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General Practice:

**Four Empirical Essays
on GP Behaviour and Individuals
Preferences for GPs**

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Four Empirical Essays on GP Behaviour and Individuals Preferences for GPs

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¹ Unfortunately there are three misprints in the published versions of essay 1 and essay 2:

Essay 1, page 207, table 3 the significance levels are:

* Indicates that the effect is significant at 5 % level

** Indicates that the effect is significant at 1 % level

Essay 2, page 185: In the third dot point "high GP-density" should be replaced by "low GP-density".

² Published in *Health Economics* 9, 199-210 (2000).

³ Published in In Lindgren, B. (ed) *Individual Decisions for Health*. London: Routledge (2002).

⁴ Published in *Journal of Economic Behavior and Organization* 43, 447-470 (2000).

⁵ Presented at the 4th World Congress of the International Health Economics Association (June 15th-18th, 2003, in San Fransisco) and at the 24th Meeting of the Nordic Health Economists' Study Group (August 15th-16th, 2003, in Bergen). The essay is revised and submitted to *Journal of Health Economics*.

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1. Introduction

General practitioners (GPs) are the first-level providers of health care, i.e. they are the population's gateway to the health care sector. During episodes of illness GPs prescribe medication, give general advice on health and illness and write medical certificates. A majority of patients receive all their treatments in general practice, but GPs also use their broad and general medical knowledge to sort out cases that will benefit from treatment by medical specialists. Their role in the first line of the health care sector and their role as medical filters for secondary health care – or the gatekeeper role – are the reasons why GPs hold a key position in the health care system.

In principle, the organization of general practice can be classified into systems where the inhabitants are free to choose among all GPs practising in a certain area, and systems where the inhabitants are registered with a certain GP. The first type of organization is most commonly used, while the latter type is the prevailing organization in England, Denmark and the Netherlands. In June 2001, a list patient system – or capitation organization – in general practice was introduced in Norway as well. The reform implies that every inhabitant is registered with a GP, and hence that every GP has a distinct list of patients to serve. The rationale behind the reform of general practice was that a contractual relationship between a person and his or her GP offers everyone in the population a physician and encourages a stable relationship adapted to individual needs.

Following the introduction of the capitation system in Norway, the number of patients and the distribution of patients according to age and gender at the individual practice level became public information. Previously, it was not known whether consultations provided during a certain period were given to a large or a small number of persons, and this made it difficult to compare practice styles. If, for instance, two GPs provide the same number of services during one year, but GP A is responsible for twice as many patients as GP B, GP B has a more service-intensive practice style. When information on the number of patients on the list is not known, we might erroneously conclude that A and B have the same practice style. For analytical purposes the new organization therefore has important advantages compared with the old one.

Fixed salary, capitation and fee-for-service are the three most commonly used methods of paying GPs. With a fixed salary contract the GP must fulfil certain requirements regarding opening hours and/or working hours. Capitation is paid as compensation for each registered person on a GP's list of patients, while fee-for-service is payment directly related to the GP's provision of services to patients. Payment systems which are based solely on one of those methods exist, but mixed systems of payment consisting of two or more of the above components are most commonly used.

Prior to the reform of Norwegian general practice, privately practising GPs were remunerated partly by fee-for-service and partly by a practice allowance component. In the new system the practice allowance component was replaced by a capitation component, and fee-for-service constitutes a larger proportion of the GP's practice income than previously was the case. In the former system the health authorities expected 40 per cent of an average GP's income to come from the practice allowance and 60 per cent from fee-for-service¹. After the reform 30 per cent of the income is expected to come from capitation and 70 per cent from fee-for-service². Ahead of the nationwide reform a trial was carried out in four Norwegian municipalities. In the payment system for GPs during the trial, the fee-for-service component constituted a smaller part of the GP's income than previously, and also a smaller part than is the case after the introduction of the nationwide reform³. The data used in essay 1 (Iversen and Lurås, 2000a), essay 2 (Iversen and Lurås, 2002a) and essay 3 (Iversen and Lurås, 2000b) are from the trial, while the data used in essay 4 (Lurås, 2003a) are from the implementation of the new nationwide system.

Because of heterogeneity among patients with similar symptoms or diagnosis and also because of different opinions among physicians, several medical treatments for a certain diagnosis or health problem are regarded as equally satisfactory from the medical profession's point of view. But even if it is well known that medical practice variation among physicians exists, the general understanding is that the patient's health status and diagnosis are the key factors behind the GP's treatment decision. The question of whether GPs' behaviour is also influenced by the prevailing payment system and by organizational constraints, such as a

¹ Investigations showed, however, that a larger share came from fee-for-service and a corresponding smaller share from the practice allowance component.

² In the Norwegian system fee-for-service is paid per consultation, but also according to whether certain procedures, like laboratory tests, are provided during the consultation.

³ In the list patient trial the distribution was 50 per cent from capitation and 50 per cent from fee-for-service.

patient shortage, is analyzed in the health economic literature. Three aspects of this issue are discussed in this thesis. We first analyze whether a change in the payment system influences the rate of referrals to specialists (Iversen and Lurås, 2000a). Our next focus is whether a shortage of patients encourages GPs to provide more services to patients than if this shortage does not occur. In essay 2 (Iversen and Lurås, 2002a), we point to the importance of analyzing micro-data for revealing income-motivated behaviour among GPs, while in essay 3 (Iversen and Lurås, 2000b) we use the suggested micro-indicator of patient shortage to identify differences in behaviour among GPs. If the way GPs adapt to the prevailing systems is of importance to the provision of health services, medical treatment not only depends on potential patients' health status. It also depends on the payment system and the organizational structure, which could be of considerable importance for the design of health policy.

When individuals need to see a general practitioner because of a health problem, they initially have to choose the GP they want to visit. Because the relationship between patients and doctors is usually long term, the choice of GP may be important to people. Still, we often get the impression that the GP's composition of patients is randomly made, and hence that each GP faces the same patient load. In essay 4 (Lurås, 2003a), we analyzed a person's choice of GP within a municipality, and we raised the question of whether this choice is informed or purely random. The answer to this question has important policy implications both for the design of a payment system for GPs and for the local health authorities when they put together collegiums of GPs that aim at serving the inhabitants in the best way.

The plan of this introduction is as follows. In section 2 a short review of the health economic literature of relevance to the thesis is presented. Section 3 provides a summary of the four essays, while section 4 discusses policy implications of our findings. In section 5 ideas and suggestions for further research are outlined.

2. A brief review of the literature

Several authors have reviewed the literature on whether GPs' treatment of patients is influenced by the organization of general practice and by the way GPs are remunerated (see for instance Scott, 2000 and McGuire, 2000). The empirical evidence of the effects of different payment systems is reviewed both in the medical and in the health economic literature (see for instance Scott, 2000, Scott and Hall, 1995, Donaldson and Gerard, 1989, Kristiansen and Mooney, 1993 and Maynard et al., 1986). It seems that remunerating doctors by fee-for-service encourages the use of services. Per capita payment, on the other hand, provides incentives to compete for patients, but it also provides incentives to minimize efforts in the consultation by referring and prescribing to reduce one's own workload. Salaried doctors cannot increase their income by providing more services to patients: they receive the same income irrespective of their effort during the consultation. Salaried payment may therefore lead to lower levels of tests and referrals compared with fee-for-service and per capita payment.

The GP's gatekeeper role and the substantial variation in their rate of referrals to specialists are frequently discussed in the literature (see for instance Ystehede, 1988, Rutle and Forsen, 1984, Wilkin and Smith, 1987 Bradlow et al. 1992 and Stoverinck et al. 1996). It is well known that after accounting for clinical and diagnostic factors and also factors such as age, gender and social class, much of the variations remain unexplained (Wilkin, 1992). Apart from an analysis of the effect on referrals of GP fundholding in the UK (Gosden and Torgerson, 1997), few authors have investigated the effects of the payment system on GPs' referral rate. One exception is Krasnik et al. (1990) who evaluated the introduction of a new payment system for GPs in Copenhagen city. They reported a decline in the number of referrals to specialists when the remuneration system was changed from pure capitation to a mixed fee-for-service and capitation system.

One of the most contentious topics in the health economic literature is the analysis of the positive relationship between physician density (i.e. number of GPs in a certain population) and the volume of medical care GPs provide (see for instance McGuire, 2000). Some authors interpret this relationship as support for the hypothesis of income-motivated behaviour among GPs, while others emphasize the importance of patient-initiated services as a result of better

access to general practice. Scott and Shiell (1997) classify empirical studies of physicians' induced demand according to the kind of data that is used. The first period of research is characterized by studies using aggregate utilization data (see for instance Labelle et al., 1994 and Dranove and Wehner, 1994). In these studies, the effect of demand creation is difficult to separate from the effect of better access. Scott and Shiell (1997a) conclude that the results from these studies are "statistical artefacts". In the second period, studies often use service provision data at the individual physician level, mixed with aggregate area-level explanatory variables, such as physician density. Some of these studies find a positive relationship between physician density and service provision (Rossiter and Wilensky, 1983 and Tussing and Wojtowycz, 1986), while other analyses reject the inducement hypothesis (Grytten et al., 1995). These studies employ data with a hierarchical structure without taking the possible correlation between error terms into account. Scott and Shiell (1997a) improve the methods of earlier studies by using econometric methods that account for the hierarchical structure of the data. The result from their multilevel analysis is that for one out of four of the medical conditions investigated, GPs in areas of strong competition are more likely to recommend a follow-up consultation than GPs in areas with limited competition. Scott and Shiell (1997a) therefore focus on the importance of uncertainty about the management of medical conditions to identify income-motivated behaviour. They recommend concentrating the development of medical guidelines on health conditions characterized by uncertainty. They recognize, however, that identifying conditions characterized by uncertainty may be troublesome.

From the medical literature (see for instance Scott, 2000) we know that factors of importance to individuals' choice of GPs are practice characteristics such as physical accessibility and waiting time for an appointment, as well as attributes of the doctor, such as age and gender. We also know that aspects of the doctor-patient relationship are the most important determinants of satisfaction among patients. Some of the work in this field is stated preference studies based on questions regarding hypothetical GPs or questions about the GP an individual has already chosen. For instance, Vick and Scott (1998) and Veale et al. (1995) use conjoint analysis when analyzing patients' preferences for attributes of the doctor-patient relationship⁴. Another class of analysis is based on the revealed preference approach, i.e. that people reveal their preferences through their actions. One example of this approach is Dixon et al. (1997) who analyze patients who change their registered GP without changing home

⁴ A discussion on conjoint analysis and quantal choice models can be found in Madansky (1980).

address. They find that 38 per cent of individuals are registered with the nearest practice, and that people are more likely to leave practices a greater distance away from their home. They also report that patients are more likely to leave small practices with shorter opening hours which provide fewer clinics than the average.

However, considerable work regarding the influence of the organizational structure and the payment system on GP behaviour and regarding the population's preferences for GPs remains to be done. In this thesis we address four important questions. First, whether a change in the payment system has an influence on GPs' referral behaviour. Second, whether we can identify if increased service provision is a result of better access or patient constraints for individual GPs. Third, whether a shortage of patients encourages GPs to provide more services to their patients than if such constraints do not exist. Our fourth and last focus is whether we, due to the establishment of a list patient system, can identify a systematic relationship between characteristics of a GP and characteristics of individuals that want to be listed with what physician.

3. Summary of essays

Essay 1: The effect of capitation on GPs' referral decisions

Because GPs obtain more reliable information when their relationship with patients is durable, the Norwegian health authorities expected a decline in the number of “unnecessary” referrals to specialists after the introduction of the list patient system. Because the GP's role as a personal spokesman for his patients may counteract this effect, we argue that the effect of introducing a new organizational system on referrals is inconclusive. In contrast to the system with a practice allowance, the per capita component is paid according to the number of patients a GP takes care of. This encourages GPs to take care of many patients. To provide time for new patients, the GP can increase the referral rate and let the specialist share the burden of the list. When the fee-for-service component is reduced, it becomes less profitable for the GP to provide services to patients, and hence more profitable to let the specialists provide the extra services⁵. We therefore claim that both the effect of replacing the practice allowance with a capitation component and the effect of reducing the fee-for-service component are that they tend to increase GPs' referrals.

We distinguish between two types of referrals: supplementary and alternative. Supplementary referrals contribute as a supplement to the services GPs are expected to deliver. Examples are ordinary X-rays, CT scans and minimal invasive surgery. Although the number of supplementary referrals varies among GPs, there is little reason to believe that the payment system has any influence on this kind of referral. In a situation when the services provided by a specialist could be equally well handled by the GP himself, the referral is deemed “unnecessary” in medical terms. These referrals can be called alternative referrals because they alternatively could be provided by the GP himself. In our model, the concern is alternative referrals, and our basic observation is that the variation in referrals to specialists is considerable.

The referral data are observations of GPs in two different periods within one municipality. Because each GP has a certain practice style related to his personality, his experience, the organization of the practice etc., it is reasonable to assume dependence between the observations in period one and two for each GP. With panel data methods it is possible to

⁵ Due to the list patient trial, the fee-for-service was reduced from 60 to 50 per cent of an average GP's income.

divide effects on the observed variables due to two sources: changes that happen over time for one individual – intra-individual effects (within) – and changes that are caused by differences between individuals in one period – inter-individual effects (between)(Hsiao 1999). This makes panel data methods suitable for analyzing the effects on referrals of an organizational change. In fixed-effects models the heterogeneity between GPs is taken into account by certain fixed coefficients. If our empirical model is linear with a constant term a_i , we can for instance assume that the constant term is the same for every GP i ($a = a_1 = a_2 = \dots = a_i$) or that the constant term differs between GPs ($a_1 \neq a_2 \neq \dots \neq a_i$). In random-effects models, on the other hand, the heterogeneity is taken into account by assuming that the parameters are realizations of stochastic variables that have a certain distribution. Individual heterogeneity represented by fixed, non-stochastic coefficients is more parameter-consuming than assuming a certain distribution of the coefficients. To determine whether a fixed-effects or a random-effects model is the best description of the data, a Hausman specification test can be employed (Hsiao 1999). Examination of our results shows that a model with random effects (on the constant term) gives the best description of changes in general practitioners' behaviour due to the organizational change⁶.

We find that the referral rate increased by 42 per cent after the implementation of the new organization and the new payment system. The result is interpreted as a net effect, which lends support to our hypothesis that the change in the remuneration of GPs has the effect of increasing the rate of referrals to specialists. This supports the results in Krasnik et al. (1990). Because patients, as an alternative to treatment by a specialist, can be treated in general practice, which generally is less costly, an increase in referrals most likely will increase public expenditure. The introduction of capitation payment may therefore imply a less cost-effective allocation between the first and the second level of the health care system. The role as a gatekeeper implies that the GP is expected to act on behalf of the health authorities to contribute to a cost-effective distribution of medical care between GPs and specialists. The introduction of a list patient system focuses on and stimulates the GP's role as a personal spokesman for his or her patients. When patients are registered with a GP, the gatekeeper role may conflict with the GP's role as a personal spokesman for the patient. Because the role as a

⁶ Further discussions on the use of panel data methods on these data can be found in Lurås and Aas (2002).

personal spokesman is more in line with the Hippocratic oath, the GP may look upon this role as more important than his role as a manager of health budgets⁷.

Norwegian GPs are free to refer patients either to hospital outpatient departments or to privately practising specialists. In a disaggregated analysis we find that while the effect on the rate of referrals to privately practising specialists is positive and statistically significant, the effect on the rate of referrals to hospitals is not significant. One explanation for this difference may be that the referral guidelines are more strictly practised in hospitals, i.e. the referral threshold is higher than the threshold for referrals to private specialists. Obtaining a consultation at a hospital outpatient department may therefore be more time-consuming for the GP, and hence the GP may be more reluctant to refer patients to hospitals. This result is supported by Hutchinson et al. (1996) who used a controlled before and after study to demonstrate no difference in hospital utilization between capitated and fee-for-service practices in Canada. It is interesting to note that when stricter medical practice guidelines exist, as for referrals to hospital outpatient departments, the health service provision to a lesser degree seems to be determined by the payment system for the GP, and probably to a larger extent by patients' health status and diagnosis.

⁷ In a qualitative study Carlsen (2003) report that GPs indicate that they are less reluctant to refer patients after the introduction of the list patient system in Norway.

Essay 2: The importance of micro-data for revealing income-motivated behaviour among GPs.

In this essay we argue that micro-data describing whether a GP has obtained his optimal number of patients are required in the study of income-motivated behaviour. The crucial distinction in our supposition is between those GPs who provide care to their optimal number of patients and those who experience a shortage of patients. The second group is denoted rationed GPs.

The data on GPs' service provision are observations in two periods and each GP belongs to a specific municipality. Demographic and cultural characteristics and the organization of primary care at the municipality level are likely to influence a GP's practice style and hence, our observations of GPs at the municipality level. The data therefore have both a panel data structure and a hierarchical structure⁸. We take account of the hierarchical structure by introducing dummies for municipalities and we estimate a random-effects model as we did in essay 1 (Iversen and Lurås, 2000a).

We illustrate our point by estimating two models: model A includes municipality dummies only, while model B includes individual rationing dummies as well as municipality dummies. The effects of the municipality dummies are of the same magnitude and significance in the two models. In municipalities with high GP density the population may experience better access, and hence a lower threshold for patient-initiated contacts, and GPs over time may develop a culture of a service-intensive practice style because they think this service intensity serves patients better. We therefore interpret the effect of the municipality dummies to reflect municipality characteristics with general access to GPs as the most important one. We find that only the municipality with the lowest GP density has a negative and statistically significant effect on service provision. Furthermore, we find a positive and statistically significant effect of rationing status in model B. Hence, individual patient constraints influence the provision of services from GPs to patients.

If only a macro-indicator of patient shortage, like GP density in the municipality, were available, we might erroneously have rejected the hypothesis of income motivation among GPs. Our main point is simply that GP density does not take account of variation in patient

⁸ Further discussions of hierarchical clustered data can be found in the summary of essay 3 (Iversen and Lurås 2000b).

constraints among GPs practising within a municipality. The distinction is that even if the “average GP” in a municipality does not experience constraints regarding the number of patients, differences among GPs may occur. Some GPs in the municipality may experience a shortage of patients, while others may have more than enough patients. We therefore emphasize the distinction between variations in GP density between municipalities and variation in individual patient constraints within a municipality. While GP density captures the general service provision level in the municipality, the measure of individual patient constraints is necessary to capture differences in service provision among GPs, above this level.

Essay 3: Economic motives and professional norm: The case of general medical practice.

In this essay we employ the suggested micro-indicator from Iversen and Lurås (2002a) to identify income-motivated behaviour among GPs. We identify two groups of rationed GPs: the lightly rationed who had a smaller list than they wanted in period one and experienced a net increase in the number of patients from period one to period two, and the strongly rationed who had a smaller list than they wanted in period one and experienced a constant or declining number of patients from period one to period two. The effect of both light and strong rationing is expected to have a positive effect on service provision. Because the strongly rationed GPs face more severe patient constraints than the lightly rationed, the effect of the latter indicator of rationing is expected to be weaker than the effect of the former.

Analogous to the data used in essay 2 (Iversen and Lurås, 2002a), the data are observations in two periods of GPs practising in four municipalities, i.e. the data have a hierarchical structure. Such clustering of data implies a correlation structure which invalidates the assumptions of independent error terms, and the methods of ordinary least square will therefore be inefficient. Similarly, a single-level approach may fail to utilize the information contained within and between the various levels in the data. We take account of the hierarchical structure by using an estimation procedure that accounts for the multilevel structure and the possible clustering of the data (Goldstein, 1995). Rice and Jones (1997) suggest using multilevel analysis to further understand differences in medical practice variation; for instance Scott and Shiell (1997a, b) applied the method in their analysis of GP behaviour. Our multilevel analysis includes three levels: observations (level 1) in two periods of GPs (level 2) practising in four different municipalities (level 3). Since level 3 has only four possible values we choose to include municipality as fixed effects. Since the rationed GPs in our sample differ from their unrationed colleagues regarding observable characteristics such as gender, preferred list size and the composition of the list, we may suspect that they also differ with respect to unobservable characteristics. If this is the case, the rationed GPs may not be a random selection of the sample. In the paper the possible selection bias of the data are not accounted for. The Heckman (1979) two-step estimator methods as well as the propensity score

matching method (Rosenbaum and Rubin, 1983, 1984) are statistical methods that can be used to correct for selection bias in a sample⁹.

We find a positive effect of rationing on income per listed person for both groups of rationed GPs, but only the effect of strong rationing is statistically significant. The results indicated that GPs who experience a severe shortage of patients have 17 per cent higher income per patient than their unconstrained colleagues. We also investigate whether we can trace this higher income to any specific component of the fee schedule. This was analyzed by estimating the effects of rationing on the number of consultations, the number of laboratory fees (the “best-paid” services) and the number of consultations that have a long duration (the “least-paid” services) per listed person. We find that GPs experiencing severe constraints on the number of patients provided both ordinary consultations and laboratory tests more often than the unconstrained GPs and that they use the long consultation more often. Because Iversen (2003) finds that the effect of patient constraints on GPs’ service provision persists five years after the introduction of the new organization, it seems that the result is not just a temporary phenomenon. If part of the GP’s income is paid as a fee-for-service component, it follows that the size of public health budgets will be higher if some GPs’ are experiencing patient constraints than if all the GPs are satisfied with their number of patients. Hence, paying GPs fee-for-service may be costly to the insurer.

We emphasize that the increase in service provision when GPs experience patient constraints, is not necessarily caused by an increase in physician-initiated services, i.e. more check-ups etc. Because we believe that the difference between patient-initiated and physician-initiated services is less clear-cut than often assumed in the health economic literature, we expect patient-initiated consultation to increase as well. This happens because the access to a constrained GP may be relatively better than the access to a GP who achieved his preferred number of patients. The reason is that the constrained GPs experience spare capacity that can be used to treat patients already on the list. For instance, if you contact your doctor because of the flu and he offers you a one-day wait, you accept the appointment. If he offers you a wait of ten days, you probably will refuse, simply because you find it likely that you will be cured within the waiting period. Hence, the accessibility offered by your physician, which might be

⁹ In a follow-up study based on panel data of the GPs for five consecutive years after the reform, Iversen (2003) suggested both these empirical methods. The estimated effect of patient shortage survives the correction for selection bias.

caused by differences in patient constraints, is likely to influence the number of patient-initiated consultations as well¹⁰.

It is important to emphasize that we do not interpret the increase in services as not being in the patients' best interest and as such our result is not a direct support of the physician-induced-demand (PID) hypothesis. To further clarify this point, we cite a definition of PID from McGuire (2000): *PID exists when the physician influences a patient's demand for care against the physician's interpretation of the best interest of the patient.* For instance, Grytten et al. (1995) assume that the GP provides insufficient care if the number of recall visits and the number of laboratory tests are set below the levels which the GP interprets as optimal¹¹. Hence, the practice profile is permitted to deviate from what the GP interprets as the optimal level of care. It then follows that the GP can balance patients' health against his own welfare, while we assume that a GP never balances patients' health and his own income¹². In our approach the reason why GPs' service provision to patients' varies is the lack of medical standards in general practice. We argue that for many treatments there is an interval of health service provision where the marginal effect on health is not documented to be different from zero. The literature on medical practice variation (see for instance Andersen and Mooney, 1990) documents this assumption. In the health economic literature the interval where the marginal health effect is zero is often referred to as "flat of the curve medicine" (see for instance Enthoven, 1990). The interpretation of our results is that in a mixed fee-for-service and capitation system, both unconstrained and constrained GPs provide services in this interval, but the former group provides the minimum volume of services while the latter group delivers services in excess of the minimum volume. Rather than claiming that rationed GPs are not acting in their patients' interest, we recommend stricter medical guidelines in the treatment of different diagnoses in general practice. Stricter guidelines will imply a reduction in medical practice variation, and hence reduce the opportunity set for income motivation. This argument is strengthened by the results in essay 1 (Iversen and Lurås, 2000a) where we

¹⁰ Further discussions can be found in Iversen and Lurås (2002b)

¹¹ Grytten et al. (1995) interpret "optimal level of care" as the GP's preferred level when neither inducement nor rationing of care takes place.

¹² This assumption simplifies the formal reasoning of the models considerably; a relaxation of the assumption would imply that the effects of economic incentives are strengthened.

found that the rate of referrals to hospitals, which practice referral guidelines more strictly than private specialist, is not influenced by a change in the payment system for GPs¹³.

We believe that the medical profession's judgement of the "appropriate" level of care is based upon evaluations on the effect of medical treatment on patients' health. Because we assume that the increase in health service provision due to patient constraints will not go beyond the interval where the marginal health effect is zero, the extra services do no harm to patients' health. Our main concern is therefore that GPs are not acting unethically in medical sense. But if physicians were able to take account of the whole life situation of his patients, for instance by including considerations of resource opportunity cost, the conclusions may be more difficult to draw. This happens because receiving health services from GPs will imply both money¹⁴ and time costs to individuals. Whether potential patients want the extra health services following from GPs' adaptation to the prevailing systems will probably vary. For instance, it seems likely that some groups of older patients always prefer more services to less because they find it satisfactory that the GPs care about them. On the other hand some groups of younger patients prefer the minimum level because they find it frustrating receiving services just for precautionary reasons. Our only concern is that if potential patients knew that the health effects of the extra services are expected to be small and that they receive the extra services because the GP has spare capacity and not because of bad health, some of them would most likely prefer another use of their own time and money.

¹³ In Sonnad and Foreman (1997) an incentive approach for guideline implementation in medical care is presented. They suggest an incentive system that rewards physicians who follow practice guidelines and who engage in guideline-related activity.

¹⁴ In Norway, the total fee-for-service component consists of patients' charges and payment from the National Insurance Administration.

Essay 4: Individuals' preferences for GPs. Choice analysis from the establishment of a list patient system.

In this essay we raise the question of whether individuals' choice of GPs is informed or purely random, as well as the question of whether observable demographic characteristics of a GP can tell us anything about the persons who want to be registered with what doctor. None of the earlier studies on the relationship between GPs and potential patients are based on individuals' actual choice of GPs and hence they do not take account of individuals' opportunities in the process of choosing a GP. By analyzing individuals' choices of GPs due to the establishment of the list patient system in Norway, we take matters a step further.

The data used comprise almost 10000 individuals who, ahead of the implementation of the new system, filled in three GP choices in an entry form. We interpret individuals' choice as the outcome of a probabilistic process and we formulate and estimate a Luce model for ranking, which is a product of three logit models: one for each step in the ranking process. In each step in the ranking the individual's actual choice and the choice set he or she face are accounted for. Because individuals choose GPs within their resident municipality the feasible alternatives differ between municipalities. The model originates from the work of Luce (1959) and is successfully implemented in, for instance, transportation economics (see for instance Beggs et al., 1981). To our knowledge, such models have not been used in the health economic literature before.

All the estimated parameters are sharply estimated¹⁵. Hence, individuals' choices are not purely random and there are systematic dependencies between characteristics of an individual and characteristics of his or her choice of a GP. We find that the smaller the age difference between a GP and an individual is, the higher is the probability of choosing that GP. We also find that the probability of choosing a GP is higher if a GP and an individual are of the same gender. The probability of choosing a GP is higher the older the GP is, and also the longer his or her stated list size¹⁶ is. Both these effects can be interpreted as the effects of individuals' preferring continuity in their relationship to GPs. If the GP is a specialist in general practice, the probability of being chosen increases. We interpret being a specialist as an indicator of being an experienced medical doctor.

¹⁵ This means that all the estimated parameters are significant at the 1 per cent level.

¹⁶ Before the new organization was implemented each GP was asked to state the number of people he would prefer to have on his list.

We find that inhabitants in a municipality make very different rankings of GPs. A policy implication of the findings regarding the connection between age and gender of the two parts of the matching process is that the collegiums of GPs in a municipality should reflect the age and gender composition of the population. Because it appears that individuals prefer continuity in their relationship to GPs, it seems important that the health authorities aim at achieving stability among GPs. The effect of individuals' preferences for GPs with a speciality in general practice is an argument for encouraging GPs to undertake further medical education, for instance by paying GPs an extra amount if he or she is a specialist in general practice. In the list patient trial GPs received an extra per capita component if they were specialists in general practice, while in the prevailing system specialists receive an extra fee per consultation if they are specialists.

The health authorities made an algorithm to allocate all inhabitants in the Norwegian population to a certain GP. The main factors that decide the matching between a GP and his patients are the individuals' seniority with their first-choice GP and the distance from the individual's home address to the GP's office. Hence, the population's well being or utility are emphasized in the algorithm. The utility of GPs is probably also an important task for the health authorities. A possible hypothesis is that GPs, to achieve about the same workload will prefer the patient list and the patient load to be as "equal" as possible among GPs. An interesting consequence of "equal" lists is a conflict between the interest of the GPs and the interest of the population. This is the case because "equal lists" imply restriction in individuals' choice.

Only 11 per cent of the inhabitants in our sample were not allocated to their preferred GP. It therefore seems that the actual composition of GPs' lists is determined by individuals' preferences. We find that female doctors have more females and older GPs have more elderly people on their lists. In the literature (see for instance Carr Hill et al., 1996 and Windmeijer and Santos Silva, 1997) it is often claimed that the elderly and females are more frequent users of medical doctors than the average. An implication of our results is therefore that some GPs have a heavier than average patient load. If GPs are not to suffer an economic loss because they treat patients with a greater need for health services, this finding should be reflected in the payment system for GPs. In the Norwegian payment system the fee-for-service component constitutes 70 per cent and the per capita component 30 per cent of an

average GP's income, which is meant to take account of differences in patient load. This composition implies that GPs with a long list of healthy individuals as well as GPs with a shorter list of people with a greater need of health care have almost the same income possibilities. Whether the allocation algorithm is optimal from the GP's point of view will depend on the GP's objectives. If their concern is income distribution and income security and not workload, the chosen algorithm may be optimal, but this conclusion rests on the design of the payment system.

4. Policy implications

In our work we have pointed out that the organization and payment system for GPs seem to influence the perception of a GP shortage, and that a shortage of GPs in one system may be transformed into a shortage of patients in another. When a capitation component replaces a practice allowance component, which was the case in Norway when the list patient system was introduced, we argue that a shift from a situation with a shortage of GPs to a situation with a shortage of patients may occur¹⁷. This happens because a practice allowance component is paid out independent of the number of persons a GP takes care of, while a capitation component will encourage GPs to take care of a large number of patients. A macro-indicator like GP density will not change when the organizational and payment structure of general practice changes. This strengthens the argument for the requirement of a micro-indicator to identify income-motivated behaviour among GPs.

We find that GPs experiencing constraints regarding the number of patients on their lists treat patients differently from GPs not experiencing such constraints: patients with personal doctors of the former type are given longer and more frequent consultations and also more laboratory tests than patients registered with doctors of the latter type. When we take account of differences in patient load and differences in patient characteristics, patients treated by unrationed GPs in the municipality with the poorest access in our sample (the lowest GP density) receive 36 per cent fewer services per year than patients treated by strongly rationed GPs in the municipality with the best access (the highest GP density). After the change in the remuneration of GPs, the average patient is given more specialist referrals. We therefore conclude that the lack of medical standards, differences in GP density, differences in patient constraints among GPs and the prevailing payment system cause variation in the volume of health services delivered to the population. Hence, variation in patients' health and diagnosis is not the only source of medical practice variation among GPs. If part of the GP's income is paid as fee-for-service, it follows that the size of public health budgets will be higher if some GPs are experiencing patient constraints than if all the GPs are satisfied with their number of patients. The increased costs may either crowd out activities in other parts of the health care sector or sacrifice activities in other sectors of the economy.

¹⁷ In the former organization the entire focus on the part of the health authorities was the shortage of GPs, while it seems that a high share of Norwegian GPs experienced patient constraints after the introduction of the new system (Iversen and Lurås, 1998 and Lurås and Iversen, 2002).

In the analysis of individuals' preferences for GPs we find systematic dependencies between characteristics of an individual and characteristics of his or her choice of GP. We also find that only 11 per cent of the population was not allocated his preferred GP. Hence, the actual composition of the GPs' lists is determined by individuals' preferences. Because we find that female doctors have more females and older GPs have more elderly people on their lists, it seems that some GPs may have a heavier than average patient load. Paying GPs fee-for-service helps to prevent an economic loss for GPs who treat patients with a considerable need for health services. The fee-for-service component in the Norwegian payment system constitutes 70 per cent and the per capita component 30 per cent of an average GP's income and this composition is intended to take account of differences in patient load. This implies that GPs with a long list of healthy individuals and GPs with a shorter list of people with a greater need for health care have almost the same income possibilities. One alternative to a payment system based on fee-for-service is a capitation system. Because not all patients are equally attractive to a GP, risk adjustment is necessary to prevent GPs from cream-skimming in a capitated system. A risk-adjusted per capita system accounts for heterogeneity among patients, i.e. the provider is paid more if his patients require more services than average. On the other hand, the population should not interpret it as stigmatizing to be labelled a specially "demanding" case. In the list patient trial GPs received a larger per capita payment if the person listed was older than 67, but this was not maintained in the nationwide reform.

5. Suggestions for further research

The ranking model used in essay 4 (Lurås, 2003a) explains the data 19 per cent better than if we assumed that individuals' choices were made on a purely random basis. Hence, we find the random part due to unobserved variables to play an important role in the choice process. A GP's personality and how individuals perceive the doctor's medical qualifications are probably the most important underlying factors of the random component (Scott and Vick, 1999 and Vick and Scott, 1998). This information may typically be observable for potential patients either by reputation in the municipality or by the individual's own experience with that doctor. Because individuals' personality and experience vary, the way individuals perceive a certain GP will vary and therefore a general characterization of a GP's personality will most likely not make sense. Analyzing the doctor-patient relationship therefore requires other analytical methods. Further analysis on this issue can be based on data from Statistics Norway's questionnaire survey for a representative sample of the Norwegian population. In this survey 5000 individuals have answered questions about the implementation of the list patient system. They are, for instance, asked to give their most important of three stated reasons for ranking their first-choice doctor. The three possible responses capture physical accessibility, the GP's medical qualifications and continuity in the relationship to a GP. The sample is also asked to answer five statements regarding GPs. The statements capture aspects like medical confidence, personal relationship and waiting time for a consultation. An analysis of these data will be a supplement to our results regarding the systematic dependencies between characteristics of an individual and characteristics of his or her choice of GP¹⁸.

Another supplement to the analysis on patients' choice of GPs is to use a revealed preference approach to analyze individuals' switching from one GP to another (see Dixon et al., 1997). Because we know the number of changes per GP and also whether the changes are due to individuals' moving to another address, or to whether the GP is reducing or closing his or her practice, we can gain more knowledge about the changing of doctors as well as knowledge concerning popular and less popular GPs. Both socioeconomic characteristics of individuals' changing to new doctors, and characteristics of doctors with a large turnover on their lists are

¹⁸ Preliminary analysis on this data can be found in Lurås (2003b).

important information for the health authorities in their efforts to design a health care system adapted to individuals' needs.

We find dependencies between characteristics of a GP and characteristics of the patients on the GP's list of patients (Lurås, 2003a) and we find the service provision (Iversen and Lurås 2000b) and the rate of referrals to specialists (Iversen and Lurås, 2000a) to vary among GPs. In the public debate we often have the impression that patients irrespective of the possible health effect prefer more health services to less. It is therefore of interest to investigate whether there is any connection between service provision and referral rates on the one hand, and the popularity of the GP on the other. If we find a connection between service provision and popularity, for instance that the most popular GPs provide more services than the less popular, this is an argument that individuals prefer more services to less, i.e. that individuals prefer to obtain services from their GP in the upper level of the "flat of the curve medicine".

To allocate GPs to all inhabitants in the Norwegian population, the health authorities used an allocation algorithm. Because we know the GP each inhabitant was assigned to, an idea for further work is to compare individuals' preferred ranking from our model in Lurås (2003a) with the actual outcome. An interesting question is whether the health authority's allocation algorithm takes account of our findings regarding individuals' preferences. If this is the case, the finding of a systematic relationship between patients and GPs may be the underlying explanation as to why patients are loyal to a GP, and the reason why their seniority with their first-choice GP is long.

The studies of the impact on service provision of patient constraints and of a change in the organizational structure and payment system for GPs are based on a small sample of GPs who participated in the list patient trial. The list patient system, implemented on a nationwide basis, gives us an opportunity to further explore these issues. Because the new available data set comprises all Norwegian GPs, it is possible to verify the results on a large sample¹⁹. But these unique data can probably also provide the basis for an analysis of how an optimal payment system for GPs should be designed. The objectives of a payment system can be divided into three main groups. First, achieve a certain income distribution or income

¹⁹ The nationwide data are based on registers in Statistics Norway and the National Insurance Administration and include all 3650 Norwegian GPs. Norwegian Social Science Data Services have prepared the data for analytical purposes.

certainty among the providers. Second, not exceed a certain level of government expenditure. Third, achieve qualitative or quantitative targets. Qualitative goals in general practice may be related to the population's access to health care or to the continuity in the relationship between a GP and his patients, while a quantitative goal may, for instance, be a certain productivity measure. Within one payment system it may be difficult to achieve different objectives. For instance, a system based solely on fee-for-service will, on the one hand, imply good access for the population and income security for the physicians. On the other hand, the system has a potential for overrunning budgets and giving a distorted income distribution among GPs. To decide whether the payment system is socially optimal, society's objectives must be explicit and the health authorities must give priority to certain goals.

In Newhouse (1992) "Pricing and imperfection in the medical marketplace"²⁰, he argues that because the market mechanism for establishing optimal prices does not operate in the health care sector, prices paid to the provider may not reflect the costs. Empirical findings such as the overprovision of services by fee-for-service physicians²¹, excess capacity of surgery in the US, selection behaviour in capitated plans and allegations of skimming and dumping in the American Prospective Payment System are explained by imperfect prices. Paying GPs fee-for-service may therefore be costly to the state. Most commonly used capitation systems are adjusted for age, gender, location and institutional status. But according to Newhouse et al. (1989) these variables only account for roughly 10 per cent of the explainable variance in treatment cost across people. This is the reason why Newhouse (1992) states that: *capitation as a basis of payment usually does not account for patient heterogeneity*. The trade-off between efficiency in production and selection behaviour implies that Newhouse (1996), to reduce welfare losses from erroneously fixed prices, suggests a mixed reimbursement scheme.

This thesis points to important effects regarding the use of fee-for-service when paying GPs. On the one hand, fee-for-service may be costly to the insurer because of income-motivated behaviour among GPs (Iversen and Lurås 2000b). On the other hand, because capitation may imply selection behaviour, fee-for-service is required to avoid GPs from cream-skimming (Lurås 2003). The thesis also points to the trade-off regarding the effect on referrals of a mixed fee-for-service and capitation system (Iversen and Lurås 2000a). With capitation, the

²⁰ A more thorough discussion can be found in Newhouse (1996).

²¹ When the fees are set above cost, over-provision may occur, while under-provision is a problem when fees are set below cost.

GP, in order to reduce his own effort, can increase the referral rate and let the specialist share the burden of the list, and if the fee-for-service component does not reflect the opportunity cost it becomes profitable for the GP to let the specialists provide the extra services. Hence, to contribute to a cost-effective allocation between the first- and the second level of the health care system, the relative sizes of the two remuneration components are important.

If we interpret an optimal payment system for GPs in relation to social goals of minimizing financial risk to the provider and providing an efficient level of health care to the whole population, the payment system should aim at protecting GPs against financial risk without inducing an inefficiently high level of health service use (Ellis and McGuire, 1990). It thus seems that a mixed payment system of capitation and fee-for-service may be a means to achieve social goals. But whether the fee-for-service component should constitute 70 per cent as is the case in the prevailing Norwegian payment system, 50 per cent which was the case in the list patient trial, or another per cent of an average GP's income is a question with no answer in the health economic literature. An important challenge to future research is therefore to gain more knowledge about the optimal composition of capitation and fee-for-service in a mixed payment system for GPs.

References:

- Andersen, T.F. and G. Mooney (eds.), 1990, *The Challenge of Medical Practice Variation*, Macmillan, London.
- Beggs, S. , S. Cardell and J. Hausman, 1981, Assessing the Potential Demand for Electric Cars. *Journal of Econometrics*,16, 1-19
- Bradlow, et al, 1992, *Patterns of referrals*, Health Services Research Unit: Oxford, 1992.
- Carlsen, B., 2003, *Er legen portvakt i fastlegeordningen?* Foredrag presentert på Den Nasjonale Helseøkonomikonferansen, Bergen 12. og 13. mai, 2003.
- Carr-Hill, R.A., N. Rice and M. Roland, 1996, Socioeconomic Determinants of Rates of Consultation in General Practice Based on Fourth National Morbidity Survey of General Practices, *British Medical Journal*, 312:1008-1013.
- Dixon, P. et al., 1997, *Patient Movements and Patient Choice*, Report for National Health Service Executive (York Health Economic Consortium, York).
- Donaldson, C. and K. Gerard, 1989, Paying General Practitioners: Shedding Light on the Review of Health Services, *Journal of Royal College of General Practitioners*, March 1989.
- Dranove, D. and P. Wehner, 1994, Physician-induced Demand for Childbirths, *Journal of Health Economics*, 13, 61-73.
- Ellis, R.P. and T.G. McGuire, 1991, Optimal Payment Systems for Health Services, *Journal of Health Economics*, 9, 375-396.
- Enthoven, A. C., 1990, *Health Plan: The Only Practical Solution to the Soaring Cost of Medical Care*, Addison-Wesley, Reading, M.A.
- Goldstein, H., 1995, *Multilevel Statistical Models*, Kendall Library of Statistics 3, 2nd Edition, Wiley, London.
- Gosden T. and D. Torgerson, 1997, The Effect of Fundholding on Prescribing and Referral Costs: A review of the evidence, *Health Policy*, 40: 103-114.
- Grytten J., et al., 1995, Supplier Inducement in a Public Health Care System, *Journal of Health Economics*, 14; 207-229.
- Heckman, J., 1979, Sample Selection Bias as a Specification Error, *Econometrica*, 47, 153-161.
- Hsiao, C., 1999, *Analysis of panel data*, Cambridge University Press.
- Hutchinson, B. et al., 1996, *Do Physician-payment Mechanisms Affect Hospital Utilisation?* A study of Health Service Organizations in Ontario, *J Can Med Assoc*, 154: 653-661.

Iversen, T., 2003, *The Effect of Patient Shortage on General Practitioners' Future Income and List of Patients*, Working Paper 2003:1, Health Economic Research Programme (HERO), University of Oslo.

Iversen, T. and H. Lurås, 1998, Innføring av fastlegeordning. Hva med legenes tilpasning? *Sosialøkonomen*, 7, 1998.

Iversen, T. and H. Lurås, 2000a, The Effect of Capitation on GPs' Referral Decisions. *Health Economics*, 9, 199-210.

Iversen, T. and H. Lurås, 2000b, Economic Motives and Professional Norms: The Case of General Medical Practice, *Journal of Economic Behavior and Organization*, 43, 447-470.

Iversen, T. and H. Lurås, 2002a, The Importance of Micro-data for Revealing Income Motivated Behaviour Among GPs. In Lindgren, B. (ed) *Individual Decisions for Health*. London: Routledge.

Iversen, T. and H. Lurås, 2002b, Waiting Time as a Competitive Device: An example from General Medical Practice, *International Journal of Health Care Finance and Economics*, 2, 189-204.

Krasnik, A. et al., 1990, Changing the Remuneration System: Effects on Activity in General Practice, *British Medical Journal*, 300: 1698-1701.

Kristiansen, I.S. and G. Mooney, 1993, Remuneration of GP Services: Time for More Explicit Objectives? A review of the Systems in Five Industrialised Countries, *Health Policy*, 24: 203-212.

Labelle, R. et al., 1994, A Re-examination of the Meaning and Importance of Supplier Induced Demand, *Journal of Health Economics*, 13: 347-368.

Luce, R.D., 1959, *Individual Choice Behaviour*, New York: Wiley.

Lurås, H., 2003a, *Individuals' Preferences for GPs. Choice Analysis from the Establishment of a List Patient System*, Working Paper 2003:5, Health Economic Research Programme (HERO), University of Oslo.

Lurås, H., 2003b, *Hva bestemmer befolkningen valg av fastlege?* Foredrag presentert på Den Nasjonale Helseøkonomikonferansen, Bergen 12. og 13. mai, 2003.

Lurås, H. and E. Aas, 2002, *Bruk av paneldatametoder til å belyse allmennlegers henvisningsmønster*, Working Paper 2002:6, Health Economic Research Programme (HERO), University of Oslo.

Lurås, H. and T. Iversen, 2002, Legemangelen som ble til pasientmangel: Variasjoner i listeønsker og pasientknapphet ved innføring av fastlegeordning, *Økonomisk Forum*, nr. 8, November 2002.

Madansky, A., 1980, On Conjoint Analysis and Quantal Choice Models, *The Journal of Business*, vol. 53, no. 3, pt. 2.

- Maynard, A., M. Marinker and D. Pereira Gray, 1986, The doctor, the patient and their contract 3. Alternative contracts: are they viable? *British Medical Journal*, 292: 1438-1440.
- McGuire, T., 2000, Physician Agency, in A.J. Culyer and J.P. Newhouse *Handbook of Health Economics*, Volume 1, Elsevier Science B.V
- Newhouse, J., 1992, Pricing and Imperfections in the Medical Care Marketplace, in P. Zweifel and H.E. Freck (eds.) *Health Economics Worldwide*, 3-22, Kluwer Academic Publishers.
- Newhouse, J. et al., 1989, Adjusting Capitation Rates Using Objective Health Measures and Prior Utilisation, *Health Care Financing Review*, 10(3): 41-54.
- Newhouse, J.P., 1996, Reimbursing Health Plans and Health Providers: Efficiency in Production Versus Selection, *Journal of Economic Literature*, 34: 1236-1263.
- Rice, N. and A. Jones, 1997, Multilevel Models and Health Economics, *Health Economics*, 6: 561-575.
- Rosenbaum, P. and D.B. Rubin, 1983, The central Role of the Propensity Score in Observational Studies for Causal Effects, *Bioemetrica*, 70: 41-55.
- Rosenbaum, P. and D.B. Rubin, 1984, Reducing Bias in Observational Studies Using Subclassification in the Propensity Score, *Journal of the American Statistical Association*, 79: 516-524.
- Rossiter, L.F. and G.R. Wilensky, 1983, A Clarification of Theories and Evidence on Supplier Induced Demand for Physicians' Services, *Inquiry*, 20: 162-172.
- Rutle, O. and L. Forsen, 1984, *Allmennpraksis – tema med variasjoner. En analyse av årsakene til ulike arbeidsmåter i primærhelsetjenesten*, Rapport 1/1983, Gruppe for helsetjenesteforskning, Oslo.
- Scott, A., 2000, Economics of General Practice, in A.J. Culyer and J.P. Newhouse *Handbook of Health Economics*, Volume 1, Elsevier Science B.V.
- Scott, A. and J. Hall, 1995, Evaluating the effects of GP remuneration: Problems and prospects, *Health Policy*, 31: 183-195.
- Scott, A. and S. Vick, 1999, Patients, Doctors and Contracts: An Application of Principal-agent Theory to the Doctor-patient Relationship, *Scottish Journal of Political Economy*, 46: 111-134.
- Scott, A. and A. Shiell, 1997a, Analysing the Effect of Competition on General Practitioners' Behaviour Using a Multilevel Modelling Framework, *Health Economics*, vol. 6: 577-588.
- Scott, A. and A. Shiell, 1997b, Do fee descriptors influence treatment choices in general practice? A multilevel discrete choice model, *Journal of Health Economics*, 16: 323 – 342.

Sonnad, S. and Foreman S.E., 1997, An Incentive Approach to Physician Implementation of Medical Practice Guidelines, *Health Economics*, vol. 6: 467-477 (1997).

Stoverinck, M.J. et al., 1996, Sex Differences in Health Problems, Diagnostic Testing and referrals in Primary Care, *Journal of Family Practice*, 43: 567-576.

Tussing, D.A. and M.A. Wojtowycz, 1986, Physician Induced Demand by Irish GPs, *Social Science of Medicine*, 23: 851-860.

Veale et al., 1995, Consumer Use of Multiple General Practitioners: An Australian epidemiological study, *Family Practice*, 12: 303-308.

Vick, S. and A. Scott, 1998, Agency in Health Care. Examining Patients' Preferences for Attributes of the Doctor-patient Relationship, *Journal of Health Economics*, 17: 511-644.

Wilkin, D. and A.G. Smith, 1987, Variation in General Practitioners Referral Rates to Consultants, *J R Coll Gen Pract*, 37: 350-353.

Wilkin, D., 1992, Patterns of Referrals: Explaining Variation, in M. Roland and A. Coulter (eds.): *Hospital referrals*, Oxford General Practise Series 22 (Oxford University Press).

Windmeijer, F. and J. Santos Silva, 1997, Endogeneity in Count Data Models: An Application to Demand for Health Care, *Journal of Applied Econometrics*, 12: 281-294.

Ystehede, B.D., 1988, *Allmennlegene og den Ambulente Spesialisttjenesten*, Thesis for the Master of Health Administration, Centre for Health Administration, University of Oslo.

The reference to essay 1 is:

Iversen, T. and H. Lurås, 2000, The Effect of Capitation on GPs' Referral Decisions.
Health Economics, 9, 199-210.

The reference to essay 2 is:

Iversen, T. and H. Lurås, 2000, Economic Motives and Professional Norms: The Case of General Medical Practice, *Journal of Economic Behavior and Organization*, 43, 447-470.

The reference to essay 3 is:

Iversen, T. and H. Lurås, 2002, The Importance of Micro-data for Revealing Income Motivated Behaviour Among GPs. In Lindgren, B. (ed) *Individual Decisions for Health*. London: Routledge.

The reference to essay 4 is:

Lurås, H., 2003a, *Individuals' Preferences for GPs. Choice Analysis from the Establishment of a List Patient System*, Working Paper 2003:5, Health Economic Research Programme (HERO), University of Oslo.

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