0.01	0.03**	0.01	0.01	0.01	0.04**	0.01
Highedu	-0.02**	0.01	0.03***	0.01	0.03***	0.01	0.04***	0.01
#Capacity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Accesspriv	355.57***	111.50	625.45***	119.00	-	-	115.71	164.15
Accesshosp	3.76	8.73	-	-	-18.43	16.03	-14.87	18.25
No. of obs. per municipality	min=1 average=36.3 max=744							

† Marginal effects are computed at the means of the estimation sample. For dummy variables the marginal effect is for discrete change of dummy variable from 0 to 1. * Estimate is statistically different from zero at 10% level in a two-sided test. ** Estimate is statistically different from zero at 5% level in a two-sided test. *** Estimate is statistically different from zero at 1% level in a two-sided test.

Table 4: Results from negative binomial regression

Population average panel data model allowing for correlated error terms within municipality. Reported standard errors are robust, adjusted for municipality clusters. No. of observations, N=6431.

	Dependent variable							
	# Consult GP		# Consult Priv. Spec.		# Consult Hosp. Spec.		# Consult Spec. Care	
Variable	**Marg. Eff.†**	**Std. Err.†**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**
Male	-0.82***	0.09	-0.10***	0.04	-0.09**	0.04	-0.20***	0.06
Young	-0.10	0.14	-0.12***	0.04	0.07	0.09	-0.06	0.11
Middle2	-0.39***	0.12	-0.09***	0.03	0.02	0.06	-0.07	0.07
Old	-0.31*	0.18	-0.04	0.04	0.02	0.07	-0.01	0.08
Vgoodhealth	-2.58***	0.13	-0.23***	0.04	-0.53***	0.06	-0.78***	0.09
Goodhealth	-1.80***	0.14	-0.05	0.04	-0.32***	0.05	-0.38***	0.07
chronic	1.33***	0.10	0.19***	0.05	0.40***	0.06	0.60***	0.09
Highinc	-0.36***	0.11	0.00	0.04	0.01	0.05	0.00	0.06
Highedu	-0.10	0.09	0.08**	0.03	0.04	0.04	0.10**	0.05
AccessGP	-0.05	0.12	0.03	0.03	0.01	0.05	0.03	0.07
Accesspriv	2976.44**	1342.60	1824.20***	280.06	-	-	331.22	776.84
Accesshosp	51.73	38.65	-	-	-2.75	11.76	33.43	21.46
No. of obs. per municipality	min=1 average=36.3 max=744							

† Marginal effects are computed at the means of the estimation sample. For dummy variables the marginal effect is for discrete change of dummy variable from 0 to 1. * Estimate is statistically different from zero at 10% level in a two-sided test. ** Estimate is statistically different from zero at 5% level in a two-sided test. *** Estimate is statistically different from zero at 1% level in a two-sided test.

Table 5: Results from negative binomial regression

Population average panel data model allowing for correlated error terms within municipality. Reported standard errors are robust, adjusted for municipality clusters. No. of observations, N=6431.

	Dependent variable							
	# Consult GP		# Consult Priv. Spec.		# Consult Hosp. Spec.		# Consult Spec. Care	
Variable	**Marg. Eff.†**	**Std. Err.†**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**
Male	-0.82***	0.09	-0.10**	0.04	-0.09**	0.04	-0.20***	0.06
Young	-0.09	0.15	-0.11***	0.04	0.08	0.09	-0.05	0.11
Middle2	-0.38***	0.12	-0.08***	0.03	0.02	0.06	-0.07	0.07
Old	-0.31*	0.18	-0.03	0.04	0.02	0.07	-0.01	0.08
Vgoodhealth	-2.59***	0.13	-0.23***	0.04	-0.53***	0.06	-0.78***	0.09
Goodhealth	-1.81***	0.14	-0.05	0.04	-0.32***	0.05	-0.38***	0.07
chronic	1.34***	0.10	0.19***	0.05	0.40***	0.06	0.60***	0.09
Highinc	-0.36***	0.11	0.00	0.04	0.00	0.05	0.00	0.06
Highedu	-0.10	0.09	0.07**	0.03	0.03	0.03	0.10**	0.05
#Capacity	0.00	0.00	0.00***	0.00	0.00	0.00	0.00	0.00
Accesspriv	2997.09**	1254.40	1372.78***	395.38	-	-	349.79	774.44
Accesshosp	-116.56***	140.85	-	-	-25.34	55.30	-13.71	101.90
No. of obs. per municipality	min=1 average=36.3 max=744							

† Marginal effects are computed at the means of the estimation sample. For dummy variables the marginal effect is for discrete change of dummy variable from 0 to 1. * Estimate is statistically different from zero at 10% level in a two-sided test. ** Estimate is statistically different from zero at 5% level in a two-sided test. *** Estimate is statistically different from zero at 1% level in a two-sided test.

6 Concluding remarks

This topic of this paper is inspired by the so-called coordination reform proposal for the Norwegian health care sector. One of the claims behind the reform proposal is that an increase in the number of primary care physicians not only would imply a better treatment of patients with chronic diseases, but also a smaller increase in cost of specialist care. We aim at confronting this claim with results from an empirical study based on hypotheses derived from theory.

We model the referral decision of a semi-altruistic general practitioner who is paid by a combination of a capitation fee and fee-for-service. We find that the effect of more capacity in primary care on referral decisions is indeterminate from theory. On the one hand, more capacity in primary care means more competition for patients among GPs. More competition implies that a GP will give more weight to a patient's utility and less weight to his own utility. This effect pulls in the direction of a higher referral rate and increased service provision in specialist care. On the other hand, with fewer patients listed, his marginal utility of leisure is smaller, so his marginal net utility from providing services has increased. This effect pulls in the direction of more services provided in general practice and decreased number of referrals and services provided in specialist health care. Hence, the sign of the total effect is an empirical issue.

By means of data from a representative survey of Norwegian citizens conducted by Statistics Norway in 2008/2009 we study whether or not we can trace an effect of increased capacity in primary care at the municipality level on the utilization of specialist care, as reported by the respondents. For a patient with a chronic disease a single referral per year is sufficient irrespective of the number of consultation with a physician specialist for that particular disease. Hence, we first estimate logit models to check whether or not the capacity in primary care has an impact on the probability of obtaining a referral. We use two alternative indicators of capacity in primary care. For one of the indicators we find that increased capacity i primary care entails a higher probability of having a referral to a private specialist. For the other indicator we find no effect. We also estimate the impact of the capacity in primary care on the number of contacts an individual has with specialist health care. Again, for one of the indicators we find a positive effect of capacity in primary care on the the number of consultations with private specialists. For the other indicator we find no effect. In total, we are not able to identify a negative effect of the capacity in primary care on the utilization of specialist health services.

There is no obvious empirical measure of capacity in primary care. In the empirical study, we have suggested two, and we argue that they both have their strengths and weaknesses. Whether or not we obtain a positive effect depends on the the capacity measure used. This is somewhat unsatisfactory. In future work we aim at developing a capacity measure that has a stronger link to the theory of competition for patients among GPs.

Both capacity measures that we use are constrained by the municipality boundary. Although GPs contract with a municipality and the great majority of individuals are listed with a GP in their residential municipality, there is not a ban on being listed with a GP in another municipality. In the next version of the paper we shall include an additional measure of competition among GPs in terms of the Herfindahl index. The index is already calculated, but some technical issues have caused some delay in having the index merged with the present data file.

Our conclusion is then that we find no support from data to the claim made in coordination reform proposal. Hence, the policy lesson from this study is that abundant capacity in primary care need not be a sufficient condition for effective gate-keeping. We suggest that a successful shift of tasks and responsibilities from specialist health care to primary care requires a policy of medical guidelines and integrated care.

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Table 6: APPENDIX: Results from negative binomial regression when right truncating the number of obs.

Population average panel data model allowing for correlated error terms within municipality. Reported standard errors are robust, adjusted for municipality clusters. No. of observations, N=6431.

	Dependent variable							
	# Consult GP		# Consult Priv. Spec.		# Consult Hosp. Spec.		# Consult Spec. Care	
Variable	**Marg. Eff.†**	**Std. Err.†**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**	**Marg. Eff.†**	**Std. Err.**
Male	-0.82***	0.09	-0.13***	0.02	-0.12***	0.03	-0.23***	0.04
Young	-0.09	0.15	-0.07**	0.04	0.00	0.05	-0.06	0.07
Middle2	-0.37***	0.11	-0.04	0.03	0.01	0.05	-0.02	0.06
Old	-0.31*	0.17	0.04	0.04	0.09	0.06	0.13*	0.08
Vgoodhealth	-2.57***	0.12	-0.21***	0.03	-0.48***	0.05	-0.69***	0.06
Goodhealth	-1.79***	0.13	-0.08***	0.03	-0.30***	0.04	-0.40***	0.05
chronic	1.33***	0.10	0.14***	0.03	0.36***	0.05	0.50***	0.06
Highinc	-0.37***	0.10	0.02	0.03	0.01	0.03	0.04	0.05
Highedu	-0.10	0.09	0.02	0.02	0.06	0.03	0.08**	0.04
#Capacity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Accesspriv	2942.22**	1234.60	1293.61***	299.31	-	-	256.73	560.01
Accesshosp	-112.51	141.76	-	-	-25.08	42.59	-33.28	65.76
No. of obs. per municipality	min=1 average=36.3 max=744							

† Marginal effects are computed at the means of the estimation sample. For dummy variables the marginal effect is for discrete change of dummy variable from 0 to 1. * Estimate is statistically different from zero at 10% level in a two-sided test. ** Estimate is statistically different from zero at 5% level in a two-sided test. *** Estimate is statistically different from zero at 1% level in a two-sided test.