FACTORS AFFECTING DOCTORS' DECISION MAKING

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1. INTRODUCTION

In most - probably all - industrialised countries there is an increasing gap between what medical technologies can provide and the resources made available to the health care sector. Whatever the reason for such 'health care crises', reforms of financing and organisation of health care are frequently the policy response. The introduction of 'market models' and 'change through financial incentives' tend to be 'obvious' components in modern health care reforms. So far, however, documented successes seem scant. In fact, in the US where market models are widely advocated and implemented, health care is more costly than anywhere else and yet leaves important equity issues unresolved (Anonymous 1990a).

When market models are introduced and/or financial incentives or other forms of incentives changed, it is seldom the case that this is done on the basis of careful considerations of what the theoretical or empirical justifications for such changes might be. There tends to be an element of 'faith' involved, sometimes quite a substantial faith. Beyond any general discussion on the adaptability of market models in health care, the crucial role of doctors in the provision of health care should be emphasised. Whatever system of governing and managing health care exists, doctors are the ultimate decision makers with respect to the utilisation of hospital services, ambulatory care, physiotherapy, prescription drugs, *etc*. Doctors are said to decide, directly or indirectly, about the allocation of 70-90% (Enthoven 1981; Rosen 1989; Eisenberg 1985) of health care expenditure. Consequently, efficient health care is not possible without efficient doctors.

If incentives, whether financial or non-financial, are to be effective in changing the way health care is provided, they will in the end do so in some way or other through doctors' decision making. What types of doctors' decisions are or should be affected -

and how? The decisions on behalf of the doctor himself, of the individual patient, of groups of patients, of the ward, of the hospital, or of society in general? A crucial question is when do we want, or expect, financial incentives to overrule other determinants of doctors' decision making? And what are these other determinants? In the context of health care reforms such questions are sometimes asked, rarely explored and almost never answered explicitly. The humble aim of the present thesis is not to answer all these questions but to shed some light on a few 'black holes' in this area of health policy.

Different scientific disciplines have put forward different theories to explain behaviour. In economics, behavioural models are based primarily on the assumption that each individual seeks to maximise his or her own welfare. This thesis, written by one whose primary training and experience are in medicine, examines the question of how useful the economists' models can be in helping to analyse and then explain certain aspects of doctors' behaviour. This is potentially a very large task and there is no suggestion that the thesis will be comprehensive in this regard. However, some hypotheses are developed on the basis of the health economics literature and then tested empirically.

2. FACTORS AFFECTING DOCTORS' DECISION MAKING

The crucial starting point in micro-economic theory is that each economic actor has an objective function which he, subject to some constraints, is seeking to maximise. For the consumer, the objective is that of maximising utility. While utility previously was seen as 'that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness (all this, in the present case, comes to the same thing), or to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered' (Bentham 1789), utility in modern economics is used more as a way to describe preferences (Luce 1957; Varian 1990). Hence, when a consumer chooses one bundle of goods rather than another, he is said to have a preference for the former (*i.e.* the chosen bundle yields higher utility).

In the theory of labour supply, the individual seeks to maximize a utility function which consists of two arguments: income and leisure. Income is obtained from the product of a given hourly wage rate and the number of hours the individual chooses to work, while leisure represents the remaining hours out of work. The chosen labour supply depends on the individual's preferences for income versus leisure. However, for most people there is not much discretion as to the number of hours worked, so the revealed 'choice' of 7.5 hours per day may not suggest more than that the individual chooses to work rather than being out of work.

This simple model seems more applicable to physicians' labour supply in that physicians appear to have more discretion as to how many hours they choose to work. Again, the chosen number of hours worked depends on each physician's trade-off between income and leisure. An important modification of this simplified model is that for many doctors (*e.g.* those on fee-for-service payment), the wage rate is not determined wholly exogenously. Certainly the level and structure of fees will have an important bearing on the sorts of levels of income doctors can achieve but the final hourly wage and hence income for individual doctors will depend finally on the way in which the individual doctor chooses to practice medicine. However an over-simplistic adoption of this type of model would predict that the chosen medical practice is the one which gives the highest hourly wage. This may not always be the case. No doctor would for example take a blood sample from every patient that he sees even if he were paid to do so. Also, doctors from time to time work overtime without being financially compensated. This suggests that doctors have arguments in their utility functions beyond income and leisure.

In fact, health economists have included additional arguments in doctors' utility functions: status, interesting patients, medical ethics, *etc.* (of which more below). Given that doctors seek to generate utility not only from income and leisure, but also from for example status, intellectual satisfaction and ethical behaviour, this means that one action is chosen rather than others because in total it involves the highest utility. Thus, doctors' decision making can be interpreted as a function of the utility arising from the available choices.

Given an understanding of those factors that generate utility or disutility (*i.e.* the arguments in doctors' utility function), it is then easier to decide how best to seek to influence doctors' professional decision making. Rochaix claims that 'influencing physicians' behaviour to suit policy-makers' goals requires finely tuned sets of controls and incentives. Solely on the basis of a thorough understanding of the physicians' behaviour and its determinants can such systems of incentives and controls be effective' (Rochaix 1991).

In most economic models of doctors' behaviour, income is central (Feldstein 1970; Evans 1974; Sloan 1974; Pauly 1980; Richardson 1981; Wilensky 1981; Zweifel 1981; Dionne 1985; Ferguson 1985; Wolff 1989; Carrere 1991; Rochaix 1991). It is assumed that when a doctor is faced with a decision, he prefers, all other things equal, the option involving the highest income. The empirical evidence in this area, however, is not conclusive. While some studies clearly support the hypothesis that doctors are influenced by financial incentives (Rimlinger 1963; Hunt 1980; Epstein 1986; Krasnik 1990; McKay 1990; Hemenway 1990), several studies yields more limited support or none at all (Steele

1965; Sloan 1970; Shwartz 1981; Hickson 1987; Robberstad 1989; Hughes 1992; Klausen 1992; Hutchison 1993; Bjørndal 1994).

In line with microeconomic theory many economic models imply that doctors, in addition to income, also have some preference for leisure (Feldstein 1970; Evans 1974; Sloan 1974; Woodward 1984; Ferguson 1985). Admittedly, doctors sometimes work long hours (Sloan 1974; Wium 1977; Høgli 1990), even when they are not paid for overtime. However, beyond a certain limit doctors will prefer leisure to income. Unfortunately, little is known from empirical studies about doctors' income/leisure trade-offs. Such knowledge is important from a policy perspective - for example in cases of doctor 'shortage' when policy makers may wish doctors to work long hours. If income per unit of time (the wage rate) were increased, doctors might choose to work longer hours (*i.e.* less leisure) because each hour of work yields more income (the income effect). However, they may also choose to work fewer hours because the higher wage rate makes it possible to substitute work by leisure without reducing total income (the substitution effect). Whether an increase in the wage rate will result in an increase or a decrease in doctors' working hours depends on the relative strengths of substitution and income effects (Varian 1990). In the US, there has been much debate over the likely effect of increasing doctors' incomes, but the evidence there is conflicting (Sloan 1975; Brown 1979).

A much debated aspect of the income-leisure trade-off is the so-called 'target income theory' proposed by Evans (Evans 1974). He suggested that doctors aim at a 'target income' which is that level of income beyond which they will prefer leisure to more income. The origin of such targets is unclear, but in Evans' words 'no more so than the origin of the utility function'.

In several models economists have proposed a socalled ethical argument in doctors' utility functions (Feldstein 1970; Sloan 1974; Enthoven 1978; Wilensky 1981; Zweifel 1981; Woodward 1984; Wolff 1989). Making decisions in conflict with medical ethics is assumed to incur a cost (disutility) on the part of the doctor. While ethical codes to a limited degree state what doctors shall or shall not do, terms like 'the health of my patient shall be my first consideration' are frequently used. This leaves much to doctors' discretion, but in their medical training doctors learn what to do in various medical circumstances. Consequently, doctors are likely to choose that medical practice which they believe yields the largest health improvements for their patients. If need is interpreted as 'potential for improved health' then there is no conflict between medical ethics and responding to patients' needs. Indeed, if one assumes that patient characteristics (*e.g.* age, sex, perceived status of health, diagnosis, *etc.*) are proxies for patient needs, there is solid evidence that doctors' decision making is influenced by such needs. In different countries (Mechanic 1979; Baker 1991; Fylkesnes 1991) and for various services (Andersen 1983; Grimsmo 1984; Elstad 1987), it has been shown that 'both perceived and 'objective' (as judged by the diagnosis) status of health are important predictors of utilisation of doctor services' (Newman 1975). Such associations can be interpreted in at least three ways: doctors derive disutility from departing from medical ethics and patients' wishes, doctors simply do what they have been taught to do in the medical circumstances, or doctors are genuinely altruistic. The key point is, however, that doctors behave as if they aim at improving patient health, or in other words have patient utility in their own utility function. Also, it has been proposed that doctors may have wider concerns than only those of their patients. For example, Ellis *et al* assumed that doctors are interested in both the benefit to the patient and the hospital's profit but this assumption was not tested empirically (Ellis 1986).

Status has repeatedly been proposed as an argument in doctors' utility function (Enthoven 1978; Richardson 1981; Wilensky 1981). Indeed, doctors have been shown to be well aware of the status attached to different diseases and specialties (Schwartzbaum 1973; Shortell 1974; Album 1991), but, except for anecdotes, there is no empirical evidence that doctors' decision making actually is influenced by status considerations.

Eisenberg, in studying medical decision making, states that 'desirable patients are often those who have unusual or challenging medical problems' (Eisenberg 1986). In line with this idea, some economic models include intellectual satisfaction, 'interesting cases', *etc.* in the utility function (Feldstein 1970; Enthoven 1978). Other things equal, doctors would then prefer 'interesting' tasks, patients, specialties, *etc.* However, except for anecdotes, there is little evidence for this kind of behaviour.

The list of arguments proposed in various economic models is rather extensive but can be extended still further. Based on anecdotes about doctors striving for professional autonomy, then this form of autonomy is a candidate for the list. Some of these arguments are obviously selfish (*e.g.* income, status or intellectual satisfaction) while the ethical argument is more unclear as it may involve altruistic behaviour. It is however unlikely that all the arguments in the utility functions play the same role in all kinds of decisions. Rather, one may hypothesise that the relative weight of each argument varies across countries and sociopolitical systems, across doctors within each system, and for each doctor across time and types of decisions. With respect to the last, doctors' decisions may conveniently be divided into three groups: short term decisions where the doctors face the consequences of their decisions within minutes to days, medium term decisions with consequences within months to a year, and long term decisions with consequences lasting for several years. Short term decisions are for example opting to see an extra patient in the afternoon, skipping lunch to go to the library in the lunch break, and all kinds of clinical decisions. Commitment to working overtime regularly, investing in capital equipment are examples of medium term decisions while choice of location or specialty are typical long term decisions.

Since medical ethics and medical training primarily address issues of clinical decision making, one may hypothesise that the ethical argument in the utility function is most heavily weighted for short term decisions, less weighted for medium term decisions (for example commitment to working overtime) and of little importance for long term decisions. This would then leave more scope for the purely selfish considerations (income, status, *etc.*) the further from patients decisions are taken.

In order to understand and predict doctors' decisions, not only is it necessary to consider the type and context of the decision. Also, the relation between the different arguments may be important. Some pairs of arguments imply synergisms while others imply trade-offs. Choosing an 'interesting' medical specialty may generate intellectual satisfaction as well as status. However, choosing the most leisure inevitably results in lower income. Extended utility functions with many arguments are appealing in that they are more realistic than simplified ones with only income and leisure. However, the extended ones have a distinct disadvantage in that they are difficult to test empirically ('*ceteris* is not always *paribus*'). The more extended and the more complex the utility function, the more cumbersome in practice it becomes. It is therefore a trade off here between theoretical rigour and the empirical demands of the real world. While the trade off is recognised in this thesis, the position adopted in principle is that we cannot always model all the arguments that 'ideally' in some theoretical construct we would wish.

However to have an understanding at a conceptual level of the fuller arguments that are likely to be present will in itself be useful.

In conclusion, there is clear evidence that doctors' observed behaviour cannot be explained by the simple utility function in which there are two arguments only: leisure and the endogenously determined wage rate. Like most other higher educated professionals, doctors seem to have fairly selfish preferences favouring status and interesting tasks. However, doctors are expected to behave within the bounds of medical ethics which, in combination with medical guidelines, impose strict guidelines for doctors' decision making. A crucial question is then to what extent and under what circumstances doctors' selfish motives are constrained by medical ethics. Some aspects of this issue will be explored in the empirical studies.

3. METHODOLOGICAL PROBLEMS ASSOCIATED WITH STUDYING DOCTORS' DECISION MAKING EMPIRICALLY

Identifying arguments in doctors' utility functions and determining their relative weights can be based on individuals' statements about their preferences (stated prefe-rences) or on actual choices (revealed preferences) (Deaton 1991; Ryan 1992). It is likely that doctors, if asked about their purely selfish motives (income, status, *etc.*) will answer strategically. Therefore, studies of revealed preferences are most frequently done.

Doctors' decisions are influenced by an array of factors. Therefore, when studying the effect of one factor, one has to control for other explanatory variables. Given the complexity of the causal mechanisms involved, it is possible to adjust for only a limited number of these variables. Randomised controlled trials are ideal for the detection of the effect of one variable while holding all others constant. Such studies of doctors' decision making however are seldom undertaken. Doctors and (other professional people) do not readily agree to participate in randomised studies of their own behaviour. Even if they were prepared to be randomised to studies of their own decision making, it would be almost impossible to conduct them in a blind fashion since the doctors would know to which group they belonged. Knowledge of the study, even if the participants do not know to which group they belong, might change the behaviour of the participants. Only very few studies based on randomisation have been published. One was done by Hickson *et al* who assigned 18 doctors training in pediatrics randomly to salary or fee per visit remuneration (Hickson 1987). They found small differences in the delivery of out-patient services.

In practice, students of doctors' decision making are referred to rely on non-experimental, observational studies of doctors' actual decision making. Such designs allow the exploration of more than one factor at a time, but they have serious inherent problems. Confounding as well as selection and information bias are likely to influence the measurement of effects (for further details see section 7.1). Also, such studies may be subject to strategic adjustments on the part of the doctor. The latter problem is most prevalent for short term (clinical) decisions. For medium term and long term decisions, doctors can not so easily make strategic adjustments. Retrospective designs may alleviate the problem of strategic adjustments but at the cost of reduced data quality.

With respect to clinical decisions, various events in the health care sector may provide the basis for quasi-experimental designs. Such designs may allow the study of one single factor although adjustments for potential confounding factors are recommended. The switch from a pure capitation to a mixed fee-for-service/capitation system among GPs in Copenhagen is an example of such a quasi-experimental study (Krasnik 1990).

Several studies have shown that health status and other patient characteristics are associated with health care utilisation (Mechanic 1979; Andersen 1983; Grimsmo 1984; Fylkesnes 1993). Apparently, doctors behave as if they take patient needs into consideration in their clinical decision making. Omitting patient characteristics from an empirical study of doctors' decisions means that serious confounding may be present (see section 7.1.3). If for example doctors on one payment system order more laboratory tests than those on another system, this may just as well be due to differences in patient case-mix as to financial incentives. Unfortunately, few empirical studies of doctors' clinical decisions have information on patient characteristics. Accordingly, the studies may be seriously confounded.

To the extent that patient characteristics are taken into account, this is sometimes done through the use of aggregate data. For example average age and sex of patients groups have been used as explanatory variables in regression analyses (Evans 1974; Zweifel 1981). Unfortunately, aggregate data involve two disadvantages. First, information is lost by aggregation. Second, and more serious, aggregation introduces the potential for committing the so-called 'ecological fallacy' (Robinson 1950). Robinson showed that one should avoid making inferences about individual level relationships on the basis of aggregate data. He found a strong correlation between literacy rates and ethnicity at the regional and state level in the US, but almost no correlation at the individual level.

Lacking large randomised studies, and lacking even the prospect that they will be undertaken, there is a need to do observational studies of doctors' clinical decisions taking individual patient characteristics into account. Also, data on doctor characteristics (age, sex, training, *etc.*) and organisational characteristics (*e.g.* doctor density, auxiliary staff) should be included in the analyses. Since the explanatory variables then have a hierarchical structure, the results of standard regression procedures are subject to the ecological fallacy and to downward bias in estimating confidence intervals. A multilevel model of analysis is then called for (see section 7.1.5.2).

Aside from the methodological limitations of several empirical studies, important policy issues are still unanswered. From a policy perspective, the choice of remuneration system for doctors is a key issue. Hitherto, there have been less than a dozen studies comparing doctors under different payment systems (*e.g.* fee-for-service, capitation or salary). In conclusion, it seems as if the understanding of doctors' decision making is limited by methodological shortcomings in the empirical studies and by the spectrum of decisions analysed.

4. AIMS AND HYPOTHESES OF THE EMPIRICAL STUDIES

The aim of papers I-III was to explore the effect of financial incentives, of organisational factors and of doctor and patient characteristics on GPs' clinical decisions. This was done through a comparison of GPs paid per item of service with those on salary. The dependent variables chosen for analysis were various laboratory tests (paper I); the length of surgery consultations, the proportion of repeat visits and the weekly number of surgery visits (II), and the proportion of home visits (III). It was hypothesised that doctors on fee-for-service payment would - *ceteris paribus* - provide more laboratory tests, shorter but more consultations and more home visits than those paid a salary. To adjust for confounding, organisational and patient characteristics were included and the latter were expected to be at least as important determinants of clinical decisions as financial incentives.

The aim of paper IV was to explore factors affecting a long term decision (choice of location). The main hypothesis was that geographic attachment influences the choice of location.

The hypothesis that medium term decisions are influenced by purely selfish objectives like income and status were tested in paper V. Here, it was expected that radiologists owning private radiology clinics would be more inclined to obtain mammographic equipment (to increase their incomes) than those in public hospitals (where the radiologists have no financial interest in the choice of equipment). Also, it was hypothesised that radiologists not perceiving mammography as a status generating procedure would have the least favourable opinions on mammography screening and be less personally involved with the procedure. The same hypotheses were postulated for doctors perceiving mammography screening as a risky procedure with respect to misdiagnosing breast cancer.

5. MATERIALS (STUDY POPULATIONS)

Paper I, II and III

In 1978 the Ministry of Health implemented a Salary Demonstration Project (in Norwegian: Prøveordningen med fastlønn) for general practitioners (GPs) in some of the 90 municipalities in Northern Norway. This offered an opportunity in research to compare doctors' clinical practice under two different payment systems (salary and fee-for-service). The data used in papers I-III were collected in 1982 as part of the evaluation of the demonstration project. This evaluation included a one week registration of direct patient contacts among all GPs (n=148) in 68 municipalities in Northern Norway. 116 doctors (78%) participated in the study. The registration form is shown in appendix 1.

We excluded 11 municipalities hosting a hospital and 11 municipalities with, according to the County Health Officer, badly functioning primary health care (very rapid turnover of personnel, vacancies in medical posts, *etc.*). Additionally, 10 doctors on salary in the city of Tromsø were included in the study of laboratory test ordering (I). In eight municipalities, all doctors dropped out from the study (Table 1).

The doctors indicated on the registration form the age and sex of the patients. Information on other determinants of doctors' decision making was collected through two separate postal surveys undertaken as a part of the evaluation of the Salary Demonstration Project. From one survey we obtained information on the collection of patient payments and on travel time for the patients. From the other, information was obtained on the number of auxiliary staff per doctor, the travel time to the nearest hospital and doctors' job satisfaction and hospital training.

Table 1. Study municipalities by type and participation status (Papers I-III)

	Remuneration system		
	FFS[1]	Salary	Total
Included in the study - doctors responding[2]	25	36	61
Included - doctors not responding	4	4	8
Excluded: hosting hospitals	9	1	10
Excluded: substandard health care	6	5	11
Total	44	46	90

[1] Fee-for-service
[2] Including Tromsø (salary)

There were 158 doctors in the 69 study municipalities (Table 2). The response rate was slightly lower among fee-for-service doctors than among those on salary (74% vs 84%, p=0.18) (Table 2).

A further description of the municipalities and of the doctors is presented in Table 2 in paper I and in Table 1 in paper III, respectively.

Table 2. The study population (invited doctors) by county and remuneration system (Papers I-III). Response rate in parentheses

	Fee-for-service		Salary		Total	
	N	(%)	N	(%)	N	(%)
Nordland	41	(73.2)	23	(82.6)	64	(76.6)
Troms[1]	5	(60.0)	60	(83.3)	65	(81.5)
Finnmark	19	(78.9)	10	(90.0)	29	(82.8)
Total	65	(73.8)	93	(83.9)	158	(79.7)

[1] Including 10 doctors on salary from Tromsø (100% response)

For each direct patient contact, the doctors registered on a special form (appendix 1) the following: patient age and sex, types of consultation, referrals, laboratory tests, sickness certification and length of consultation. Table 3 shows the direct patient contacts recorded during the study period.

Table 3. Direct patient contacts in papers I-III

	Type of patient contact[1]						
	1	2	3	4	5	Unknown	Total
Total[2]	2,943	2,849	557	132	344	433	7,258
Paper I[3]	3,224	3,055	569	-	-	-	6,848
Paper II	2,943	2,849	557	-	-	-	6,349
Paper III	2,943	2,849	557	132	344	-	6,825

[1] 1=initial surgery visit, 2=return surgery visit, 3=acute surgery visit (out of hours), 4=acute home visit, 5=scheduled home visit
[2] Tromsø not included
[3] Including 499 surgery visits in Tromsø

In paper I, ordering of laboratory tests was studied in 6,848 surgery visits (including 499 surgery visits in Tromsø) (Table 3). In paper II, the use of time was studied in 6,349 surgery consultations. In paper III home visiting was studied in 6,825 consultations.

6. MAIN RESULTS

In paper I, we found that doctors on fee-for-service remuneration ordered urine microscopy more frequently than those on salary (Odds Ratio 1.33, 99% Confidence Interval 1.06-1.83), but there was no effect of financial incentives on the ordering of other laboratory tests. If the Tromsø doctors were excluded from the study, we found largely the same results. In Table 4 the ordering of urine microscopy is analysed with standard (unilevel) logit modelling and with multilevel modeling in ML3 (Goldstein 1987; Prosser 1991a; Woodhouse 1992; Prosser 1991b). The regression coefficients are largely the same, but the confidence intervals are wider in the multilevel modelling and only patient age and sex remain statistically significant.

About 50% of doctors on salary reported that they always collected the patient copayment (on behalf of the municipality government) in contrast to 23% of fee-for-service doctors who collected the payments on their own behalf.

In paper II, doctors on fee-for-service had consultations which were on average 0.7 minutes shorter than those of doctors on salary ($p=0.0005$), after adjusting for other explanatory variables. The weekly number of consultations and the proportion of return visits were about the same for the two groups.

In paper III, fee-for-service doctors offered home visits more often than doctors on salary when the problem was not acute (OR 4.50, 99%CI 1.67-12.08). The consultation rates were about the same in municipalities with doctors on salary as in those with a fee-for-service system (2.4 vs 2.2 per person per year).

Age and sex of the patient were the strongest and most consistent predictors of doctors' clinical practice (I-III). Age and sex were statistically associated with laboratory utilization, with the length of consultation, with a higher proportion of return surgery visits and with home visiting (the last only being marginally significant). If patient age and sex were omitted from the analysis (Table 4), this would change the observed effects of other variables very little. However, if doctor density were omitted, this has a considerable effect on the analyses. For example, the odds ratio for remuneration system increases from 1.24 to 1.61 and becomes statistical significantly different from one.

Table 4. Unilevel and multilevel logistic regression analyses (Odds Ratio (OR) and 99% Confidence Interval (CI)) of ordering of urine microscopy (0=no test ordered; 1=test ordered). 6,776 encounters (Tromsø included)

	Unilevel		Multilevel		Multilevel		Multilevel	
Independent variable	OR	(99% CI)	OR	(99% CI)	OR	(99% CI)	OR	(99% CI)
Reimbursement system (0=salary, 1=FFS)	1.40[1]	(1.06-1.83)	1.24	(0.71-2.17)	1.23	(0.70-2.17)	1.61	(1.00-2.61)
Sex of physician (0=male, 1=female)	1.43	(1.07-1.92)	1.50	(0.90-2.49)	1.55	(0.93-2.58)	1.47	(0.89-2.44)
Age of physician	1.06	(1.01-1.12)	1.07	(0.98-1.17)	1.07	(0.98-1.17)	1.07	(0.97-1.17)
Medical school (foreign=0, domestic=1)	1.12	(0.87-1.45)	1.15	(0.73-1.80)	1.14	(0.73-1.80)	1.15	(0.73-1.80)
Experience as a GP (years)	1.01	(0.95-1.07)	0.99	(0.90-1.10)	0.99	(0.89-1.10)	1.00	(0.90-1.11)
Experience as a hospital doctor (years)	0.93	(0.78-1.12)	0.92	(0.67-1.27)	0.92	(0.67-1.26)	0.91	(0.66-1.25)
Job satisfaction (1=low, 7=high)	1.03	(0.94-1.12)	1.00	(0.85-1.17)	1.00	(0.85-1.16)	0.99	(0.85-1.16)
Physician density (population/doctor-ratio)	1.51	(1.14-2.01)	1.62	(0.87-3.02)	1.62	(0.86-3.06)	---------------	
Number of months in post	0.93	(0.88-0.98)	0.95	(0.85-1.06)	0.96	(0.85-1.07)	0.94	(0.84-1.06)
Population of municipality	0.97	(0.95-0.98)	0.97	(0.94-1.00)	0.97	(0.93-1.00)	0.99	(0.96-1.01)
Proportion of population reached within 1/2 hour	1.00	(1.00-1.01)	1.01	(1.00-1.02)	1.01	(1.00-1.02)	1.01	(1.00-1.02)
Copayment always collected (0=no, 1=yes)	1.01	(0.81-1.27)	0.98	(0.65-1.47)	0.98	(0.65-1.47)	1.00	(0.66-1.50)
Travel time to hospital (hours)	1.03	(0.95-1.12)	1.00	(0.85-1.17)	0.98	(0.83-1.15)	1.03	(0.87-1.21)
Auxiliary staff per doctor	1.34	(1.10-1.63)	1.20	(0.84-1.73)	1.23	(0.86-1.76)	1.20	(0.84-1.71)
Sex of patient (0=male, 1=female)	2.66	(2.15-3.28)	2.55	(2.06-3.15)	---------------		2.54	(2.06-3.14)
Age of patient (in 10 years)	1.14	(1.10-1.19)	1.14	(1.09-1.19)	---------------		1.14	(1.09-1.19)

[1] The odds ratio is slightly different from the number in paper I due to rounding off errors

* 0.01>p>0.001

** 0.001>p>0.0001

*** p<0.0001

In paper IV, we found that doctors' current location was associated with place of residency and with their spouse's place of birth. It was - *ceteris paribus* - five times more likely that a doctor would choose to live in the peripheral areas of Norway rather than the central ones when the spouse was born in the peripheral areas.

In paper V, mammography utilisation rates were higher in counties with private (for profit) X-ray clinics than in those with public (non profit) clinics only. Doctors who thought the risk of misdiagnosing cancer by mammographic examinations was high, tended to be less favourably inclined to breast screening in women aged 40-49, but there was no effect on doctors' opinions with respect to women over the age of 50. Most radiologists do not see mammography as a status generating procedure, and those who do seem not to be influenced it in their attitudes or practices.

7.1 Methodological considerations

The methodological shortcomings of the present empirical studies are considerable, but should be seen against the general problems associated with studying professional decision making as outlined in section 3. In papers I-III GPs' revealed preferences for clinical practice were studied. The lack of suitable routine data on clinical practice necessitated the use of registration forms filled in by the doctors themselves. To what extent this has influenced the results is discussed below. The study of medical specialists' revealed preferences for location was based on data collected for other purposes. This precludes strategic answering but severely constrains the choice of variables. In paper V stated preferences were elicited through a questionnaire. This allowed the inclusion of a wide range of variables, but the use of stated preferences in a somewhat 'touchy' area introduces the potential for strategic answering and opens for the gap between stated preferences and actual decisions.

The skeptical reader might conclude that the methodological problems are so marked that no conclusions are warranted on the basis of the five papers. This judgement is fair enough. However, neither GPs' clinical decisions, medical specialists' locational choices nor radiologists' involvement with mammography can be tested in large scale randomised trials. If the methodological requirements are too rigid, researchers will be unable to make any contribution to health policy. Unsubstantiated models, ideology and 'fashion' would then constitute the basis for health policy. Feinstein states that 'investigators who want to get scientific answers to important clinical questions will have to reach beyond the constraints of the paradigm that requires formal experimentation as the sole method of science' (Feinstein 1983). The same is likely to be the case in health policy. Imperfect studies can still be useful so long as their shortcomings are taken into consideration. In the following some of these shortcomings will be further explored.

7.1.1 Selection bias

Selection bias refers to a 'distortion in the estimate of effect resulting from the manner in which subjects are selected for the study population' (Kleinbaum 1982) and may be present in all five papers (I-V). During the 1970s in Norway, there was a debate over which was 'the best remuneration system' (Andreassen 1982). There were ardent supporters of both fee-for-service and salary remuneration, and most doctors were concerned about the issue. Therefore, there are reasons to believe that doctors selected the municipality in which they wished to work, *inter alia*, according to their preferences for the remuneration system. If the preference for system is associated with practice style, self-selection may exaggerate differences in behaviour under the two systems.

About 20% of the doctors who were invited to participate in the study, chose not to do so. It is conceivable that doctors who knew that they were influenced by the nature of the remuneration system opted out of the study. This might be the case for fee-for service doctors as well as for those on salary. This selection would tend to conceal the effects of the financial incentives.

In paper IV, we studied doctors who had submitted information to the directory 'Doctors in Norway 1984'. The majority (90%) had submitted, and it is less likely that non-submission is associated with locational choices. We purposely over-sampled doctors from Northern Norway to increase the number of doctors from this area. This clearly introduces a potential bias although separate analysis without over-sampling did not indicate biased effect estimates.

In paper V, there was probably a selection bias in favour of doctors involved with mammography. Since involvement with mammography was associated with opinions, the proportion of doctors in favour of mammographic screening is probably overestimated. Whether such selection bias led to bias in the estimated effects of various predictors of opinions and practices is less clear.

7.1.2 Information bias

Information bias refers to a 'distortion in the estimate of effect due to measurement error or misclassification of subjects on one or more variables' (Kleinbaum 1982). In papers I, II and III, such bias is linked primarily to the doctors' recording of patient encounters. It is likely that busy GPs forgot to record one or more encounters on the registration form. Even if an encounter were recorded, the doctor could forget to indicate procedures or indicate patient characteristics incorrectly. Most of these errors (*e.g.* erroneous recording of patient age and sex) probably occur at random, but some are likely to be systematic. Doctors with the highest numbers of visits were likely to miss encounters or tick incorrectly on the registration form. Preferences for remuneration system may influence registration of length of consultation or laboratory utilization. Doctors in favour of fee-for-service remuneration may have 'forgotten' to tick for laboratory tests in order to conceal a high number of tests, and doctors in favour of salary may have overestimated their length of consultation.

In paper V, there was considerable scope for information bias. Mammography screening has been a controversial issue among doctors for several years. It is therefore conceivable that some of the responses to the questionnaire were strategic rather than genuine. One may hypothesise all sorts of biases caused by strategic answering but these would be mainly speculations. The number of mammographic examinations was lower when reported by the doctors than by the mammographic centres. The latter are likely to have correct information since the number is crucial with respect to remuneration. The under-reporting among doctors may be due to drop-out from the study or to incorrect information in the questionnaire for those who participated in the study. The ambiguity with respect to the unit of measurement may partly explain incorrect information, but deliberate under-reporting is conceivable, especially if the doctors want to conceal incomes from 'moonlighting'.

7.1.3 Confounding

Confounding is a bias that arises when the 'study factor effect is mixed, in the data, with the effects of extraneous variables' (Kleinbaum 1982). Some authors consider confounding to be different from bias since the latter is primarily introduced by the investigator or study participants, while confounding is a function of inter-relationships between various independent variables and the dependent variable (Hennekens 1987).

As mentioned in section 3, patient 'need' should be adjusted for to avoid confounding in studies of the effect of financial incentives on clinical decisions. We had no direct measurement of such needs in papers I-III, but patient age and sex are proxy variables for diagnosis, functional capacity and disease severity. It is likely that doctors' perceptions of patient need were the real determinant of variation in medical practice, not age and sex per se. However, since patient age and sex were introduced in the analysis as proxies for 'patient need', this was not a confounder. Rather, it was a variable that was measured indirectly.

Omitting patient age and sex in this study appears to have few consequences (Table 4). This is because there was hardly any correlation between patient characteristics and the other explanatory variables. In particular, this was the case with respect to remuneration systems. The likely explanation is that all doctors in each municipality had the same payment system and selection by payment system was not possible unless patients would seek doctors in other municipalities. The problem of confounding, however, is well illustrated by omitting doctor density from the analysis (Table 4). This omission makes the remuneration system a statistically significant determinant of ordering of urine microscopy.

Locational decisions are likely to be influenced by *inter alia* perceptions of income potential, quality of the job environment and preferences for leisure activities. Information on such variables was not available and these variables consequently represent potential confounding factors. However, it is not easy to judge how this potential confounding might have influenced the results.

7.1.4 Validity

Internal validity concerns inferences about the target population from which the sample is drawn. External validity relates to an external population (Kleinbaum 1982). Internal validity depends on bias and confounding (see above). External validity may be judged on the basis of consistency with other findings, of knowledge of the target population and the external population, and of theoretical considerations.

Inferences about doctors outside the 61 study municipalities (papers I-III) should be made with caution. The study population is a young one with a mean age of 34 years (I) as compared with a national mean of 44 (Rutle 1981). Most Norwegian doctors prefer to live in urban areas in the south of the country, and doctors in the rural areas of North Norway are likely to be more idealistic and committed to 'doing good' than the rest. Nevertheless, two other Norwegian studies (one from a rural area in the south and one from the capital city) concluded that doctors were not influenced in their clinical practice by the way they were paid (Robberstad 1989; Bjørndal 1994). This is at least some indication of external validity.

Papers IV and V are based on national samples. To what extent the findings in these papers as well as those in papers I-III can be generalised to countries outside Norway, for example other Nordic countries, is unclear. With respect to papers I-III, the only comparable Nordic study reports a considerable change when Danish doctors in Copenhagen switched from a wholly capitation system to a mixed capitation/fee-for-service system (Krasnik 1990). The effect of financial incentives has been studied in a few other countries (see section 2), but the incentives and the context were too different to draw conclusions about external validity.

With respect to paper IV, one would expect that locational choices would be much the same in other countries with medically underserved remote areas. The only similar study is reported from Scotland where dentists were shown to be influenced by the location of their original home, of relatives and of dental training (Fyffe 1989).

In paper V, the findings might be generalised to other Norwegian doctors although radiologists represent a somewhat selected group. They tend to be more orientated to routine medical tasks than to scientific work, and they are possibly less concerned with status. Some of the findings comply with foreign studies of the role of professional networks in the diffusion of technologies (Coleman 1966; Becker 1970; Feeny 1986).

7.1.5 Multivariate analysis

To study the relationships between decisions (the dependent variables) and several explanatory (independent) variables, various multivariate methods have been employed. In biological research, regression coefficients can be interpreted 'deterministically'. For example, the risk of liver cirrhosis is to some degree 'determined' by the level of alcohol consumption in the sense that liver disease is an unavoidable consequence of high alcohol intakes. In the present studies, such interpretations are not justified. First, the cross sectional design does not allow conclusions about causal relationships. Second, the dependent variables in the present studies most often reflect decisions. Certain decisions may be associated with various factors, but they do not inevitably follow from these factors. The relation between the independent variables and the decision has to be established by the decision maker as the 'decision maker selects criteria upon which the decision is going to be based' (Hansen 1981). This selection process is likely to be influenced by arguments in doctors' utility functions although the doctor within wide bounds is in principle free to decide.

7.1.5.1 Unilevel analysis

Linear regression assumes a linear relationship between the dependent variable and the independent variable(s). When there is more than one independent variable, the effect of one explanatory variable is assumed to be independent of the effect of others (Gujarati 1988). If this assumption does not hold, there is an interaction between the independent variables. The number of potential interactions is considerable when there are many independent variables. For practical purposes, testing for interactions is usually restricted to those which could be expected from knowledge of the context. For example in paper II a potential interaction between doctor gender and a number of other explanatory variables could be expected (Table 5 in paper II). Interaction was ruled out by confirming, in separate analyses, that the regression coefficients were the same for men and women.

In paper II the length of consultation was a continuous variable, but it was measured in four categories. To take into account the properties of the underlying variables an ordered probit model was employed (McDonald 1980; Anonymous 1991). The range of the underlying variable was specified for the four categories. However the benefit of employing an ordered probit model instead of an ordinary linear regression was limited in that the difference in the results of the two methods was minor.

Linear regression should be replaced by logistic regression when the dependent variable is categorical. In logistic regression it is assumed that the log of the odds in favour of the event is a linear function of the independent variables (Gujarati 1988; Anonymous 1990b) and the regression coefficients are interpreted accordingly. Ordered logistic regression can be used when the dependent variable is ordinal. However, this method does not yield correct estimates unless for each step the effects on the dependent variable are the same (the proportional odds assumptions) (Ashby 1989). This was the case when ordered logistic regression was employed in paper V.

7.1.5.2 Multilevel analysis

In papers I-III the explanatory variables have a hierarchical structure (patient, doctor and municipality level). One may then adopt one of five approaches in the data analysis. One is to aggregate and then analyse at that aggregate level. In paper I, this could for example be done by analysing the proportion of patients of each doctor having a urinalysis. This strategy has two disadvantages (loss of information and the 'ecological fallacy') as discussed in section 3.

A second strategy is to use individual level variables and introduce a dummy variable for each group. This procedure would enable the detection of group effects, but the dummy variables do not allow inference about group level characteristics accounting for the group effects.

A third strategy is to model individual and group variables in the same analysis and disregard the hierarchical data structure. This procedure will tend to underestimate the standard errors of the regression coefficients and may consequently introduce type I errors.

A fourth strategy is to run a separate regression analysis for each group with individual level explanatory variables (*e.g.* patient characteristics) and then use the coefficients from these analyses as response variables in regression analyses with group variables (*e.g.* doctor characteristics) as the independent ones. This strategy is cumbersome and hardly useful for three level data structures.

The final and recommended strategy is the use of multilevel modelling. During the last 10 years there has been a renewed interest in analysing multilevel data (Boyd 1979; Goldstein 1987; Nuttall 1989; Iversen 1991; Jones 1991; Albandar 1992; Bryk 1992; Korff 1992) and multilevel statistical packages have been developed. These allow multilevel data structures to be analysed by estimating the effect of independent variables at individual and group levels (the so-called fixed part of the model). Additionally, they allow modelling of variations in the effects across groups (the random part of the model) in order to detect interaction effects. ML3 (Prosser 1991a; Prosser 1991b; Woodhouse 1992), HLM (Bryk 1989) and VARCLUS are tailor-made for multilevel modelling.

Disregarding the multilevel data structure may have serious consequences. When analysing ordering of laboratory tests in paper I, we found a statistically significant effect of the payment system when employing unilevel logistic regression. When multilevel programmes later became available, the use of ML3 showed no statistically significant effect of remuneration on test ordering (Table 8). The effect estimates were largely the same in uni- as in multilevel modeling, but the confidence intervals were wider in the latter. Although these should not be interpreted as a proof that financial incentives did not affect test ordering, the use of multilevel analysis indicates that the conclusions in paper I may have been too strong.

7.2 General discussion and conclusion

What is apparent from the previous sections is - not surprisingly - that doctors' decision making is a complex process. Nevertheless, a few conclusions may be justified on the basis of the findings of the empirical studies.

First, patient characteristics such as age and sex are strongly associated with GPs' decision making. This was the case with respect to ordering of laboratory tests, length of consultation as well as home visiting, but not with respect to the weekly number of consultations. While the former are typical short term, clinical decisions, the last is more a medium term decision not necessarily related to individual patients. It is likely that some variables that were not available like diagnosis or severity of the illness would be even stronger determinants of clinical decisions than proxies like patient age and sex.

Second, financial incentives appear to influence some decisions (the length of consultation, home visiting for non-acute illnesses, acquiring of mammography units) but not others (*e.g.* laboratory testing and home visiting for acute conditions). As expected, while the size of the effect on mammography practices (a medium term decision) was considerable, the effect on the length of consultation was rather small. Doctors appear to be more influenced by financial incentives and less by 'patient need' the further from the patient decisions are being made.

Third, doctors in their decision making appear to consider, on occasion at least, the interests of a wider community and not just their own concerns and those of their patients. The fact that doctors on salary more often collected the patient copayments (on behalf of the employer) than those on fee-for-service (on behalf of themselves) indicates that doctors may even take their employers' financial situation into consideration. Also, their spouses' preferences seem to count in locational decisions.

Fourth, some hypotheses were not supported. Even if patient characteristics are dominating clinical decisions, it was expected that financial incentives would have some impact but this was not the case with respect to ordering of laboratory tests and repeat visits (papers I and II). Nor was the status-hypothesis supported. Such negative results may have several interpretations. Clearly, the hypothesis may be false. However, the null-hypotheses may mistakenly be accepted (type II error) because of random errors or selections bias. It is for example conceivable that a minority of doctors, possibly non-participants in empirical studies, were strongly influenced while the majority were not.

Fifth, there was considerable variation in clinical practice (see for example Table 1 in paper I). Only small proportions of this variation were explained by the various factors included in the study. To some extent this may be due to the fact that we did not have data on all relevant explanatory factors. For instance we had limited information on patients' need. However, it is conceivable that some of the variation was random or simply due to disagreement between doctors with respect to what is 'good medical practice' (Evans 1990).

From a methodological standpoint, two messages are quite clear. First, when explanatory variables have a hierarchical structure, this should be accounted for in the analysis. Paper I illustrates this point by showing that the effect of the payment system on the ordering of urine microscopy is statistically significant when disregarding the multilevel data structure but not when a proper analysis is performed. Second, confounding can be a serious problem in studies of clinical decision making. If patient and organisational characteristics are omitted from the study, one may easily draw incorrect conclusions about factors influencing doctors' decision making.

These conclusions are hardly surprising. At least many doctors would probably agree that this is what they always have thought. The value of these studies is therefore likely to lie more in confirming what to many might look like common sense than bringing a revolution in the understanding of doctors' behaviour.

The apparently weak effect of financial incentives on clinical decisions conflicts with the belief some people have. For example, in an analysis of primary health care the Norwegian Medical Association, without any reservations, states that GPs would order more tests if they were paid per test (Andreassen 1982). The apparent discrepancy between the findings of the study and common beliefs however may not be real. As indicated earlier, it may be due to type II errors or selection bias. However, the conclusions of papers I-III are to some extent supported by the results of a survey of people living in North Norway (Kristiansen 1989). In municipalities with GPs on salary, people somewhat more often reported queuing and difficulties with getting a GP home visit than in municipalities with fee-for-service, while there was no difference with respect to the perceived length of consultation. Also, previous studies in Norway (Robberstad 1989; Bjørndal 1994), the UK (Hughes 1992), Canada (Hutchison 1993) and the US (Epstein 1986) indicate muted effects of financial incentives on clinical decision making. One of the few studies reporting substantial effects of financial incentives is a study from Copenhagen (Krasnik 1990). Here, GPs reduced their referrals to specialists by more than

10% while they increased the provision of fee-yielding diagnostic services by at least 35% when small fees per service were introduced. At the other end of the spectrum lies the experience from the Canadian province of Ontario (Hutchison 1993). Here GPs could receive rewards up to $65,000 per year for reducing the number of hospital admissions. Remarkably, no effects of this were detected.

Whether the substantial variation across countries in the effects of financial incentives is real or not is unclear. If it is real, there are no simple explanations for the variation. Clearly, it may be more legitimate for doctors to aim at high incomes in some countries like the US than in for example the UK but such differences can hardly explain the findings of the Copenhagen study since one would expect Scandinavian countries to be like the UK. A possible implication of the variation however is that the weighting of the arguments varies for each doctor over time. One may hypothesise that when a doctor moves from one country to another this will, because of differences in culture and traditions, influence the weighting of the arguments in the utility function. Also, it is conceivable that the young doctor may be eager to achieve high incomes, the same doctor may be relatively more interested in leisure later in life.

From a policy perspective the uncertain effect of financial incentives on clinical decisions is potentially important (Kristiansen 1993). Health care reforms based on the assumption that 'competition' and 'financial incentives' will change the behaviour of hospitals as well as of primary health care may fail if doctors' clinical decisions are too strongly influenced by medical ethics. Until we have more evidence in this area, policy makers may do well in not expecting too much from 'market orientated reforms'. Indeed, when reporting on the reforms of the British National Health Service, Maynard indicates that competition is a 'mission impossible' (Maynard 1993). This is not to say that doctors are immune to financial rewards. If the rewards are great enough, most doctors would probably be influenced. If for example doctors were paid millions of dollars to live in remote areas, there would hardly be any 'doctor shortage' in those areas. The political and financial costs might however be considerable.

As indicated earlier the influence of medical ethics is likely to be an effect of social learning. If policy makers repeatedly tell doctors that they in front of their patients are expected to respond to financial incentives, they may in the end respond accordingly. Whether such changes in attitude are in the interest of society is open to discussion. Some warn that they can profoundly change the patient-doctor relationship and even threaten the quality of health care (Kassirer 1995).

With respect to medium term decisions, paper V indicates that financial incentives may be effective. There was however a lack of information on income potential with respect to long term decisions (paper IV). On this issue, other studies yield somewhat conflicting evidence. Choice of location or specialty appeared to be influenced by income potential in some studies (Rimlinger 1963; Benham 1968; Bazzoli 1985) while others report little or no such influences (Steele 1965; Sloan 1970; Fruen 1980). In any case, paper IV indicates that financial incentives are not the only way to influence doctors' location. Selecting medical students from the underserved areas is likely to increase the chance that they settle there later.

The concept of utility is a theoretic construct which cannot be observed directly. Nevertheless, this thesis indicate that economic models may be useful in understanding doctors' decision making. However, models containing only income and leisure in the doctor's utility function, while appealing in their simplicity, are likely to be conceptually flawed and in practice misleading. This is because of the presence, and potentially dominating presence, in this area of ethics and professional guidelines. Only when the models as well as their empirical testing reflect the complexity of the real world are they likely to be able to attain their true value as useful tools in health policy.

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PAPER I

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The General Practitioner and Laboratory Utilization: Why Does It Vary?

IVAR SØNBØ KRISTIANSEN* AND PER HJORTDAHL**

Kristiansen IS and Hjortdahl P. The general practitioner and laboratory utilization: why does it vary? *Family Practice* 1992; **9**: 22–27.

In a study of the practice patterns of 128 general practitioners in Northern Norway information concerning 6848 surgery consultations was registered. The ordering of haemoglobin and sedimentation tests was noted as well as urinalyses, forwarding of biological specimens (blood, urine, smears, etc) to other laboratories, and referrals for X-ray examinations. The extent to which doctors ordered these tests varied widely (haemoglobin 0–72% of encounters, urinalyses 0–70%, forwarding of tests 0–56%). Fee-for-service doctors ordered urine microscopy more frequently than did their salaried colleagues, but the ordering of haemoglobin or sedimentation test, and the forwarding of biological samples was about the same. Female and older doctors as well as doctors trained in Norway tended to request tests more often. Laboratory utilization was higher in municipalities with a high turnover of doctors, but the doctors' years of postgraduate experience *per se* did not affect the extent of test ordering. Tests were requested more often for female patients and with increasing age of the patient. However, only 10% of the variation in laboratory utilization was explained by the variables used in the analyses. This may imply that the medical condition at hand is the strongest determinant of test ordering behaviour.

INTRODUCTION

The use of laboratories is an integral part of general practice. Primarily the test results are important in the diagnostic process or in monitoring disease and treatment; they do, however, also have wider implications. Proper use of the laboratory frequently leads to patient reassurance and consumer satisfaction, while over-utilization increases the chances of false positive answers, placing extra burdens on both patient and doctor.[1,2] Furthermore, even though each test is relatively inexpensive, they are ordered in such high numbers that the laboratory constitutes a substantial proportion of primary health care costs.[3]

Studies have revealed a wide variation in the utilization of the laboratory in general practice.[4,5] Although there is no set norm, or 'gold standard', of proper use, it appears reasonable to assume that both over- and under-utilization occur.[6] Hence it is of considerable interest, both from medical and economic aspects, to elucidate the different factors influencing doctors' decision-making related to testing.

The use of the laboratory may be assumed to be guided by several factors, including the medical problem at hand, the doctor's attitude, general medical knowledge and understanding of the relevant laboratory tests, and patient expectations. Socio-demographic characteristics of both doctor and patient are also important, as are the availability and the economics of the test procedures, and features of the structure of the health care delivery system.[7,8]

The present study is part of an evaluation of a new remuneration system introduced in Norway in 1978. Traditionally general practitioners have been reimbursed on a fee-per-item basis by the National Health Insurance. In this system fees are provided for each encounter, and additional reimbursements are paid for each procedure and laboratory investigation performed at the practice. The fee for each procedure and test is primarily intended to compensate for the costs involved—direct expenses (use of laboratory reagents, auxiliary staff, etc) and the doctor's time. An alternative system based on fixed salaries was introduced in 1978 to attract doctors to the northern parts of Norway, where the number of doctors was severely limited. The transition from fee-for-service to salary was voluntary and left to the preferences of the doctors. Thus both remuneration systems existed in the study area at the same time, although all doctors in each practice had the same system.

This paper describes variations in the use of the laboratory, the major hypothesis to be addressed being

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that the reimbursement system *per se* affects the utilization of tests. However, it is possible that this effect could depend on the type of test. As urinary microscopy involves more of the doctor's time than, for instance, haemoglobin or sedimentation tests, the latter tests could involve a greater potential for income generation. Consequently, one would expect urinalysis to be less influenced by the renumeration system. Referral of patients to radiological examinations does not attract extra fees from the National Health Insurance. Such referrals should thus not be affected by the remuneration system, and may act as a control in the hypothesis testing.

One may also postulate that several other factors may be positively associated with laboratory utilization: doctor density, travel distance to the nearest hospital, number of auxiliary staff, female patients, and increasing age of the patient.[9] Other studies have demonstrated that the place of medical training and the sex of the doctor affect test ordering.[10-12]

Most previous studies in this field are based on aggregated data.[13] As the present data have been collected at the individual (patient) level, there is an opportunity to test within the same analysis the effects of the health care system, doctor characteristics, and patient characteristics.

METHODS AND MATERIALS

All general practitioners in 69 municipalities in Northern Norway were asked to register their patient contacts during the tenth week of 1982. Of the 158 eligible doctors 126 (80%) returned completed registration forms. The response rate was 74% among fee-for-service doctors and 84% among salaried doctors. Altogether 6848 surgery consultations were registered. Age and sex, whether it was a new illness or a follow-up consultation, duration of the consultation in minutes, use of haemoglobin analysis, sedimentation rate, urine microscopy, the taking and forwarding of tests to other laboratories, and referrals to radiologists and to other medical specialists, were also registered for each patient.

The doctors submitted information on their own age and sex, place of graduation from medical school, years since graduation, years in general practice and experience as a hospital doctor, and job satisfaction. This latter variable was evaluated on a seven point progressive scale ranging from low to high. The number of auxiliary staff, travel time to the nearest hospital, and the proportion of the practice population who could be reached within 30 min for home visits were noted.

Characteristics of the health care system, such as type of reimbursement, population to doctor ratio, geographical stability of doctors (number of months in post), and municipal structure were obtained from various sources of information which were publicly available.

Differences between groups were tested by t-test or the χ^2-test. Predictors of continuous variables were tested by multiple, linear regression analysis, while dichotomous variables were tested by logistic regression. Due to the high number of significance tests, 0.01 was chosen as the limit of significance. This implies that in the regression analyses a t-value less than −2.56 or greater than +2.56 means that the predictor is significant at the 1% level.

RESULTS

In our sample population, patient characteristics and the use of laboratory procedures (Table 1) are similar to those of a large representative Norwegian primary health care utilization study from the same time period.[14] Doctor characteristics are shown in Table 2. Their mean age was 33.2 years (range 27–52) and 15% were females. Mean time since graduation was 6 years (range 1–19). They were, however, not typical of the Norwegian general practitioner population, being significantly younger (mean 33.2 *vs.* 44.3 years) and

TABLE 1 *Practice pattern in 126 general practitioners by 6848 surgery consultations, North Norway 1982.*

Procedure	Mean (%)	Range (%)
Proportion first visit	47.1	4.2–80.0
Proportion female patients	58.8	25.0–86.7
Referred medical specialist	4.5	0–18.8
Referred X-ray examination	4.3	0–20.0
Referred physical therapy	2.5	0–15.4
Hospital admission	3.0	0–16.7
Haemoglobin analysis	24.2	0–72.2
Sedimentation rate analysis	19.4	0–70.4
Urine microscopy	14.1	0–70.4
Biological sample sent other lab.	20.1	0–56.3
No laboratory tests	39.5	20.0–93.7
Sickness certification	8.2	0–36.4

TABLE 2 *Characteristics of the General Practitioners, North Norway 1982.*

	Reimbursement system	
	Fee-for-service (n = 48)	Salary (n = 78)
Sex (% female)	10	18 NS
Age (years)	34.0	32.7 NS
Years since graduation	6.3	5.7 NS
GP experience (years)	4.0	2.9 NS
GP experience in municipality (years)	3.5	2.8 NS
Proportion graduated in Norway (%)	75	67 NS
GP's job satisfaction (1–7)	5.2	5.2 NS
Proportion always collecting copayment (%)	23	50 *

* $P<0.005$

having less experience as general practitioners (3.4 *vs.* 13.1 years).[14,15] Practice organization was relatively homogeneous, small communities having one medical centre with 2–5 doctors being the norm.

During the week's registration the doctors had between 16 and 189 office encounters each, the mean being 57.9. Mean patient age was 41.5 years (range 0–94) and 59% were females.

In 2705 (40%) of the consultations, no laboratory tests, excluding X-ray, were ordered (Table 1). Haemoglobin was conducted in 24%, sedimentation rate in 19%, urine microscopy in 14% and samples forwarded to other laboratories in 20% of all consultations. The diversity of test utilization among the 126 physicians is shown in Table 1.

The results of the regression analyses of predictors of laboratory utilization are listed in Table 3. The ordering of urine analysis was positively associated with fee-for-service remuneration of the doctors. Whereas the probability of ordering a urine microscopy was about 0.13 when a patient visited a salaried doctor this probability was 0.17 at a fee-for-service doctor, adjusting for the other variables. The odds ratio (numerically about the same as relative risk) for such test ordering was 1.33 (1% confidence interval: 1.06–1.83) implying that the probability of ordering a urinalysis was 30% higher among fee-for-service doctors. There was no significant association between the remuneration system and the ordering of haemoglobin and sedimentation test or the sending of biological specimens, but the total number of tests at each encounter was marginally higher among fee-for-service doctors ($P = 0.014$).

Female, trained-in-Norway, or older physicians tended to request tests more often. No association was demonstrated between laboratory utilization, experience as a physician and job satisfaction. However, there was a positive association between doctor turnover in the municipality and the ordering of tests.

Low doctor density, large populations and short distance to the nearest hospital were associated with frequent use of urine microscopy. The number of auxiliary staff was positively correlated with use of haemoglobin, urine microscopy, as well as with the number of tests undertaken. The collection of patient copayment was not associated with laboratory utilization.

All tests were requested more often with increasing age of the patient, and female patients had more tests undertaken. The strongest predictor of a particular test being undertaken was, however, the ordering of other tests at the same encounter (not included in the analyses (Table 3) to avoid colinearity). This was par-

TABLE 3 *Multiple regression analyses (t-values*) of laboratory utilization.*

Independent variable	Dependent variable (t-values) HGB	SR	URINE	SENT	X-RAY	TEST
Reimbursement system (0 = salary, 1 = fee-for-service)	0.92	1.72	3.12	0.90	−1.05	2.18
Sex of physician (0 = male, 1 = female)	3.10	2.36	3.11	2.94	0.00	4.03
Age of physician	2.95	3.36	3.14	3.74	0.17	4.49
Medical school (foreign = 0, domestic = 1)	4.23	5.27	1.15	2.61	−0.14	4.77
Experience as a GP (years)	0.14	0.64	0.46	−1.58	0.60	−0.08
Experience as a hospital doctor (years)	−0.75	−2.23	−0.98	−0.52	−0.82	−1.82
Job satisfaction (1 = low, 7 = high)	0.10	0.20	0.73	−0.55	0.62	0.25
Physician density (population/doctor-ratio)	−0.10	0.00	3.74	−0.45	−1.75	0.98
Number of months in post	−3.16	−1.79	−3.30	−3.54	−2.65	−3.92
Population of municipality	−2.57	−2.22	−5.05	−1.16	1.15	−3.70
Proportion of population reached within 1/2 hour	−1.98	1.36	2.11	−0.89	−0.61	0.10
Copayment always collected (0 = no, 1 = yes)	1.50	2.36	0.17	−0.10	0.20	1.61
Travel time to hospital (hours)	−4.10	−3.87	0.84	−0.01	0.30	−2.65
Auxiliary staff per doctor	3.88	−0.69	3.74	0.94	0.81	2.76
Sex of patient (0 = male, 1 = female)	11.69	3.57	11.84	8.75	−1.41	12.64
Age of patient	12.35	18.79	8.15	12.66	2.84	19.02
R^2	–	–	–	–	–	0.097

* $P<0.01$ if $t<-2.56$ or $t>+2.56$

HGB = Haemoglobin test, SR = sedimentation rate, URINE = urine microscopy, SENT = biological sample sent to another laboratory, X-RAY = referred to radiological laboratory (0 = no test ordered; 1 = test ordered), TEST = total number of tests ordered. 6648 encounters in Northern Norway 1982.

ticularly true with haemoglobin; when this test was ordered the probability of requesting a sedimentation rate at the same time was 70%. Referrals to radiology were associated with older patients and high doctor turnover, but not with the reimbursement system.

We also performed supplementary analyses with the doctor (n = 126) as the observation unit instead of the encounter (n = 6848). In these analyses the dependent variable was the proportion of the various tests taken at encounters. There were fewer significant predictors in these analyses, but otherwise they confirmed the results in Table 3.

DISCUSSION

Variation in Laboratory Utilization

In spite of the homogeneity among the doctors in terms of age and education, the availability of office laboratories and similarities in practice organizations, our study demonstrated a very substantial variation in laboratory utilization. The most conservative (in this sense) physicians used the laboratory in 6% of consultations, while the most liberal used it in 80%. This variation is in accordance with other studies.[13,16,17] Our multivariate analysis, however, indicated that the reimbursement system and other factors examined only explained 10% of the observed variance in laboratory utilization.

In more than half of all the encounters one or several tests were ordered. In comparison with laboratory usage in other countries, such as Denmark and Great Britain where corresponding figures are around 25%,[11,18] our observations appear rather high. They are, however, much in accordance with other Norwegian studies.[19,20] Some of these differences may be due to discrepancies in registration, but most are likely to be due to different national medical traditions. In Norway general practitioners are used to performing tests and analysing the results: in 1978, 99% reported having a haemometer in their office, and 98% possessed a microscope; 87% claimed to use it regularly.[21]

Other researchers have claimed that laboratory investigations are often requested unnecessarily.[22] Our study supports this view. Haemoglobin estimation was ordered in almost one-quarter of all encounters; some physicians requested it in more than two-thirds of their consultations. The most frequent medical indications for measuring haemoglobin are tiredness, pregnancy, and follow up of known anaemia. Less than 10% of patients seeing general practitioners fall within these categories.[23] A substantial over-utilization thus seems to be present. This may partly be a side effect of a fee-for-service system where the fees are reimbursed by a remote third party, and not paid directly by the patient.

Reimbursement and Laboratory Utilization

The remuneration system was introduced 4 years prior to our study. Physicians entered the new system throughout this period. Hence, one may postulate a time-lag effect masking the effect of the reimbursement system on test ordering behaviour.

Although the response rate among physicians in this study was good (80%) there may be different practice patterns among the non-respondents. The lower response rate, 74% *vs.* 84%, among the fee-for-service doctors may to some extent have been expected, because taking part in the study entailed lost time and income for these doctors. A previous study of a similar nature found the non-responders to be different from those participating, mainly by being more strongly in favour of a system based on free enterprise and fee-for-service.[24] Such a self-selection bias, with physicans maximizing the fee-for-service possibilities among the non-responders, would hide the associations between reimbursement systems and test ordering behaviour. It is also likely that, to some extent, individual doctors selected between remuneration systems in such a way as to take advantage of its specific characteristics. This selection would imply that observed differences between the two systems might be exaggerated in our analysis.

Analysing the individual test procedures and reimbursement, a significant association was shown for urine microscopy, but not for the other tests. Although the level of significance adopted (0.01) was not quite attained for the total number of tests ordered at each encounter, it was nearly reached. Consequently, the findings support the hypothesis about an association between laboratory utilization and remuneration. Our second hypothesis, that urinary microscopy, being a doctor labour intensive procedure, would be less influenced by fee-for-service reimbursement, was not confirmed. This may be related to the fact that urine microscopy was reimbursed at a higher rate than the other tests.

Taking possible self-selection bias and the time lag effect into account, it would appear that the association between reimbursement system and test ordering behaviour is underestimated in this study.

Other Explanatory Variables

Our finding that female physicians ordered more tests than their male colleagues, after controlling for all other factors, is somewhat surprising. Similar findings are scarce in the literature. Compensation for a stronger feeling of uncertainty in the decision-making process among female doctors could be an explanation. It is conceivable that men, *ceteris paribus*, feel more confident than women when making decisions under uncertainty, and consequently perceive less need to request tests.

Studies have shown that inexperienced, younger, and foreign trained doctors tend to request more tests.[12,25,26] This was not the case in our study. A substantial portion of Norwegian doctors graduated from foreign medical schools, predominantly Central Europe and Ireland, between 1960 and 1980. These doctors requested tests less frequently than doctors trained in Norway. This phenomenon fits with studies showing that the type of pre- and post-graduate training do affect the test ordering behaviour.[10,12] However, in our study the number of years experience as a general practitioner did not significantly influence test ordering behaviour but older physicians tended to request more tests. A reason for this apparent contradiction with the literature[12,27] may be found in the young and fairly homogeneous group of participating doctors in the present study. Another study of test ordering behaviour demonstrated that the decline in test ordering was not linear with the physician's age.[21] General practitioners below the age of 50 had a fairly constant test ordering profile, those aged 50–60 years showed somewhat less activity, while a marked decline took place in physicians older than 60. This may represent a cohort phenomenon, making comparisons with the present sample difficult.

In the present study the number of auxiliary staff per doctor was positively associated with laboratory use. This is in accordance with most other studies.[28,29] Wages are a major expense of any general practice, and ordering of tests represents an income potential to cover the wage expense. However, there is an optimal point where the auxiliary staff are used maximally, but not so much that the demand for hiring another person is created.

The ordering of tests was linked to the sex of the patient. There was a higher number of haemoglobin determinations and urinary tests, and forwarding of biological specimens (cytological and microbiological, etc) to other laboratories for female patients. This is most likely due to sex-specific reasons for the encounter, such as prevention counselling, maternity care, and genito-urinary problems. The sedimentation rate did not show the same association with sex. All test ordering, especially the sedimentation rate and the total number of tests, was strongly associated with increasing age of the patient. Since age and sex are proxies for severity and case-mix, it is likely that the medical condition was strongest predictor of test ordering. Hence, the lack of patients' diagnoses was a main weakness in this study.

CONCLUSION

Our study demonstrates a considerable range of variation in the test ordering behaviour of general practitioners in Northern Norway. It lends support to the statement by Donaldson that 'fee-for-service remuneration can lead to induced or unnecessary demands for fee-yielding services'.[30] The study also indicates a link between doctors' training, organizational aspects, geographical factors and test ordering behaviour. However, all these factors account for only a small proportion of the variation in doctors' behaviour. The major effects are most likely to be found in the medical problem itself, the attitudes and habits of the doctor or in expectations of the patients. In depth studies are needed to delineate these important aspects of doctors' test ordering and decision making.

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PAPER II

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THE GENERAL PRACTITIONER'S USE OF TIME: IS IT INFLUENCED BY THE REMUNERATION SYSTEM?

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Abstract—The practice pattern of 116 general practitioners in 60 rural municipalities in Northern Norway was studied with respect to length of consultation, the weekly number of consultations and the proportion of return visits. The average length of consultation was 14 mins, and only slightly lower for fee-for-service (FFS) doctors (13.7) than for salaried ones (14.8). The weekly average number of surgery consultations was higher for FFS doctors than for the salaried (63 vs 49), but the weekly number of hours spent consulting and the proportion of return visits were about the same.

Further, the characteristics of the health care system (doctor density and doctor turnover) were associated with variations in the doctors' use of time. The most consistent effects, even if weak, were the age and sex of the patients. The strongest effects on the length of consultation were referrals and various medical procedures. This suggests that in this instance the medical condition at hand would appear to have a greater influence on the doctors' use of time than either the remuneration system or other characteristics of the health care system.

Although the association between the doctors' use of time and the type of remuneration was weak, the study indicates that the type of remuneration does matter. Consequently, financial incentives can be used to influence the practice pattern of GPs.

Key words—general practice, remuneration system, use of time, length of consultation

INTRODUCTION

The 'quality' of primary health care provision is likely to be a function of many things. We hypothesise that one of these will be the length of the consultation [1–6] which in turn is likely to be a function of the remuneration system. (Knowledge on this and the effect of different remuneration systems more generally remains surprisingly limited. See for example Donaldson and Gerard [7].) Although a longer consultation does not guarantee higher quality in the context of the doctor–patient relationship, a short consultation allows the patient to present at most a few simple problems [5]. Some studies from general practice indicate that patient satisfaction which we here tend to equate with quality depends more on the patients' perception of having 'enough' time during the consultation than other factors such as waiting lists, the doctor's willingness to offer home visits, etc. [8, 9]. However other studies report a weaker association between consultation time and patient satisfaction [3, 8] or no association at all [10].

Against this background this paper examines what factors influence the length of consultations by general practitioners (GPs) and the *relative* impact of these factors. Obviously, length must be constrained by the fact that doctors seldom devote more than 50 hr per week to their professional work. Hence, in busier practices, the potential for lengthy consultations is more limited, and the GP has to make a trade-off between the length and the number of consultations in order to keep the waiting list at some reasonable level [11]. (In Norway patients with relatively minor ailments may have to wait up to three weeks to see a GP. In the study area 13% of the public reported a waiting time of more than 14 days. This was significantly longer for salaried doctors [9].) In areas where a single group of doctors is responsible for providing services to the residents in the area, there is no possibility for shifting patients to other doctors. In principle, all that then matters is the number of hours doctors devote to seeing patients: increasing the length of consultations simply means offering fewer services.

In practice, however, it is slightly more complicated since the doctors have the ability to influence the number of follow up visits. During the consultation the doctor in collaboration with the patient decides if a return visit should take place. In this process the doctor presumably takes into consideration the medical condition, the patient's wishes, and the doctor's own interests such as income, leisure, workload, preferences for different tasks, etc. Similar considerations will apply when the GP allocates his or her time between curative, preventive or administrative tasks.

Since the doctor has considerable scope to influence the weekly working hours and the number and type of consultation, it is important to ascertain which factors influence practice pattern in these respects. It is often assumed that fee-for-service remuneration promotes 'productivity' in the sense that the doctors offer more consultations. Doctors reimbursed on the basis of primarily a salary, but who are paid additionally and at a higher rate for hours beyond the basic, have an incentive to work long hours (but not necessarily efficiently). Further, it can be assumed that salaried doctors devote more of their time to non-clinical professional work. However, it is also possible that, ceteris paribus, fee-for-service doctors offer shorter consultations and more follow up visits as, depending on the nature of the fee schedule, this is likely to increase their incomes.

Income and leisure are clearly not the only considerations that matter to doctors. A range of other factors may influence the use of time in general practice; the medical problem at hand, the age and sex of the patient, doctor characteristics, the organization of the practice, doctor density, geographical factors, etc. [12–15].

The study reported here had the primary objective of studying the effect of the reimbursement system on practice pattern. In Norway GPs were traditionally reimbursed on a fee-for-service (FFS) basis. In 1982 the doctors were paid £6.65 (£1 = 11 NOK) for a first consultation during normal office hours, £5.90 for the second, and £4.10 for each subsequent one for the same episode of illness. A part of these sums was paid by the patients directly (£4.10 for the first visit, £3.20 for the second, nothing thereafter) and the rest was covered by National Health Insurance. Additional fees were paid for various procedures and laboratory investigations, but there were no additional patient charges for such services.

In 1978 an alternative system based on a fixed salary was introduced in the rural areas of Northern Norway to attract more GPs to these parts of the country. This was introduced on a municipality basis, i.e. each municipality had the one system or the other. It was only introduced if all doctors in the municipality agreed. Once the fixed salary system was introduced in a particular municipality, that municipality's doctors could not revert to an FFS system (which might be desired by the doctors if they changed their minds or if new doctors came in with different preferences). Under the salary system the doctor was paid a fixed amount for working 38 hr per week (the standard working week) for all tasks undertaken during that time. Hours over 38 in a week attracted overtime payments which involved 50% extra compensation per hour. The intention was that the two systems should provide approximately the same income on average for the same effort.

Patient payments were the same in both systems. It should be noted that these were retained as a part of his/her income by the doctor under the FFS system, but not under the salary system. These copayments represented 20–40% of the gross income of FFS doctors, depending on the practice profile. Under the salary system the doctors collected the copayments on behalf of the health authorities. Traditionally some doctors did waive the copayment under certain circumstances; for instance if the patient had a low income or was severely ill.

If the content or nature of clinical work were at all influenced by its income potential, we would hypothesise that fee-for-service doctors would have more and shorter consultations. This could be achieved by more frequently offering return visits either to make the first visit shorter or to have the income potential from a short return visit; or both. It is less obvious which system would better promote more time in total on consulting. However, since compensation for overtime for salaried GPs had to be approved by the health authorities, but for fee-for-service doctors there was no stipulated upper limit with respect to the number of consultations they provided, the latter may well have had a longer average working week.

METHODS AND MATERIALS

There are 90 municipalities in Northern Norway. In this study 22 of these were excluded in an attempt to make the study population as homogeneous as possible. Those excluded were 11 municipalities with a local hospital and 11 rural municipalities with, according the County health officer, badly functioning primary health care. In the remaining 68 rural municipalities all GPs were asked to register their patient contacts during a specified week in 1982. Of the 148 eligible doctors 116 (78%) in 60 municipalities returned completed registration forms. The response rate was 74% among fee-for-service (FFS) doctors and 82% among those who were salaried.

Physician density was lower in municipalities with FFS remuneration (1571 population per doctor) than fixed salary (1075 per doctor) and the average population was also higher in FFS municipalities (4748 vs 2961). In other respects (doctor turnover, proportion of the population reached within 30 min travel time from the doctor's surgery, and number of auxiliary staff) the municipalities were comparable.

Of the doctors 14% were female and the average age was 33. The mean number of years since graduation was 6, and 68% graduated from a Norwegian medical school. (Because of the relatively low number of places at Norwegian medical schools, substantial numbers of Norwegian doctors train abroad, for example in Germany, Austria, Netherlands, Ireland.) With respect to age, sex, number of years since graduation, place of training and job satisfaction, the FFS doctors were comparable to the salaried. However, the latter more often collected patient copayments. Among salaried doctors 53% reported that they *always* collected the copayment as compared with only 23% of the FFS doctors.

Altogether 6349 surgery consultations were registered on special forms (Table 1). The sex of the patient, whether the visit was for a 'new' illness or a follow-up visit, was recorded by ticking relevant alternatives. If a patient returned with the same condition within three months of the initial consultation, it was defined as a follow-up visit. The duration of consultation (minutes) was registered by ticking one of the following: 1–9; 10–14; 15–19; or 20 or more. The doctors were asked to include in this the

Table 1. First and follow up visit by sex of patient

Type	N (%)	Sex (%)	
		Female	Male
First visit	2943 (46.4)	45.8	47.5
Follow up visit	2849 (44.9)	46.9	41.8
Office visit on duty	557 (8.8)	7.3	10.7
Total	6349 (100.1)	100.0	100.0

6349 office visits. Northern Norway

time *they* spent on laboratory work and on referral letters for the individual patient. The time of laboratory assistants and secretaries spent on such work was not included. When the average length of consultation was calculated, we assumed 7, 12, 17 and 22 min respectively. We calculated the number of hours spent on consultations weekly by multiplying the number of consultations by the average length of consultation for each doctor. Surgery visits to doctors while on call were not included in the analyses of return visits.

The information regarding the doctors was collected using a postal questionnaire. The doctors' overall job satisfaction was assessed on a scale from 1 (very dissatisfied) to 7 (very satisfied). The remaining information on the health care system and the municipalities was obtained from various public sources [16].

Differences between groups were tested by t-test (continuous variables) or χ^2-test (categorical variables). Predictors of continuous variables were tested by multiple, linear regression analysis, while dichotomous variables were tested using logistic regression. To analyze the length of consultation we used an ordered probit regression model with fixed cut off values (the SAS Lifereg procedure [17]). Although the length of consultation was recorded in categories, the intervals of the underlying variable (0–9 min, 10–14, 15–19, 20+) were specified in the regression model. To take into account the hierarchical structure of the explanatory variables we also used multilevel analysis with the HLM programme [18, 19].

Due to the high number of significance tests, 0.01 was chosen as the level of significance.

RESULTS

Length of consultation

A small proportion (18%) of the surgery consultations lasted less than 10 min, and a similar proportion more than 20 min (Table 2). The average length of consultation was 14.4 min and slightly higher ($P < 0.0001$) for the first visit (14.7) than subsequent visits (13.8). Also, the FFS doctors had on average shorter ($P < 0.001$) consultations, but the difference was small (13.7 vs 14.8 for salaried doctors).

Since the length of consultation may be influenced by a variety of factors, we performed various analyses to adjust for such factors. First, a multiple, linear regression analysis revealed that age and female sex of the patient are positively associated with the length of consultation with a modest explained variance ($R^2 = 0.03$). Adding a dummy variable for each doctor in the regression model increased the explained variance considerably ($R^2 = 0.17$) which indicates that differences between doctors may contribute a substantial part of the variation in the consultation length. Thirdly, we performed an ordered probit model regression with fixed cut off values where both patient characteristics (age and sex) and contextual factors (doctor and municipality characteristics) were included (Table 3). Still, the remuneration system remained a significant ($P < 0.001$) predictor, but the average length of consultation was only marginally longer (0.7 min) for the salaried doctors when adjusted for the other variables. Further, various other factors were positively associated with longer consultations: number of years since graduation, high doctor density, high turnover of doctors, large population of municipality, female patients and older patients.

In these regression analyses the consultations were assumed to be independent observations which was clearly not true since we had over 6000 consultations but only 116 doctors. Consequently, we employed a multi-level analysis (HLM programme) with patient age and sex as individual variables and the others as group (contextual) variables. In these analyses age and sex of the patient were highly significant predictors. Remuneration system, doctor density and doctor turnover were of borderline significance ($P < 0.05$) when they each were introduced as the sole contextual variable. The magnitude of the effect was about the same as in the probit analysis. When introducing all nine contextual variables in the multilevel model, none was significant. We also performed separate analyses for male and female patients, but the associations were very similar.

The most consistent finding in these analyses were the effect of age and sex on the length of consultation. The probit analysis indicates that female patients had on average 0.9 min longer in consultations than male patients (Table 3). A similar increase was observed for a 25 years increase in the age of the patient. According to supplementary regression analyses (not shown in the tables) longer consultations were positively associated with referral to hospital (4.6 extra min), to a specialist (3.2), to a physiotherapist (2.2), to X-ray examination (2.5) and with various other procedures such as sickness certification (0.4),

Table 2. Duration (min) of consultation by sex of the patient

Duration	N (%)	Sex (%)	
		Female	Male
0–9	1143 (18.0)	15.8	21.3
10–14	2013 (31.7)	30.7	33.0
15–19	1667 (26.3)	27.8	24.1
20+	1147 (18.1)	19.4	16.0
Unknown	379 (6.0)	6.3	5.6
Total	6349 (100.1)	100.0	100.0

6349 office visits. Northern Norway.

Table 3. Regression analysis (SAS Lifereg procedure) of length of consultation (min)

Independent variable	Parameter	P
Remuneration system (0 = salary, 1 = fee-for-service)	−0.661	0.0005
Sex of physician (0 = male, 1 = female)	−0.004	0.9851
Number of years since graduation	0.062	0.0015
Medical school (foreign = 0, domestic = 1)	−0.429	0.0137
Job satisfaction (1 = low, 7 = high)	−0.110	0.0841
Physician density (population/1000 doctors)	−0.904	0.0001
Number of years in post (doctor turnover)	−0.334	0.0001
Population of municipality (in thousands)	0.059	0.0065
Proportion of population reached within 1/2 hr	−0.007	0.0570
Sex of patient (0 = male, 1 = female)	0.904	0.0001
Age of patient (in 10 years)	0.360	0.0001

6279 office visits (70 observations were deleted due to missing values). Northern Norway.

haemoglobin test (2.2), urine analysis (0.7), other laboratory tests (0.5) and blood samples sent to other laboratories (1.7). It was also 0.8 min longer ($P < 0.001$) for the first than for subsequent consultations. However, longer than average consultations were not associated with lower weekly number of consultations.

Return visits

About 45% of the surgery visits were return visits under both remuneration systems. In the logistic regression analysis such consultations were positively associated with the male sex of the doctor, female patients and older patients (Table 4). However, the hypothesis that FFS doctors had more return visits was not confirmed. Also, there was no association between the proportion of return visits and numbers of referrals or laboratory tests. Office visits outside normal office hours were not included in the analyses of return visits.

In the multilevel analysis (HLM) age and sex of the patient were significant predictors whereas doctor and municipality characteristics were not.

Weekly number of consultations and work hours

Surgery consultations averaged 54.7 per week. This figure was higher ($P = 0.008$) among FFS doctors than among salaried (62.8 vs 49.0). Adjusting for other relevant variables this association was not statistically significant (Table 5).

The average time per week spent on patient consultations in the surgery was 14.0 hr. There was no significant difference between FFS and salaried doctors in this respect ($P = 0.07$). The regression analysis indicated no association between the weekly number of consultation hours and various independent variables (Table 5).

We also performed analyses of the number of hours per week and the number of consultations for male and female doctors separately, but this did not alter our previous conclusions.

DISCUSSION

The data collection method for this study has both advantages and disadvantages. Simply ticking relevant alternatives for each encounter and recording the age and sex of the patient involves little work for the doctor. This probably contributed to the fairly high response rate. To what extent the reported lengths of consultation accurately reflect the actual time is uncertain. (For a discussion of this issue, see Wilson [20].) The main disadvantage of this feature of the design is the lack of medical information on such factors as diagnosis, severity of illness, etc.

The study design introduces two types of biases. It is likely that the behaviour of non-responders is different from that of responders [21]. In particular, the busiest FFS doctors might drop out since recording patient contacts takes time and may reduce their income. Secondly, doctors may be influenced in their choice of where to practice to take advantage of the specific characteristics of the remuneration system. The first of these biases will tend to dampen the

Table 4. Logistic regression analysis of return visits (0 = first visit, 1 = return visit)

Independent variable	OR	(99% CI)	P
Remuneration system (0 = salary, 1 = Fee-for-service)	1.06	(0.88–1.27)	0.4495
Sex of physician (0 = male, 1 = female)	0.77	(0.62–0.97)	0.0032
Number of years since graduation	1.00	(0.98–1.02)	0.7261
Medical school (foreign = 0, domestic = 1)	1.07	(0.90–1.27)	0.2889
Job satisfaction (1 = low, 7 = high)	0.96	(0.91–1.03)	0.1339
Physician density (population/1000 doctors)	0.97	(0.79–1.19)	0.6875
Number of years in post	1.02	(0.98–1.06)	0.1575
Population of municipality (in thousands)	0.98	(0.96–1.01)	0.0579
Proportion of population reached within $\frac{1}{2}$ hr	1.00	(1.00–1.00)	0.8130
Sex of patient (0 = male, 1 = female)	1.19	(1.03–1.36)	0.0019
Age of patient (in 10 years)	1.12	(1.09–1.16)	0.0001

Odds ratio and 99% confidence interval. 5734 (58 observation were deleted due to missing values). 557 office consultations on duty were not included in the analysis. Northern Norway.

Table 5. Regression analyses (parameter estimates) of the number of consultations per week and the number of hours spent consulting per week

Independent variable	Consultations Parameter	Consultations P	Hours Parameter	Hours P
Remuneration system (0 = salary, 1 = Fee-for-service)	3.397	0.5739	0.206	0.8896
Sex of physician (0 = male, 1 = female)	−13.768	0.0688	−3.505	0.0597
Number of years since graduation	−0.258	0.7009	0.013	0.9334
Medical school (foreign = 0, domestic = 1)	0.970	0.8581	−0.035	0.9787
Job satisfaction (1 = low, 7 = high)	0.030	0.9882	−0.081	0.8713
Physician density (population/1000 doctors)	15.212	0.0348	2.917	0.0983
Number of years in post	0.444	0.7413	−0.190	0.5650
Population of municipality (in thousands)	0.795	0.3147	0.227	0.2427
Proportion of population reached within $\frac{1}{2}$ hr	0.169	0.1744	0.032	0.2957
Sex of patient (0 = male, 1 = female)	−0.231	0.9926	0.488	0.9367
Age of patient (in 10 years)	−7.092	0.1411	−1.773	0.1345
R^2 (adjusted)	0.13		0.06	

116 doctors. Northern Norway.

potential differences in the effect of the remuneration system on doctors' behaviour and the second to increase them. What the net effect would be, we cannot judge.

The study sample was rurally based. In more urban areas where the practice style of GPs is less transparent to the local population, the differences we observed in Northern Norway are if anything likely to be still greater.

The analysis of predictors for doctor behaviour (length of consultation, etc.) represents a problem since the explanatory variables have a multilevel (hierarchical) structure. Two variables are observed at the patient level (age and sex of the patient) while others are contextual variables (doctor and municipality characteristics). Regression analysis at the patient level (Tables 3 and 4) assumes independent observations which was not true since interdependence was likely for each doctor's consultations. Consequently, the effects of the contextual variables may be overestimated. One solution is to analyze at the doctor level, but this means the loss of information for the individual consultation. Another option is to employ multilevel analysis which is designed to remedy this type of interdependence problem [18, 19]. However, when employing the HLM programme in the analysis of consultation length, the introduction of more than two contextual variables eliminated all the contextual effects. We have chosen to present both regression analysis and multilevel analysis to show the fragility of the findings. In conclusion, the data indicate that patient characteristics (age and sex) affect the length of consultation and the proportion of return visits. The same holds for three contextual variables (remuneration system, doctor density and turnover), but with respect to length of consultation only.

We found a higher weekly number of surgery consultations (54 vs 45) than did a Norwegian study by Nilsson from 1985 [22]. However, the weekly number was much higher (167) in an American survey [23]. The proportion of return visits was the same as that found in a Norwegian nationwide sample from 1978 [24].

The low number of hours spent consulting does not reflect the total weekly working hours. General practitioners spend a considerable amount of time on home visiting, various preventive activities, visiting nursing homes, collaborating with other parts of the health care and social welfare systems, etc. This is an integral part of salaried doctors' job whereas FFS GPs are paid per hour for such tasks.

The mean length of consultation (min) is substantially longer than the U. K. average which used to be 5–7 min [25, 26] and is more recently reported in the range of 5–11 min [27–31]. Also, it is somewhat longer than that in the U. S. (11–12 min) [23, 32], and in New Zealand (12 min) [33], but shorter than the Canadian (15 min) [34] or Swedish (21 min) [10]. We cannot offer any clear explanation for these differences. It should be noted, however, that at least some of the reported differences may be attributable to the methods used to assess the lengths of time [20].

The nature of GP consultations is likely to vary depending on whether patients normally have to go through their GP to get further in the system (e.g. specialist or outpatient referral) or can self-refer. Further, there is likely to be a difference in medical 'culture' with respect to the use of time. Whereas waiting times of 3–10 days for a non-urgent visit is normal in Norway, and 2–4 weeks may occur, 1–2 days seems to be common in the U.K. In small communities the patients have no choice but to use the 2 or 3 local doctors. In practice, the patients face local monopolies where the prices (patient charges) are set by the Government in negotiation with the Norwegian Medical Association.

Some authors doubt the usefulness of financial incentives in influencing GPs' behaviour [35]. Although the findings of this study may be interpreted differently, our view is that the data lend support to the hypothesis that doctors are influenced in their clinical practice by the remuneration system. However, in our analysis the effect on use of time seems to be rather weak. Even if FFS doctors on average see more patients in a week, the difference was not statistically significant after adjusting for other factors. Also, patients may not notice a difference of just 1 min in consultation time. Indeed, in a survey of a random sample of the population covering the same time period, there was no perceived difference in length of consultations between the remuneration systems [9].

Further, other contextual variables seem to have a significant, but weak influence on the doctors' use of time. The association between doctor density, workload and length of consultation is in accordance with other studies [5, 36–39].

Further, high doctor turnover was associated with longer consultations. It is conceivable that doctors who have been working for a longer period in the one place offer shorter consultations since they know their patients better.

Overall, the most consistent factors affecting doctors' use of time were the age and sex of the patient. There is clearly a positive association between age and case mix. Young people are more likely to have less severe ailments. Older people more often have serious illnesses. Also, by tradition elderly people tend to be more hesitant to seek a doctor. Consequently, for the same diseases, for those who do go to the GP, the older patient may be more severely ill. Our findings here are in accordance with other studies [40]. Clearly, the sex of the patient influences what problems are presented. For example, genito-urinary problems often involve a gynecological examination which can be time consuming.

Although our study provides no direct information about the medical condition of patients, the age and sex compositions of a population are proxies for variations in case-mix and severity. The same is probably true for referrals and medical procedures. Consequently, we can infer that the medical condition may be the strongest predictor of doctors' use of time.

The fact that salaried doctors more often collected the patient copayments (on behalf of health authorities) than FFS doctors (on their own behalf) may be explained by the fact that salaried doctors could not waive the charge since the money belonged to the health authorities. This behaviour has the interesting implication that doctors appear to be 'better' advocates for the state than for themselves. However, it should be noted that income loss for an FFS doctor may be small if the doctor only infrequently waives the patient's fee.

CONCLUSION

Other, but relatively few studies [7, 41–44], have shown that practice patterns are influenced by the remuneration system. Our study supports that view but goes further in examining the relative importance of the remuneration system *vis-à-vis* other factors. Thus doctor density and doctor turnover appear to be at least as important as the nature of the remuneration system. However, all these factors are weak when compared with the influence of the age and sex of the patient, referrals and medical procedures. This suggests that the medical problem at hand has a greater influence on clinical practice than organizational factors.

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PAPER III

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Effect of the remuneration system on the general practitioner's choice between surgery consultations and home visits

Ivar Sønbø Kristiansen, Knut Holtedahl

Abstract

***Objective*—To assess the influence of the remuneration system, municipality, doctor, and patient characteristics on general practitioners' choices between surgery and home visits.**

***Design*—Prospective registration of patient contacts during one week for 116 general practitioners (GPs).**

***Setting*—General practice in rural areas of northern Norway.**

***Main outcome measure*—Type of GP visit (surgery *v* home visit).**

***Results*—The estimated home visit rate was 0·14 per person per year. About 7% (range 0–39%) of consultations were home visits. Using multilevel analysis it was found that doctors paid on a "fee for service" basis tended to choose home visits more often than salaried doctors (adjusted odds ratio 1·90, 99% confidence interval 0·98, 3·69), but this was statistically significant for "scheduled" visits only (adjusted OR 4·50, 99% CI 1·67, 12·08). Patients who were older, male, and who were living in areas well served by doctors were more likely to receive home visits.**

***Conclusion*—In the choice between home visits and surgery consultations, doctors seem to be influenced by the nature of the remuneration when the patient's problem is not acute. Although home visiting is a function of tradition, culture, and organisational characteristics, the study indicates that financial incentives may be used to change behaviour and encourage home visiting.**

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The concern about escalating costs of health care has brought about health care reforms in several countries. A crucial objective in these reforms is to change doctors' decision making. Financial incentives inter alia have been proposed as a means of doing this. Yet, there are surprisingly few studies of the extent to which doctors change their clinical practice in response to changes in these incentives. A Danish study[1] showed that general practitioners (GPs) reduced the number of patients referred to specialists by a quarter and to hospitals by a third when remuneration was changed from a per capita system to a mixed per capita/fee for service system.

We present a case study of financial incentives designed to meet policy objectives by examining the influence of the system of remuneration on home visiting in northern Norway. In Norway, and in Sweden too, planned reforms of general practice are aimed at improving the patient-doctor relationship and encourage inter alia more home visiting.

All Norwegian GPs used to be remunerated on a fee for service (FFS) basis for curative care. In 1978 an alternative salary system was introduced in some areas. Each municipality had either one system or the other. The salary system was introduced only if all doctors in a municipality agreed. Once it was introduced, a municipality could not revert to an FFS system. This natural experiment offered a rare opportunity to study the influence of two different remuneration systems operating in similar environments.

For a home visit, FFS doctors were paid a consultation fee plus compensation for travel time. The salaried GPs were paid a fixed amount per day for being on call and a small fee per home visit. In principle, the salaried doctor was to have the same income as an FFS colleague for "a notional average number" of consultations on duty. However, the extra (or marginal) income for a visit was much lower under the salary system. For example, an FFS doctor would earn £31·50 for a home visit 30km away (not unusual in Norway), whereas the salaried doctor received only £6·36. Since most home visits were provided out of office hours, the doctor would forego leisure by home visiting. The decision as to whether to provide telephone advice only, a home visit, or a surgery visit may, in addition to professional judgement, be influenced by the "trade off" between income and leisure. We hypothesised that FFS doctors would more readily provide home visits.

The extent to which doctors were influenced by financial incentives could be measured by the degree to which salaried doctors—ceteris paribus—would choose a telephone or a surgery consultation more often than FFS doctors when the medical conditions did not clearly indicate a home visit. There are two fairly distinct types of home visits, "acute" and "scheduled". When a patient has an acute problem, a doctor may see the patient in the patients' home (acute home visit) or in the surgery. A scheduled home visit is an alternative to a repeat surgery consultation for an old or a chronically ill patient. Since the medical indications for home visits are less clear cut for scheduled home visits than for acute home visits, the latter are likely to be less influenced by the remuneration system.

Clearly, practice patterns in this respect may also be influenced by other organisational characteristics (doctor density, doctor turnover, etc), geographical characteristics (average travel time from the patient to the doctor and to the nearest

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hospital, population size, etc), provider characteristics (doctor's age, sex, medical training, etc) and patient characteristics (patient's age, sex, diagnosis, etc). The aim was to use multivariate methods to model the influences of incentives after adjusting for these confounding factors.

Methods

All general practitioners in 68 rural municipalities in northern Norway were asked to register their patient contacts during a specified week in 1982. Of the 148 elegible doctors, 116 (78·4%) in 60 municipalities returned completed registration forms. The response rate was 73·8% among fee for service doctors and 81·9% among those salaried. There was no difference between responders and non-responders with respect to age, sex, place of graduation, or number of years since graduation.

The doctor density (measured as population per doctor) was lower in municipalities in which the doctors received FFS remuneration than in those in which they were paid a salary (1571 *v* 1075, p<0·001) and the average population was higher (4748 *v* 2961), p=0·01) (table I). In other respects (doctor turnover, patients' travel time to the doctor, and travel time to the nearest hospital) the municipalities were comparable.

Table I Characteristics (mean) of the 60 municipalities

	Remuneration system		
	Fee for service (n=25)	Salary (n=35)	p
Doctor density (population/GP ratio)	1571	1075	<0·001
Doctor turnover (no of months in post)	36	26	0·208
Population	4748	2961	0·013
Proportion population reached within 30 min	75%	71%	0·427
Travel time to hospital (h)	1·7	2·3	0·067

Of the responding doctors (48 FFS and 68 salaried), 14% were female and the average age was 33 years. The respondents graduated on average six years before the study, and 68% of them were from a Norwegian medical school. There were no differences between FFS doctors and the salaried doctors in any of these respects. The methods have been described in more detail elsewhere.[2 3]

The doctors indicated on the registration form the place of direct contacts (surgery or home visit) using the following categories:

(1) Surgery consultation for a new illness (initial visit).

(2) Follow up consultation during office hours (scheduled surgery visit).

Table II Type of consultation (percentage) by remuneration system*

	Remuneration system		
Type of consultation	Fee for service (%) (n=3251)	Salary (%) (n=3574)	Total (%) (n=6825)
(1) Initial surgery visit (office hours)	42·2	44·0	43·1
(2) Return surgery visit (office hours)	42·1	41·5	41·7
(3) Acute surgery visit (out of hours)	8·5	7·9	8·2
(4) Acute home visit (doctor on duty)	4·8	5·3	5·0
(5) Scheduled home visit (doctor off duty)	2·5	1·4	1·9
Total	100·1	100·1	99·9

*433 consultations omitted from the analyses due to lack of information regarding type of consultation

(3) Surgery consultation, out of hours, for doctors on call (acute surgery visit).

(4) Home visit for doctors on call (acute home visit).

(5) Home visit for doctors not on call (scheduled home visit).

Altogether 7258 direct contacts (433 had missing information about the type of consultation (table II) and 3062 telephone contacts were registered. Type 1 visits were excluded from the multivariate analysis as the choice of place of consultation is made by the patient and not by the doctor.

STATISTICAL METHODS

Differences between groups of doctors were tested by *t* test (continuous variables) or χ^2 test (categorical variables). A number of variables associated with home visiting behaviour, in particular doctor density, may confound the hypothesised relationship between the remuneration system and home visiting behaviour. In order to adjust for potential confounding, multivariate analysis was used to estimate the independent effect of the remuneration system. We chose to use the number of years since graduation instead of the doctors' age in the multivariate analyses since the latter describes more precisely the experience as a GP.

To take into account the hierarchical structure of the explanatory variables (that is, the patient, the doctor, and the municipality level), we employed multilevel analyses using the ML3 programme.[4] These analyses show "the baseline effects" of the explanatory variables (the fixed part of the model) and the variation in each effect depending on the variation of other explanatory variables (interaction effects; the random part of the model).[5]

Because of the high number of significance tests undertaken, 0·01 was chosen as the level of statistical significance.

The estimation of consultation rates (number of visits per person per year) was based on the assumptions that the number of consultations was the same for non-responding as for responding doctors and that the registration week was a typical one.

Results

During one week, the GPs registered 476 home visits (6·9%) and 6349 surgery consultations plus the 433 visits not specified (table II). The average numbers of consultations per week were 71·6 for FFS doctors and 56·2 for salaried doctors (p=0·003), corresponding to consultation rates of 2·2 and 2·4 per person per year, respectively. The proportion of home visits was about the same in FFS and salaried doctors (7·3% *v* 6·7%; p=0·34) as was the weekly number of home visits per doctor (5·1 *v* 3·8; p=0·17), with home visit rates of 0·14 per person per year for both groups of doctors. The proportion of home visits ranged from 0% to 39% for individual doctors, and 28 doctors had no home visits during the specified week (26% of FFS doctors *v* 21% of salaried, p=0·63). Most of the home visits (72%) were house calls by doctors on duty (acute home vists) (table II). The salaried doctors provided more of their home visits while on duty (79%) than did the

FFS doctors (66%) (p=0·03). There was a tendency that doctors who provided many home visits also had many telephone consultations (r=0·20, p=0·06). The proportion of home visits was highest for children and elderly people of both sexes for acute and scheduled home visits.

Of 901 acute visits, 344 (38%) were home visits, with similar proportions for FFS and salaried GPs. Of 2981 scheduled visits, 132 (4·4%) were home visits, the proportion was higher among FFS doctors (5·6%) than among salaried doctors (3·3%) (p=0·003).

MULTILEVEL ANALYSES

The choice between all surgery visits (type 2 and 3) and all home visits (type 4 and 5) was first analysed in a three level model with the patient as level one (n=3813), the doctor as level two (n=116), and the municipality (organisational and geographical characteristics) as level three (n=60). Because there was no significant variation at level three in any of the models, only two level models were analysed (doctor and municipality characteristics were assumed to be at the same level).

In univariate analysis, doctor density and the sex of the patient were the only statistically significant predictors (table III). When all explanatory variables were used in a multivariate model (our proposed model), doctor density was still significant (OR 0·42, 99% CI 0·19, 0·92), indicating that a home visit was more than twice as likely for each 1000 population per doctor increase in density. Patient sex was also significant (OR 0·76; 99% CI 0·58, 0·99; women had a 75% probability of a home visit compared with men). A home visit was nearly twice more likely to have been carried out by FFS doctors than salaried ones (OR 1·90, 99% CI 0·98, 3·69); this was borderline statistical significant.

No random variation of the coefficients was detected (that is, there were no interactions), and only the intercept was retained in the random part of the model.

Most coefficients did not change significantly when analysed together suggesting there was little confounding between them. Only the remuneration system was not "robust"—but that was to be expected since the remuneration method was largely determined by doctor density and population size. The full model shows the independent effect of remuneration, adjusted for the other factors which differ between the areas.

Repeating the multivariate analysis for acute visits only (type 3 *versus* type 4 visit), home visiting was associated with smaller populations (OR 0·85; 99% CI 0·72, 0·99), short travel times to the nearest hospital (OR 0·66; 99% CI 0·45, 0·98), and older patients (OR 1·13; 99% CI 1·05, 1·23). There was no association between the remuneration system and home visiting (OR 1·20, 99% CI 0·37, 3·95).

On the other hand, for scheduled visits (type 2 *versus* type 5) home visiting was associated with FFS remuneration (OR 4·50; 99% CI 1·67, 12·08), high doctor density (OR 0·19; 99% CI 0·05, 0·66), and older patient age (OR 1·18; 99% CI 1·04, 1·33).

Table III Multilevel analysis of the choice between surgery consultation (=0) and home visit (=1) for 3813 visits (odds ratio (OR) and 99% confidence interval)

	Unadjusted: explanatory variables introduced one at a time		*Adjusted for all explanatory variables*	
	OR (99% CI)	*t*	*OR (99% CI)*	*t*
Intercept			0·24 (0·04, 1·58)	−1·94
Remuneration system (0=salary, 1=fee for service)	1·13 (0·63, 2·01)	0·54	1·90 (0·98, 3·69)	2·48
Doctor density (1000 population/doctor)	0·51 (0·27, 0·97)	−2·66	0·42 (0·19, 0·92)	−2·82
Doctor turnover (no of years in post)	0·97 (0·86, 1·11)	−0·51	0·92 (0·79, 1·06)	−1·54
Population of municipality (in 1000s)	0·95 (0·87, 1·02)	−1·84	0·95 (0·87, 1·03)	−1·61
Proportion of population reached within ½ h	1·00 (0·99, 1·02)	0·32	1·00 (0·99, 1·02)	0·85
Travel time to nearest hospital (h)	0·94 (0·77, 1·16)	−0·72	1·00 (0·82, 1·23)	0·03
Sex of physician (0=male, 1=female)	0·47 (0·20, 1·11)	−2·25	0·54 (0·23, 1·24)	−1·90
No of years since graduation	1·03 (0·97, 1·10)	1·35	1·05 (0·98, 1·13)	1·78
Medical school (0=foreign, 1=domestic)	0·66 (0·38, 1·14)	−1·92	0·79 (0·44, 1·41)	−1·05
Job satisfaction (1=low, 7=high)	1·09 (0·86, 1·37)	0·90	1·06 (0·84, 1·33)	0·64
Age of patient (in 10 y intervals)	1·05 (0·99, 1·11)	2·18	1·05 (0·99, 1·11)	2·07
Sex of patient (0=male, 1=female)	0·75 (0·58, 0·98)	−2·79	0·76 (0·58, 0·99)	−2·67

p<0·5 if t >1·96
p<0·01 if t >2·56

Discussion

The remuneration system emerges as a predictor of scheduled home visiting. For scheduled visits, the doctor has more freedom to choose the preferred place of consultation than when the problem is acute. The total consultation rates were higher in municipalities with salaried doctors (and higher doctor density). Assuming that the "medical need" is about the same in both types of municipalities, FFS doctors could have provided more consultations if they had wished. This may indicate that FFS doctors aimed at a target income rather than a maximum income.[1 6]

The doctors in one municipality may serve different patient groups with different needs for home visits. Consequently, some of the observed associations may be attributable to medical factors which are not accounted for in the analyses. However, "medical need factors" are associated with age and sex of the patient, and these were adjusted for in the analyses.

A potential for bias arises because doctors may have chosen the municipality with their preferred remuneration system. Bias may also be introduced if selective dropout from the study was systematically different between doctors with different forms of remuneration.[7] It is difficult to judge the net effect of these potential biases. However, it should be noted that the higher doctor density (smaller population per doctor) in salaried municipalities was due to governmental decisions, not to doctors' preferences.

The explanatory variables describe the individual patient, the doctor, or the municipality. This hierarchical structure presents an analytical problem since the 3813 observations are not independent.[8-10] We chose to use a multilevel programme which is designed specifically to handle such hierarchical structures.[4]

Patient age had an effect on the choice between home and surgery visit (5–18% more likely per 10 year increase in age), but this was statistically significant only in the separate analyses of acute and scheduled visits. Since severity and immobility increase with age, the study indicates that the patient's need has a strong influence on doctors' decisions.

Male patients had more home visits than female ones (but not in the separate analyses of acute and scheduled visits). We do not have a clear explanation of this finding.

The study confirms the commonly held view that home visiting is greater where the doctor density is higher. It may be worthwhile to note, however, that 40 years ago home visit rates were higher than now despite a lower doctor density.

Not surprisingly, the rate of acute home visits was lower in municipalities with larger populations. Usually, only one doctor is on duty at a time for acute problems. With a larger population to serve, the doctor may be forced to choose surgery consultations in order to see all the acutely ill patients in need of consultation.

Provision of home visits is essential to establish and maintain the public's trust in primary health care,[11 12] and we believe that home visiting should be at least as frequent as that found in this study for a "high quality family practice". Many doctors claim that seeing the patient in her own social context results in a better understanding of her psychosocial problems,[13] and may also yield important insights into diagnosis, drug safety and compliance, functional capacity, and social network in elderly patients.[14] Despite this, various reports indicate a decline in home visiting in the UK[15 16] and Norway.[17-20] A dramatic decline has taken place in the USA and Sweden, where home visiting is now negligible in some areas.[21-24] The wide variation in home visiting between countries may be explained by differences in tradition, culture, and the organisation of general practice.[25-27]

If encouragement of home visiting is to be a feature of health policy, a variety of measures may be relevant. A relatively high doctor density seems to be a factor favouring the provision of home visits. Clearly, professional consensus is important, but organisational factors may also be changed to encourage home visiting. Other studies have indicated that remuneration systems affect clinical behaviour.[1 28-30] Our study supports these findings suggesting that financial incentives can be successful in encouraging home visiting.

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PAPER IV

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MEDICAL SPECIALISTS' CHOICE OF LOCATION: THE ROLE OF GEOGRAPHICAL ATTACHMENT IN NORWAY

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Abstract—The relation between current place of work (area of the country) and factors that might possibly represent doctors geographical attachments was studied in a sample of 322 Norwegian medical specialists. Location of hospital residency, age and geographical origin of spouse were associated with current location.

Geographical attachment seems to influence doctors' locational choices from start of medical school until the end of their residency. The probability that a doctor shall locate in peripheral areas may increase from less than 10% to more than 50% if the doctor has the residency training in the periphery.

Hence, favoring entrance to medical schools of students from the underserved areas, and location of graduate and postgraduate medical training in the underserved areas, as far as it is feasible while still maintaining medical standards, is suggested by the study.

Key words—market for medical manpower, distribution of doctors, medical education, spouse-effect

INTRODUCTION

The maldistribution of doctors has been a recurring problem in many countries for the past two hundred years [1]. In Norway this problem has been most prevalent in the primary health care. However, from time to time there has been a severe shortage of medical specialists in several remote hospitals. Such shortage means considerable inconvenience to the patients who may be denied specialist services or forced to travel up to 5–6 hr to get appropriate care. Lacking any real understanding of the basic causes of the maldistribution of doctors, policy measures have been under much debate. Recruitment programmes with favorable terms of employment, restrictions on the establishment of medical practices and increased enrollment in medical schools have been the principal policies proposed.

The situation of Norway

Access to health care is considered a right for every citizen of Norway irrespective of location, income, etc. Accessibility has two components [2]. Physical access may be a considerable problem in a country like Norway where large areas are sparsely populated. Economic access, however, is not much of an issue. The financing and provision of health care is mostly public, and direct patient charges are minimal.

In Norway primary health care is provided by municipal authorities while the county councils are responsible for specialized services. In rural areas such services are almost exclusively provided by hospitals (in-patient and out-patient) which means long journeys for the clients. To obtain a permanent position in one of the 70 hospitals, the doctor needs to be a certified specialist (5–8 years of practical and theoretical training after internship). Doctors with such certification are considered specialists in this paper. No specialist certification is needed at the primary level although training programmes in family and community medicine were established in the early 1980s.

Norway is divided into four regions. The Eastern (central) region, including the capital Oslo, dominates in both population (2.29 million) and economic influence. The Western region (0.84 million) and the Middle region (0.61 million) lag somewhat behind, while the Northern (0.46 million) is the least developed. The peripheral parts of the Western and Middle regions and most of the Northern region are faced with unemployment and out migration. Oslo (Eastern region) and Bergen (Western) have had medical schools for many years whereas those in Trondheim (Middle) and Tromsø (Northern) date only from the 1970s.

While two remote counties (Finnmark in the Northern region and Nord-Trøndelag in the Middle) have a population to specialist ratio of approximately 5000 and 2500 respectively, Oslo's is 300. In the county of Finnmark in 1988 the vacancy rate for specialist posts was about 70%. The lack of physical accessibility for the people in several remote areas is not in accordance with the fundamental values of equity and equality on which the Norwegian health care system supposedly is based. While Oslo provides some services for the rest of the country, nonetheless the maldistribution is considered unacceptable in both the medical and the political communities since utilization of specialist services tends to be much lower in the remote areas. The high specialist density in the Eastern region indicates that doctors have preferences for locating there. This may partially be caused by an attractive medical environment with

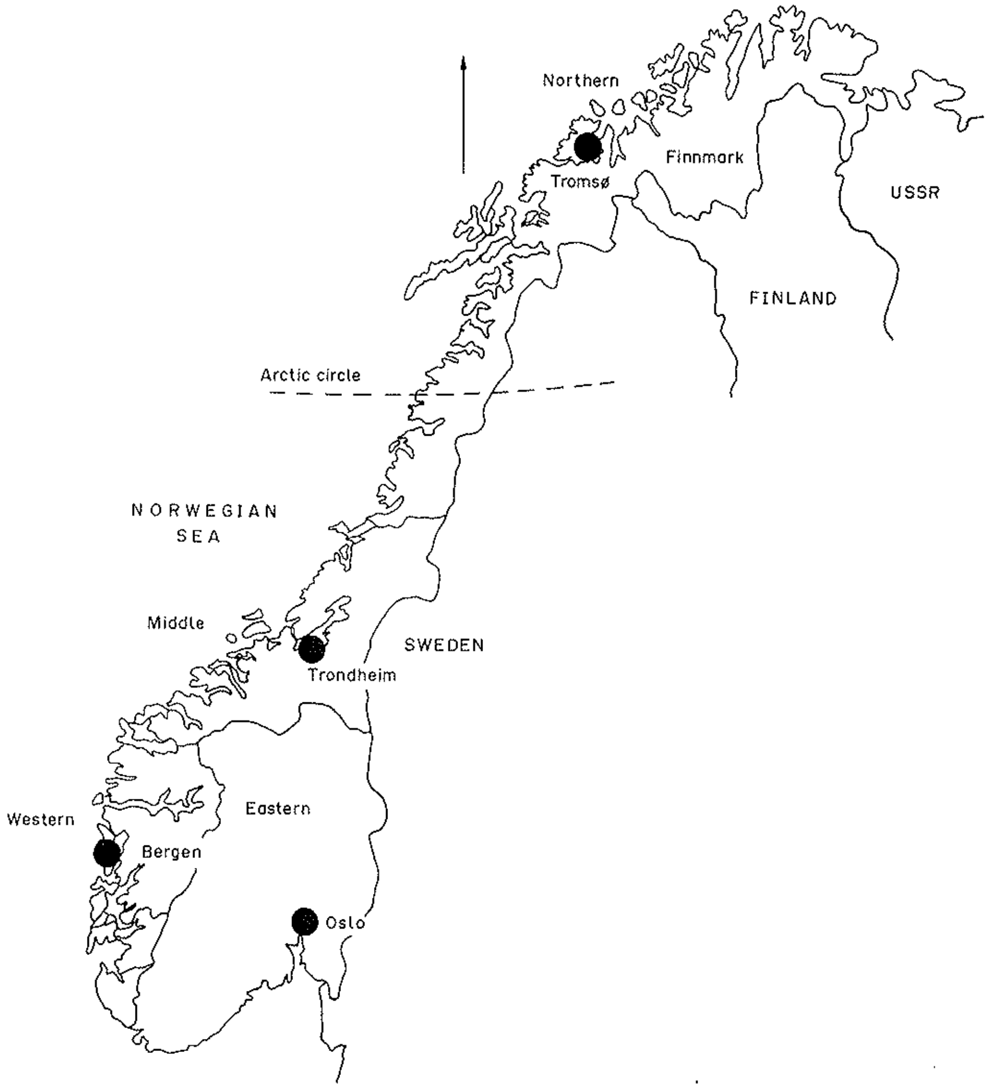

Fig. 1. Norway (with the medical schools (●), and regions indicated) and adjacent countries.

various advanced hospitals and laboratories. However, favorable climate and cultural amenities may also contribute to the preferences for location in the capital city.

The county of Finnmark has the highest mortality (e.g. lung cancer, myocardial infarction, violent death [3]) and morbidity (e.g. sexually transmitted diseases) rates for some diseases and the lowest life expectancy of the country [4]. To what extent the higher mortality and morbidity is attributable to the low specialist density is not known.

Redistributional policies

Maldistribution of doctors has been a problem in many countries for a long time. Second class doctors were trained in France at the beginning of the last century to alleviate the shortage of medical services in French rural areas [1]. However, even these doctors preferred an urban practice leaving the problem unsolved.

Still today many industrialized countries experience maldistribution of doctors although some European countries report 'over-production' [5]. Although one may argue that shortage of doctors is just an indication that patients in the area have low willingness to pay (low socioeconomic status) [6], we believe that a minimum of access to doctor services is necessary for both medical and political reasons.

One way of redistributing doctors might be to change their preferences by some sort of incentives. There is quite a lot of evidence that financial incentives in the form of wage differences increase the supply of doctors in an area [7–13] whereas the effect of loan forgiveness is more ambiguous [14]. To what extent non-financial incentives (continuing education rewards, better career advancement, etc.) change doctors' preferences for location has not been reported.

A second potential redistributional measure is restrictions on the number of new posts and practices in the preferred areas. Such policies tend to be quite unpopular in the medical profession [15] and the distributional effect has not been proven although there is some evidence [16].

A third way is using the educational system in such a way that doctors to a lesser degree have preferences for location in areas with the highest doctor density. First, one can favour applicants to the medical schools from the underserved areas since doctors tend to settle where they were reared [17–19]. Second, location of medical schools in peripheral areas tend to induce preferences for working in the same area [1, 17–21]. Third, location of postgraduate training (internship and residency) may conceivably influence preferences for place of work. If this were the case, training should be located as much as possible in the less preferred areas. A Norwegian proposal based on this principle was met with skepticism within the medical profession although there is some evidence that internship and residency may influence later location [18, 19, 22].

Several of these policies have been implemented in Norway during the last 25 years. The establishment of medical schools in Trondheim and Tromsø was one of these. Students graduated from the University of Tromsø are shown to locate more often in peripheral areas [19, 20]. The number of new doctor posts was regulated in two periods (1979–83 and 1988–89) to 'force' doctors out of the cities. The number of vacant positions declined during these periods [16], but systematic evaluation of the regulations was not carried out. Various incentive packages have been used from time to time, but they have never been thoroughly assessed.

This study aims at exploring the determinants of specialists' choice of location, and testing the hypothesis that the location of internship and residency training influences later choice of place of work in the doctors' career. The analysis is based on the directory "Doctors in Norway 1984" [23] which covers almost all practicing doctors in Norway through 1984 (later editions are not available).

METHODS AND MATERIALS

We randomly sampled one doctor on every four pages of text in "Doctors in Norway 1984". Each of the 1350 pages of the text lists in alphabetical order 6–12 doctors with name, address, year and place of birth, marital status, year and place of graduation, post-graduate training, speciality if appropriate and type of position currently held, for all doctors who wish this information published on their behalf. The directory covers almost all 11,600 doctors in Norway (about 45% were registered specialists), but 10–20% were lacking information other than name and address. The inclusion criteria were: (1) certified specialist; (2) holding a permanent position or having a private practice; (3) age less than 50 years. We excluded doctors who: (1) graduated from high school *and* medical school abroad; (2) had more than half of their residency abroad; (3) currently lived abroad; (4) specialists in family or community medicine. This left us with a sample of 291 doctors.

Since this sample only contained two doctors currently working in the Northern region, we added a stratified sample by including any person from this region on the sampled pages if they otherwise satisfied the selection criteria ($N = 31$). The total sample was thus 322 registered specialists for whom we filed data describing geographical background, training etc.

The geographical region of hospital residency was defined as the region where more than half of the training had taken place. Some doctors ($N = 47$) had their residency in three or four regions.

Differences between groups were tested by t-test for continuous variables and by χ^2-test for categorical ones. Since choice of current location is influenced by a variety of factors, we performed logistic regression analyses of the locational choices. Geographical data were dichotomized such that the Eastern region was defined as central location while the rest were defined as peripheral. General surgery including subspecialities (gastroenterology, etc), gynecology, ophthalmology and otology were classified as surgical specialties in these analyses; all other as non-surgical.

RESULTS

The sample consisted of 40 females (12.4%) and 282 males (Table 1) with a mean age of 43 (33–49) for both sexes. More than half of the sample (61.2%) was currently working in the Eastern (central) region. The supplementary sample from Northern Norway did not differ from the main sample in terms of age or sex. Separate analyses excluding this sample did not produce significantly different results. In what follows both samples are included.

A little more than half of the doctors (53.0%) graduated from high school in the Eastern region as distinct from 10.3% in the Northern region. Half of the doctors (49.8%) had internships in the Eastern region, 9.7% in the Western, 15.8% in the Middle region and 22.2% in the Northern region.

Out of the 153 doctors trained in the Eastern region, 132 (86.3%) were currently working in this region (Table 2). The proportion was 63.6% in the Northern region. This suggests an association between residency and current place of work ($P < 0.001$). A substantial proportion (65.8%) of the

Table 1. Doctors by sex and current location (region), Norway 1984

Current location	Female (%)	Male (%)	Total (%)
Eastern	22 (55.0)	175 (62.1)	197 (61.2)
Western	9 (22.5)	40 (14.2)	49 (15.2)
Middle	7 (17.5)	38 (13.5)	45 (14.0)
Northern	2 (5.0)	29 (10.3)	31 (9.6)
Total	40 (100.0)	282 (100.1)	322 (100.0)

Table 2. Doctors by current location (region) and location of residency (region), Norway 1984

Location of residency	Current location East	West	Middle	North	Total
Eastern	132	5	9	7	153
Western	13	34	4	1	52
Middle	8	4	25	0	37
Northern	7	3	2	21	33
Different regions	37	3	5	2	47
Total	197	49	45	31	322

doctors had chosen to work in the *region* where they had been trained as specialists. Also, two thirds of both female and male doctors had at least some of their residency training in the *city* in which they currently lived.

Doctors often worked in the region where their spouse was born ($P < 0.0001$). Of the 109 doctors with a spouse from the Eastern region, 88 (80.7%) worked there, too. This proportion was 39.6% in the Western region, 40.0% in the Middle and 50.0% in the Northern region.

Regression analyses

There has been excess demand for medical manpower in the 1980s, and doctors could consequently most often get a job at their preferred location. We therefore assumed that choice of location revealed the preferences for location. We performed regression analyses to study the association between the potential predictors and the final choices. We studied the four location choices (medical school, internship, residency and current work). The independent variables included characteristics of the doctor and his/her spouse and various geographical variables prior in time to the actual location choice.

Graduates from high school in peripheral regions tended more often to go to a peripheral medical school (Table 3). There were no significant predictors for location of internship. Location of birth, of high school and of internship were predictors of residency location.

Current place of work was more often in the periphery for young doctors with peripheral residency training [odds ratio 35.8 (95% CI: 17.9–69.7)] or a spouse from the peripheral regions [odds ratio 5.7 (95% CI: 3.4–9.7)]. The regression model indicates a 1% probability for a peripheral place of work for a 50 year old male doctor with central geographical attachment and a wife from the Eastern region, and a 9% probability for a similar 40 years old doctor. The latter would have a 37% probability for a peripheral location if he had a wife from the periphery increasing to 78% if he had peripheral residency training (but a wife from the Eastern region).

Interaction between the spouse's place of birth, the doctor's place of birth and the doctor's sex could be expected. However, supplementary regressions with interaction variables included did not indicate such phenomena.

As a result of missing information, only 171 doctors were included in the analysis of current work place. In alternative regression analyses with all 322 doctors included, we replaced missing information with the average value of the actual variable. This did not alter the conclusions.

DISCUSSION

The possible sources of error in this study are above all linked to missing or incorrect information in the directory "Doctors in Norway 1984". Since some doctors did not provide information or provided incomplete information for the directory, we may have a somewhat selected study population. However, to the extent that selection exists, we do not believe it is associated with any of the phenomena discussed in this paper. The sampling procedure means that popular family names have higher representation in the study than unpopular ones. However, it is rather unlikely that this bias affects the conclusions. Also, the oversampling from the northern region may introduce bias, but separate

Table 3. Logistic regression analyses of location[1] of medical school, internship, residency and current place of work (standardized estimates), Norway 1984

Explanatory variable	Medical school $N = 316$	Internship $N = 300$	Residency $N = 256$	Current location $N = 171$
Age (yr)	0.205*	0.075	−0.021	−0.602**
Sex (female = 0, male = 1)	−0.029	0.002	0.006	−0.311
Location of birth[1]	0.002	0.074	0.234*	0.186
Location of high school[1]	0.475***	0.144	0.315**	0.256
Location of medical school[1]		0.080	0.062	0.166
Location of internship[1]			0.294***	0.252
Location of residency[1]				0.989***
Specialty (surgical = 0, others = 1)				0.125
Marital status # (unmarried = 0)		0.027	−0.008	
Occupational mobility of spouse				−0.156
Place of spouse's birth[1]				0.482**

[1] Location variables: Eastern region = 0, other regions = 1.
By the end of internship.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

analyses without this oversampling leaves the results unchanged.

It is clear, as other studies have shown, that doctors are influenced by geographical attachment when they choose place of work. However, when deciding upon distributional policies it is important to recognise the relative importance of the different factors constituting geographical attachment.

Strong associations between events with a close relationship in time was a prevalent, and not surprising, finding in this study. The study design does not allow for direct inference on causality, and when describing and interpreting the effect of geographical attachment, we are immediately aware of the limitations of this term. Still, except for the time of marriage, the time sequence is known, and when associations make sense and are known to exist, our study is rather a demonstration of the relative impact of different known determinants. In relation to the policy implications of our findings it is also of minor importance whether doctors move to the place of spouse's birth for residency or chose a local candidate for marriage during residency. Both result in geographical attachment which can be exploited in manpower policies.

The analyses confirmed the hypothesis that location of postgraduate training influences later locational choices. In fact, the regression analyses indicate that the effect may be rather strong since it may increase the probability of peripheral location from some 10% to above 50%. Our finding is in accordance with American and British studies [18, 22, 24–26]. However, only a small fraction of doctors seem to leave their hospital of residency and then later return to the same hospital. The 'salmon-effect' as it is called in Norway, seems rather weak although imprecisions in data may be concealing it.

Where the spouse was reared seems to be more important than the doctor's own geographical origin. It suggests doctors take the wishes of the spouse into consideration when deciding upon their career. It may well be that doctors devoting much of their time and effort to medical practice give concessions to their spouses when it comes to locational decisions.

It is not surprising that young doctors to a greater extent work in peripheral areas than the older ones. By tradition, career-patterns have been directed towards obtaining a final position in central areas. However, the average period spent in peripheral regions is so lengthy that the doctors there constitute a stable work force even if many in the end do move.

Policy implications

Although most studies we have come across stem from U.S. or Canada, their conclusions coincide with our own finding. Hence, we think our conclusions are applicable to medical manpower policies. Taking into consideration that choice of location is influenced by a variety of factors, it is not reasonable to base distributional policies on one single factor. Rather, they should be based on several components:

—Discriminatory enrollment of students from underserved areas to the medical schools.
—Location of medical schools in underserved areas as far as possible.
—Location of postgraduate training (internship and residency) in underserved areas as far as possible.
—Restrictions on the number of posts and practices in the most popular areas.
—Incentive packages (financial and non-financial).
—A system of locum tenems to ease leave of absence (for continuing education, vacation, etc).
—Regionalized specialist services such that specialists in remote areas are part of a network which link them to central hospitals.

We have not included in this list a general increase of enrollment to medical schools which has been a policy in most industrialized countries during the last 25 years [27, 28]. Although some countries, e.g. U.S., have experienced a somewhat improved distribution of doctors, the problem seems to remain mainly unsolved [29, 30]. Apparently the increased number of doctors do not have much effect on their spatial distribution in itself [31, 32].

In Norway maldistribution is still present, and about 300 specialist positions at peripheral hospitals were vacant in 1990. It may be worthwhile noting that relocation of a small proportion (6%) of specialists may alleviate the problem by distributing the vacancies evenly across the country. This is in accordance with other studies [33].

To the extent the problem *can* be solved, we believe it can be solved by a lasting and consistent manpower policy. Probably doctors don't easily or rapidly change preferences for location. Hence, changing the distribution of doctors means committment to lasting and comprehensive policies. Medical education all through the career should be used consciously to direct doctors to the underserved areas. If it is possible to identify criteria associated with preferences for living outside the larger cities, these could be used by student enrollment. These policies could constitute a positive selection of doctors to remote areas while, for instance, wage differentiation could have the opposite effect. However, incentive packages should also be used—not only because they may change short term preferences for location, but also because they ensure necessary support for the less popular policies.

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PAPER V

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PHYSICIANS' OPINIONS AND USE OF CONTROVERSIAL TECHNOLOGIES

The Case of Mammographic Screening in Norway

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Abstract

In a survey of 196 Norwegian radiologists and 37 breast imaging centers, physicians' preferences were found to be likely to influence the use of mammography. In their decision making, the radiologists appear to be influenced by income motives and by perceptions of the risk of misdiagnosing breast cancer. Despite opinions favorable to mammographic screening, most radiologists would prefer a CT scanner or a magnetic resonance imaging unit to a mammographic unit if the x-ray department were in a position to acquire capital equipment.

Medical innovation is a major cause of increasing health care expenditures. Yet the understanding of how medical technologies are disseminated, used, and eventually abandoned is fairly limited. Those theories based on economics adopt a stance of constrained maximization (13) where financial incentives may be crucial for the diffusion of a technology. Other theories emphasize the role of information dissemination (8), the severity of the disease (40), the organization and management of health care, or innovation cycles (13). Whatever the most appropriate theory, physicians hold the key. Even in settings where health care managers, in principle, make the decisions with respect to the use of technologies, asymmetry in information places the physicians in a pivotal role.

Physicians' behavior can be seen as a function of various motivating factors or, in economic terms, arguments in their "utility (preference) function." It is assumed by economists that all individuals aim at maximizing their utility (welfare) subject to certain constraints and that behavior is a function of the factors that generate

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utility. For physicians, patient benefit (as perceived by the physician), income, status, intellectual satisfaction (interesting cases etc.), and autonomy are likely to be the most important factors (22). Consequently, the more a technology generates health benefits, income, and status, the more the physicians would prefer to be involved with it.

To study the effect of physicians' preferences on the use of technologies, we chose screening for breast cancer with mammography as a case study. Introduced in the 1950s (17), there has been little agreement as to its net benefit (11;16;32;35; 37), despite several epidemiologic studies (21). In the United States various authorities recommend regular mammographic screening (11;14), but in Europe the issue has been more controversial with different policy recommendations in different countries. It now seems that a consensus is emerging that screening reduces breast cancer mortality for women aged 50–69 years (27), but there remains uncertainty with respect to the effectiveness among women aged 40–49 years (27).

In Norway in 1987, the Report of the Public Enquiry into Mammographic Screening (23) recommended the establishment of a nationwide screening program for women aged 50 and older. This failed, however, to win approval with the Ministry of Health. In 1989 a Norwegian consensus conference (3) came out against mammographic *screening* (breast imaging in asymptomatic women) but emphasized the need to improve and expand *clinical* mammography services (examination of those with symptoms or signs of breast disease). In 1990 the members of the 1987 Public Enquiry Committee submitted an updated policy recommendation to the government (24). Again, they recommended mammographic screening for women aged 50–69 years.

Mammographic screening involves benefits (e.g., life extension, increased potential for breast conserving surgery) and costs (e.g., use of resources, harm of negative biopsies). For a technology where the impact on life extension has been disputed, physicians' opinions and use are likely to depend on the relative weights that they attach to the various benefits and the costs.

We hypothesize that this weighting may be influenced by physicians' preferences with respect to patient benefit, status, intellectual satisfaction, income, by sociodemographic variables such as age and sex, and by knowledge and personal experience with the technology. Opinions may also be influenced by training in scientific methods. Interpreting mammograms involves a risk of overdiagnosing (false positive) and underdiagnosing cancer (false negative), and a risk of criticism of the physician by the patient and relatives. Perceptions of such risks may influence physicians' opinions and their use of breast cancer screening. Views on mammography among peers may also constitute an important basis for forming opinions.

The use of mammography is likely to be influenced by supply-side and demand-side factors. A high density of mammographic centers (a supply-side factor) is likely to be associated with high utilization rates. Since patient payments have been shown to influence utilization negatively (25;41), one would expect that counties with relatively low incomes (a demand-side factor) would have low utilization rates.

HEALTH CARE AND RADIOLOGY SERVICES IN NORWAY

Norway has a public health care system with access for all 4.2 million inhabitants. There are 70 acute care, somatic hospitals (6 university clinics, 14 intermediate-level hospitals, and 50 smaller local hospitals) in addition to a few specialized somatic hospitals. In-hospital services are financed by block grants while outpatient services are on a fee-for-service basis. Radiology services are provided by the somatic hospitals (all of which are public) and private x-ray clinics, the latter existing only in densely populated areas. Operated in agreement with health authorities, private clinics are owned by one or more of their radiologists. In addition to the owners, other radiologists may be employed and are usually paid per examination. In hospitals radiologists are paid a salary.

Inpatient hospital services are free of patient charges while, for example an outpatient x-ray examination involves a copayment of US $10 (US $1 = NOK7). Private clinics are reimbursed by patient payments (at the same rate as public centers) and by transfers from various public sources on a fee-for-service basis. Public hospitals usually require a referral from a physician and only conduct mammographic screening by special agreements (e.g., with a group of women or an organization). In 1991 private clinics received reimbursement of $93 for a clinical mammographic examination. Public hospitals were reimbursed at a somewhat lower rate.

In principle, screening procedures (e.g., mammography) of healthy individuals are paid in full by the person tested. The charge is about $40–$70 per woman for mammographic screening in private clinics and somewhat less in public hospitals. However, when a woman is referred by a clinician for mammographic examination, it is classified as a clinical examination and reimbursed accordingly. Since referrals may be based on fairly vague symptoms or findings or simply on the patients' wishes to undergo mammographic examination, the difference in practice between clinical and screening examinations may be rather small.

METHODS AND MATERIALS

In October 1992 all Norwegian specialists in radiology (i.e., registered as such by the Norwegian Medical Association) aged less than 71 years of age ($n = 280$) were mailed a questionnaire on mammography. A cover letter described briefly the conclusions of the three Norwegian policy recommendations. The questionnaire covered some background variables, mammography practice and training, knowledge of various policy recommendations on breast cancer screening, opinions on the use of mammography in breast cancer screening, risks of misdiagnosing breast lesions, and priority setting between various imaging techniques. Nonrespondents were followed up at least once, and twice if necessary.

We excluded those with unknown addresses ($n = 9$). Of the remaining 271 radiologists, 196 (72%) returned a completed questionnaire, while 40 (15%) did not wish to participate in the study and 35 (13%) did not respond at all. In what follows, the terms "physicians" and "radiologists" refer to the 196 participants in the study. The participants had a mean age of 48 years (29–68) and 52 (27%) were female (Table 1). The age and sex distribution of participants and nonparticipants was approximately the same. A further description of the participants is presented in Table 1.

An index of knowledge of the three policy recommendations for breast cancer screening was constructed by giving knowledge of any recommendation a value of 1 and then aggregating (with, for example, no information scoring zero, and knowledge of all three scoring 3). Physicians' assessment of the risk of misdiagnosing was measured by the response to the question about perceived risk of false-negative mammograms.

A county index for opinions on mammographic screening was constructed by scoring a negative opinion as zero, a favorable one as 2, uncertainty as 1, and taking the mean of the county. A similar index was calculated for each radiology department. The physician's own score was excluded from the calculation of these indexes. The

Table 1. Characteristics of the Physicians (196 Participants)

	N[a]	Male	Female	All	*p*
Age (mean)	196	48.9	47.0	48.4	0.1100
Sex (%)	196	73.5	26.5	—	—
Years since specialist certification	191	12.3	10.0	11.7	0.0304
Number of working hours	186	42.7	41.0	42.3	0.1923
Number of publications (co-)authored[b]	196	10.0	2.2	7.9	0.0001
Involved with mammography now or in the past (%)	196	48.6	71.2	54.6	0.0050
Abandonment of mammography (%)	107	52.9	37.8	47.6	0.1390

[a] The number of radiologists responding to the question.
[b] Assuming that the 72 missing observations mean zero publications.

department opinion index was set equal to the country mean (1.42) where there was only one radiologist in the hospital department.

There were missing values for some variables, such as the perceived risk of a false-negative mammogram ($n = 19$), the perceived risk of criticism for overlooking a cancer ($n = 23$), and the perceived prestige involved with mammography ($n = 14$). To keep all observations in the regression analyses, we replaced missing values with the mean value for the variable.

Information on the use of mammography in 1991 was collected by telephone interviews of all mammography centers (public hospitals and private x-ray clinics with a mammographic unit) in Norway. There was a 100% response rate to this inquiry. Due to the reimbursement system, the centers register the number of breasts examined. The number of examinations was calculated by dividing the number of breasts by two, assuming that each examination involved two breasts. Since it can be difficult to distinguish between clinical and screening mammography, we expressed the utilization rates as the total number of examinations (clinical and screening) per 1,000 women aged 40 through 69 years (a few women have more than one examination in a year).

Differences between groups were tested by chi-square tests and *t* tests. Linear regression and ordered logistic regression were used in various multivariate models (33;34).

RESULTS

Apart from the conclusions mentioned in the cover letter, relatively few participants knew the content of the 1987 policy statement (42%), its 1990 update (22%), or the 1989 consensus statement (44%).

When asked which new technology they would acquire if their own hospital department were in a position to expand its capital equipment budget, only 21 indicated mammography (100 physicians did not respond to the question). When given a choice between various radiologic equipment intended to improve the services provided by an intermediate level hospital, only 17 physicians chose a mammographic unit. A computed tomography (CT) scanner ($n = 114$), a magnetic resonance imaging (MRI) unit ($n = 30$), or intervention equipment ($n = 21$) was chosen more often.

When asked about influences on the adoption of mammography in a hospital, 65 physicians suggested that the radiologists themselves were the most influential, 44 indicated the politicians, 28, the health authorities, 23, the surgeons, and 43, women's groups.

Table 2. Ordered Logistic Regression Analysis[a]

	Odds ratio	(95% CI)	*P*
Intercept 1	0.31	(0.02–6.43)	0.4519
Intercept 2	0.06	(0.00–1.26)	0.0705
Age (in 10 years)	1.39	(0.90–2.14)	0.1357
Sex (male = 0), female = 1)	1.13	(0.54–2.37)	0.7438
Currently involved with mammography (no = 0, yes = 1)	2.91	(1.18–7.18)	0.0206
Number of publications (co-)authored	0.86	(0.71–1.04)	0.1263
Number of years mammography involvement	0.90	(0.83–0.98)	0.0194
Knowledge of policy recommendations (0–3)	1.36	(1.01–1.83)	0.0425
Publication(s) as basis for opinion (no = 0, yes = 1)	2.12	(0.69–6.52)	0.1902
Peers as basis for opinion (no = 0, yes = 1)	3.58	(0.91–14.2)	0.0684
Perceived risk of overlooking cancer (often = 1, seldom = 3)	1.67	(0.85–3.27)	0.1339
Radiologists may be criticized (agree = 1, disagree = 5)	0.92	(0.65–1.30)	0.6495
Status attached to mammography (no = 0, yes = 1)	1.59	(0.59–4.26)	0.3601
Department opinion index (0–2, negative = 0, favorable = 2)	2.32	(1.26–4.16)	0.0065
County opinion index (0–2, negative = 0, favorable = 2)	0.45	(0.12–1.61)	0.2227

[a] Analysis of responses to the question, "Taking all things into account, do you think that all Norwegian women aged 50 and older should be offered screening mammography?" (no = zero, uncertain = 1, yes = 2), $n = 193$. Three observations with missing values for the response variable were omitted from the analysis.
Note—2 log likelihood 325.9.

Opinions on Screening Mammography

The majority (57%) of the physicians thought that, with all things taken into account, all women aged 50 and over should be offered mammographic screening, whereas 15% said no, and 27% were uncertain. Among those 111 physicians in favor of screening, 98 indicated reduced breast cancer mortality as the most important reason for being in favor. For women aged 40–49, only a minority (17%) of the physicians thought that screening mammography should be offered, whereas 34% were opposed, and 45% were uncertain.

Ordered logistic regressions were used to detect predictors of opinions on screening mammography. The proportional odds assumption was secured by testing models in which the ordinal dependent variable was dichotomized in four different ways (2).

Favorable opinions on mammographic screening in women aged 50 and older were positively associated with the following variables: currently being involved with mammography (odds ratio [or] 2.9, 95% confidence interval [CI] 1.2–7.2); knowledge of the policy recommendations (OR 1.36, 95% CI 1.01–1.83); mentioning names of colleagues as the basis of the opinion (OR 3.6, 95% CI 0.91–14.2, $p = .0684$, marginally significant); and department opinion index (OR 2.32, 95% CI 1.26–4.16) (Table 2). This odds ratio means, for example, that it was 2.9 times (OR 2.9) more likely that a physician was favorable to instead of opposed or uncertain when the physician was currently involved with mammography as when he or she was not. Favorable opinions were negatively associated with the number of years in which the physician had been involved with mammography (OR 0.90, 95% CI 0.83–0.98). None of the other variables was significant. If the knowledge index was replaced by knowledge of the individual policy recommendations, none was significant. Also, we tested for an interaction between current involvement and years of involvement but found none.

In a similar analysis of opinions on screening women aged 40–49 years, age (OR 1.79, 95% CI 1.20–2.68) and perceived risk of false-positive mammograms (OR 0.54,

Table 3. Regression Analysis of the Log of the Number of Mammograms Examined by Each Physician, $n = 196$

Variable	Parameter estimate	t
Intercept	2.515	1.427
Age (in 10 years)	−0.376	−1.849
Sex (male = 0, female = 1)	0.757	2.134
Number of publications (co-)authored	−0.126	−1.278
Number of years mammography involvement	0.327	9.199
Weekly working hours	0.017	1.019
Knowledge of policy recommendations (0–3)	0.590	4.297
Perceived risk of overlooking cancer (often = 1, seldom = 3)	−0.287	−0.885
Radiologists may be criticized (agree = 1, disagree = 5)	−0.043	−0.258
Status attached to mammography (no = 0, yes = 1)	−0.605	−1.272
Own opinion on screening (negative = 1, favorable = 3)	0.227	1.076
Department opinion index (0–2, negative = 0, favorable = 2)	0.298	0.948
County opinion index (0–2, negative = 0, favorable = 2)	−1.129	−1.823

F Value 15.3 ($p = 0.0001$), adjusted R-square 47.2%.

Table 4. Number of Institutions in Norway with and without Mammographic Equipment and Number of Women Examined by Type of Institution in 1991

	Hospitals		Examinations		
Institution	With	Without	Screen	Clinical	Total
University hospital	5	1	0	14,591	14,591
Central hospital	10	4	300	7,994	8,294
Local hospital	6	41	1,055	2,946	4,001
Private clinic	16	1	46,605	21,871	68,476
Total	37	47	47,960	47,402	95,362

95% CI 0.30–1.00, $p = .05$) were significant predictors (not shown in the tables). The physicians who perceived the risk as low tended to have more favorable opinions.

Physicians' Use of Mammography

The majority of the radiologists ($n = 137$) did not examine any mammograms in 1991. Among those who did ($n = 59$), the number of examinations (screening and clinical) varied from 3 to 7,000 (mean = 795, median = 450) in full-time positions and from 1 to 3,250 in part-time positions (mean = 583, median = 150). In total, the participants reported 52,828 examinations or 55% of the total number for 1991 (see the later section on utilization rates). Variations in the number of examinations (full-time and part-time) were analyzed through linear regression (Table 3). Since the distribution of the numbers was skewed, we used the logarithm of the number (zero examinations was set to 1 since the logarithm of zero is undefined). A high number of examinations was associated with female physicians ($p = .034$), with a high number of years of involvement ($p = .0001$), and with knowledge of the policy recommendations ($p = .0001$). It was not associated with one's own opinions on screening or the opinion indexes.

Mammography Utilization

In 1991 mammography was offered in 21 public hospitals and 16 private clinics (Table 4). In total, 95,362 examinations were performed (140 per 1,000 women), the majority of them (72%) in private clinics. The utilization rate varied from 0 to 257 across the counties (the capital city of Oslo and the surrounding county of Akershus were analyzed as one county). In regression analyses (not shown in the tables) high rates were positively associated with a high density (number of clinics per 100,000 women aged 40–69 years) of public mammographic centers, and even more with a high density of private centers. They were also associated with high purchasing power and with densely populated counties when one of these variables was introduced at a time. When both were introduced, neither was statistically significant.

DISCUSSION

Methods

This study confirms that physicians' preferences influence the use of mammography in Norway, but certain limitations of the study should be noted when interpreting the results. It is uncertain to what extent responses to the questionnaire fully reflect physicians' attitudes and opinions. It is conceivable that physicians answer strategically when the issues are controversial (e.g., breast cancer screening) or sensitive (e.g., working hours, physicians' influence on health policy, etc.). Also, it is possible that the respondents are biased towards opinions favorable to mammography, since it is clear from personal knowledge of Norwegian radiologists that physicians involved with mammography are overrepresented among the respondents. However, there was no bias in the selection of physicians from departments with a mammographic unit, and there was no bias in the selection by age or sex.

The mammography centers reported the number of breasts examined. In the postal survey we did not specify the unit of examination although, because of the reimbursement system, the breast is the common unit in Norway. The discrepancy between the total number of examinations reported by the mammographic centers and by the participants indicates that some radiologists reported the number of *women* instead of *breasts* examined. In the regression analysis, the logarithmic transformation of the dependent variable will reduce the effect of this error.

The relatively high response rate is a strength of the study. The registry of the Norwegian Medical Association is supposedly complete because the association certifies medical specialists on behalf of the Ministry of Health.

Physician Characteristics

As expected, female physicians more often examined mammograms than did their male colleagues. However, their opinions on screening were about the same, but conflicting effect by physician gender is not unique (6;10;28;39).

It is not surprising that physicians with current mammographic involvement are more likely to have favorable opinions. What is cause and what is effect is less clear. Physicians with more lengthy involvements tended to be more skeptical, which may be due to frustration from work experience (31). A considerable proportion of mammograms are clinical examinations requested because of symptoms or signs. Radiologists may experience the difficulty of interpreting mammograms and may doubt the benefit of mammography as a screening procedure (19), although they are still involved with clinical mammography.

Where Do Radiologists Get Their Information?

The index of knowledge of the policy recommendations was associated with opinions on screening, but when the index was replaced by knowledge of the individual (and conflicting) policy recommendations, none was significant. One interpretation of this finding is that physicians with positive opinions acquire knowledge of the policy statements, but the statements do not influence opinions.

Information from other radiologists does seem to influence opinions. Judged by the opinion indexes, this was the case with respect to peers in the same department but not those elsewhere in the same county (Table 2). Most of the 23 who mentioned radiologists as a basis for their own opinions named a few respected Norwegian colleagues rather than close peers or foreign "gurus." This underlines the importance of opinion leaders ("clinical leadership" [12]), which has been found in other studies (7;8;13).

Most physicians in favor of mammographic screening indicated reduced mortality (an epidemiological issue) as the most important argument, but few radiologists mentioned epidemiological publications as the basis of their opinion. In conclusion, the basis of opinions remains somewhat unclear, but it is conceivable that imperfect information (30) underlies the diffusion and use of mammography.

Physician Income

In the private clinics, radiologists who own the clinics (reimbursed per examination) and employees (paid per examination by the owners) have a financial incentive to increase the number of patients screened. Mammography represents a major potential for attracting customers in a health care system where public hospitals tend to have queuing and do not need to recruit patients. Since the radiologists may influence utilization by acquiring necessary equipment and by providing mammographic examinations, the adoption of mammography in private clinics (during the period 1989–1993 the number of private mammographic units in Norway increased from 12 to 17), and the high utilization rates in counties with private clinics are clear indications that physicians are influenced by motives related to income.

Status and Attitude Towards Risk

Whereas some studies have shown that attitude towards risk can influence physicians' behavior (20;26), our study lends only limited support to this theory. Two points are worth noting, however. First, the assessment of attitude to risk was not ideal. The use of hypothetical gambles is preferable (5), but this method is inappropriate in a postal survey. Second, malpractice lawsuits are uncommon in Norway, and radiologists have never been sued for overlooking cancer by mammography.

Our study clearly indicates that physicians do not perceive mammography as a status-generating procedure, but we could not detect any association between perceived status and opinions or behavior.

General Discussion

An intriguing question is why mammography has been adopted in so few public hospitals in Norway. Mammographic units were in use in 23 hospitals in 1989, in 21 in 1991 (two centers were closed due to their obsolete equipment), and again in 23 in 1993. In 1991 there were 58 CT scanners and 6 MRI units in operation. Since then, 12 more CT scanners and 5 MRI units have been installed. Mammographic units have lower costs and more well-established effectiveness (27;36;38) than CT-scanners or MRI-units (4;9). Public policies cannot be the explanation for the different diffusion rates. The Ministry of Health recommended against further diffusion of MRI but has not published any mammographic policies. Rather than these explanations, the findings of the study suggest that the slow diffusion of mammography in public hospitals is attributable to a lack of interest among the radiologists. Few radiologists would choose mammography if a hospital could expand its capital equipment budget. Indeed, if radiologists were keen on getting mammography units in public hospitals, politicians and health care managers could hardly resist them, in alliance with women's groups, in a fight for adoption of mammography in a "war" against breast cancer.

The reason that so few radiologists prefer to use mammography may be its low status, although perceived status was not significant in the regression analyses. Lack of intellectual satisfaction may be another explanation. Interpreting mammograms can be monotonous and difficult, with a considerable risk of misdiagnosis. Computed tomography and MRI, on the contrary, are high status-high tech and represent variation in organ examination and differential diagnostics.

The reluctance of the participants to adopt mammography and the low utilization rates are not unique to Norway. In the United States, primary care physicians have been slow to refer their patients to mammography, although this is widely recommended by various professional bodies (6;10;15;18). The U.S. guidelines recommend annual mammography for women 50 years and over but little more than 50% of the population meet this target (10;41). Low rates are reported from Denmark (29) and Australia (1) as well.

The findings of the study are compatible with the hypothesis that physicians' preferences influence the use of technologies. Income objectives and, to some extent, risk preferences appear to affect the use of mammography in Norway, but we did not detect any effect of status perceptions. Many radiologists see themselves as the key decision makers in adopting mammography. This self-image seems justified as the slow diffusion of mammography in public hospitals is compatible with the explicit priorities of the radiologists.

CONCLUSIONS

To the extent that the findings of this study may be generalized, three lessons can be learned. First, policy recommendations appear to have limited influence on physicians' opinions on a technology. If health authorities wish to influence physician opinions, they could probably do so just as well, and perhaps better, through influential physicians with preferred opinions as through policy documents.

Second, favorable opinions on a technology do not guarantee its widespread adoption and use. Although most radiologists are favorably inclined to mammographic screening in women aged 50-69, relatively few would reflect this in their priority setting.

Third, financial incentives appear to favor the diffusion of a technology for which physicians have favorable opinions.

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APPENDIX I

The registration form for general practitioners in Northern Norway 1982 (papers I-III)

PASIENTREGISTRERING EVALUERING AV FASTLØNNSORDNING I NORD-NORGE.

Dato .... (registreres fra kl. 0800 til neste morgen kl. 0800) Kodenummer .... Utekontor: ☐ *ja* ☐ *nei*

	Pasientkarakteristikk				Pasientkontakt					Henvisning						Laboratorieprosedyrer							Tid pr. konsult.				Kommentar
																							Antall minutter				
Nr.	Fødselsår	Mann	Kvinne		Kontorkonsult. første	Kontorkonsult. senere	Kontorkonsult. vakt	Hjembesøk ikke vakt	Hjembesøk under vakt	Sykehuspoliklinikk	Priv.prakt.spes.	Røntgenundersøkelse	Fysioterapi	Innleggelse ø.hj.	Innleggelse vanl.	Hgb.	SR	Urinmikroskopi		Prøvetaking/sending		Sykmelding	1-9	10-14	15-19	20—	
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Telefonkonsultasjoner (summarisk):

FORTSETTELSE fra forrige side (når mer enn 20 kontakter i løpet av døgnet).

Nr.	Pasientkarakteristikk				Pasientkontakt					Henvisning						Laboratorieprosedyrer						Tid pr. konsult. Antall minutter				Kommentar
	Fødselsår	Mann	Kvinne		Kontorkonsult. første	Kontorkonsult. senere	Kontorkonsult. vakt	Hjembesøk ikke vakt	Hjembesøk under vakt	Sykehuspoliklinikk	Priv.prakt.spes.	Røntgenundersøkelse	Fysioterapi	Innleggelse ø.hj.	Innleggelse vanl.	Hgb.	SR	Urinmikroskopi		Prøvetaking/sending	Sykmelding		1-9	10-14	15-19	20 —
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Aas & Søns Boktrykkeri A/S, Harstad

Telefonkonsultasjoner (summarisk):

APPENDIX II

The mammography questionnaire (paper V)

RADIOLOGER OG MAMMOGRAFI I NORGE

KONFIDENSIELT

Sett kryss for JA i ruten ved siden av hvis du samtykker i å være med. Dersom du ikke ønsker å delta, sett kryss for NEI og returner skjemaet i vedlagte frankerte svarkonvolutt, så blir du ikke purret på.

☐ JA
til å delta i undersøkelsen
☐ NEI

1. PERSON-INFORMASJON

Alder .... år

Kjønn ☐ kvinne ☐ mann

Hvilket år ble du spesialist i radiologi? .... år

Hva er dine arbeidsområder innen radiologien: (kryss av på ett eller flere alternativer)
- ☐ generell radiologi
- ☐ CT
- ☐ MR
- ☐ Ultralyd
- ☐ Mammografi
- ☐ annet (spesifiser) ....

Hvis du har publisert vitenskapelige artikler, hvor mange artikler er du (med)forfatter på? ....

2. ARBEIDSFORHOLD

Stillingstype: ....

Hvor mange timer arbeider du i gjennomsn. pr uke ved avdelingen? Antall timer: ....

Er arbeidsbelastningen ved din avdeling så stor at avdelingen bør ha flere legestillinger? ☐ Ja ☐ Nei

Hvis ja, hvor mange nye stillinger? Antall: ....

3. UTDANNING OG ERFARING MED MAMMOGRAFI

Har du arbeidet med mammografi nå eller tidligere? ☐ Ja ☐ Nei

Hvis nei, kan du gå til punkt 4

Hvis ja, hvor mange år har du arbeidet med mammografi? Antall år: ....

Hvilke(n) type(r) mammografi arbeider du med?
- ☐ Screeningmammografi
- ☐ Klinisk mammografi

Utfører du?
- ☐ Ultralyd av mamma
- ☐ Merking for biopsi-taking
- ☐ Cytologi

Omtrent hvor mange mammografiundersøkelser tolket du i 1991 i **hovedstilling**? ....

Omtrent hvor mange mammografiundersøkelser tolket du i 1991 i **bistilling**? ....

Har du kurs i mammografi? ☐ Ja ☐ Nei

Hvis ja, omtrent hvor mange dager i alt? ....

4. NOU 1987:7 - MAMMOSCREENING I NORGE

Kjenner du hovedinnholdet i NOU 1987:7 utover konklusjonen gjengitt i orienteringsbrevet? ☐ Ja ☐ Nei

Bedømmer du utredningens anbefaling som rimelig? ☐ Ja ☐ Nei ☐ Vet for lite om utredningen

Kjenner du hovedinnholdet i 1990-oppdateringen av NOU 1987:7 utover det som er gjengitt i orienteringsbrevet? ☐ Ja ☐ Nei

5. KONSENSUSKONFERANSEN 1989

Kjenner du hovedinnholdet i uttalelsen fra konsensuskonferansen om mammografi (Soria Moria april 1989) utover konklusjonen gjengitt i orienteringsbrevet? ☐ Ja ☐ Nei

Var konsensuspanelet etter din mening rimelig sammensatt? ☐ Ja ☐ Nei ☐ Vet for lite om konferansen

Bedømmer du konsensuspanelets anbefaling som rimelig? ☐ Ja ☐ Nei ☐ Vet for lite om konferansen

Tror du at anbefalingen om å ikke innføre screening-mammografi har hatt betydning for utviklingen i Norge?
- ☐ Stor betydning
- ☐ Noe betydning
- ☐ Liten betydning
- ☐ Ingen betydning

6. BØR MAMMOGRAFI-SCREENING GJENNOMFØRES I NORGE?

Etter en samlet vurdering - mener du at alle norske kvinner **over 50** år bør få tilbud om mammografi-screening? ☐ Ja ☐ Nei ☐ Usikker

Hvis ja, hva er grunnen: Sett 1 for viktigste grunn, 2 for nest viktigste, osv.
- ☐ Screening reduserer dødeligheten av ca. mammmae
- ☐ Screening bedrer mulighetene for brystbevarende kirurgi
- ☐ Screening reduserer unødig frykt for brystkreft
- ☐ Andre grunner

Hvis nei, hva er grunnen: Sett 1 for viktigste grunn, 2 for nest viktigste, osv.
- ☐ Effekten på overlevelse er ikke godt nok dokumentert
- ☐ Kostnadene er for høye
- ☐ Vi mangler røntgenleger
- ☐ Strålebelastningen kan innebære en helserisiko
- ☐ Metoden innebærer for stor belastning for kvinnene ved falsk positivt mammogram
- ☐ Andre grunner

Fortsettes neste side

Mener du at alle norske kvinner i alderen **40-49 år** bør få tilbud om mammografi-screening?

- ☐ Ja
- ☐ Nei
- ☐ Usikker

Dersom du legger vekt på vitenskapelig dokumentasjon i dine svar, hvilke(n) undersøkelse(r) legger du mest vekt på?

....
....
....

Dersom du legger vekt på andre radiologers vurdering i dine svar, hvilke radiologer er dette?

....
....
....

7. KLINISK MAMMOGRAFI

Hvilke typer sykehus bør tilby klinisk mammografi?
(Kryss av for ett eller flere alternativ)

- ☐ Regionsykehus
- ☐ Sentralsykehus
- ☐ Store lokalsykehus (over 100 senger)
- ☐ Alle sykehus som driver med mamma-kirurgi

8. FAGLIG VURDERING AV MAMMOGRAFI-TEKNIKKEN

I denne delen er vi intessert i å få dine synspunkter på ulike sider ved mammografi. Angi ved avkryssing hvordan du stiller deg til en del utsagn om mammografi:

Benigne forandringer kan tolkes som maligne (falsk positive)

- ☐ Skjer ofte
- ☐ Skjer av og til
- ☐ Skjer sjelden

Maligne tumores kan oversees (falsk negative)

- ☐ Skjer ofte
- ☐ Skjer av og til
- ☐ Skjer sjelden

Radiologer kan lett bli utsatt for kritikk når cancer har blitt oversett ved mammografi

- ☐ Helt enig
- ☐ Litt enig
- ☐ Nøytral
- ☐ Litt uenig
- ☐ Helt uenig

Hvordan vurderer du vanskelighets-graden ved tolking av mammo-grammer?

- ☐ Svært vanskelig
- ☐ Vanskelig
- ☐ Ganske vanskelig
- ☐ Ganske lett
- ☐ Svært lett

Tror du mammografi oppfattes som en prestisjetung prosedyre blant norske radiologer?

- ☐ Ja
- ☐ Nei
- ☐ Usikker

9. PRIORITERING

Ressursknapphet er et økende problem i norske sykehus. Hvis **din avdeling** likevel ble tilført ekstra ressurser for å ta opp en ny undersøkelsesmetode, hvilken ville du foreslå:

....

Hvis **et sentralsykehus** skulle prioritere forbedring av sitt diagnostikk-tilbud, hvordan ville du prioritere på medisinsk faglig grunnlag?
(kryss av for ett alternativ)

- ☐ MR
- ☐ Intervensjonsradiologi
- ☐ Doppler
- ☐ Utskifting av 10 år gammel CT
- ☐ Mammografi

10 HVEM HAR INNFLYTELSE

Hvilke grupper tror du har størst innflytelse på innføring av mammografi ved det enkelte sykehus i Norge?
(Sett 1 i den gruppe som har størst innflytelse, 2 ved den gruppe som har nest størst innflytelse, osv.)

- Radiologene ved sykehuset ☐
- Kirurgene ved sykehuset ☐
- Fylkespolitikerne ☐
- Sentrale helsemyndigheter ☐
- Kvinnegrupper/ kvinneforeninger ☐

11. ANDRE KOMMENTARER

Hvis du har kommentarer til dette spørreskjemaet eller mammografi, kan du skrive dem her:

....
....
....
....
....
....
....
....
....

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TAKK FOR HJELPEN !

LUNDBLAD GRAFISK A/S, TROMSØ - TLF 083-86775 - ONR 4497 B

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De som er merket med * har vi dessverre ikke flere eksemplar av.