Examining utilization of specialized outpatient care in Norway

An analysis of the factors explaining total consumption, public provision, private provision and the possibility for substitution in a public-private mix provision of specialized outpatient care

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Abstract

BACKGROUND: There is a scarcity of international and Norwegian studies investigating the relationships inherent in a public-private provision of specialist outpatient care. Information on these relationships is needed in order to better organize the provision of care at the specialist level.

OBJECTIVE: To investigate factors that explain total consumption, public provision, private provision and the possibility for substitution in a public-private mix provision of specialist outpatient care.

METHOD: A Weighted Least Squares regression method that incorporates a "fixed effects" model for all health enterprises has been used to run the analyses. A comprehensive cross sectional dataset covering observations on health status, socio-economic status and supply side factors has been used as a proxy for establishing the need for specialist care. The dataset contains observations from all the 430 municipalities disaggregated into municipal, gender and age-group units.

RESULTS: The number of general practitioners has an insignificant effect on the utilization of specialist outpatient care. Personal income is important in explaining the use of private specialists but not the use of public specialists. Travel-time has a negative effect on the general use of specialist care. The share of the population represented by the elderly above 80 years has an insignificant effect on the utilization of both public and specialist care. Immigrants from countries outside Western Europe have a strong negative effect on the use of specialist outpatient care.

The potential for substitution exists between public and private specialists in the treatment of a broad amount of need-groups represented by different variables. However, the substitution effect is very weak as evidenced by the extremely low estimate values ranging from 0.000 to 0.032.

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Abbreviations and acronyms

PPP	Purchasing Power parity score
RHA	Regional Health Authorities
RHE	Regional Health Enterprises
NIS	National Insurance Scheme
ABF/ISF	Activity Based Financing *(Innsatsstyrt finansiering)*
GPs	General Practitioners
OECD	Organization for Economic Cooperation and Development
SSB	The Central Bureau of Statistics *(Statistik Sentralbyrå)*
SPSS	Statistical Package for Social Sciences
St. Meld	Norway's Parliamentary Report or Commission
DRG	Diagnosis Related Groups
OLS	Ordinary Least Squares
WLS	Weighted Least Squares
HELFO	Norwegian Health Economics Administration
NAV	Norwegian Labour and Welfare Service
VIF	Variance Inflation Factor

1 Introduction

The main aim of this analysis is to clarify what factors influence the demand for outpatient specialist health services. Additionally, the analysis seeks to explain the variation in the use[1] of outpatient specialist health services between public and private providers by testing whether there is any substitution between them. This will be done by disaggregating the provision of health services to the municipal level based on patients' residence, age and gender, and then statistically testing different explanations for any observed variation in utilization of specialist health services. This will enhance the existing knowledge and body of research on public – private relationships and consequently fill an existing gap on these relationships at the specialist level.

Previous studies on specialist services have found demographic and socioeconomic effects in the use of specialist services (Nerland and Hagen 2008; NOU 2008; Hagen 2009). Other studies have tested whether there is substitution between primary care and specialist care. For instance, Tjerbo (2009) finds no effect of General Practitioners capacity on the usage of specialist care; however he finds some effect of competition between GPs on the utilization of specialist ambulatory care. Hagen (2009) finds a very limited form of substitution between municipal health services and somatic specialist services. The substitution primarily concerns the elderly admitted to acute wards and those who have long-bed-days. However, these studies on usage, access or demand of specialist care have not disaggregated their analyses between private or public provision (Iversen and kopperud 2002; Iversen and Kopperud 2002; Iversen and Kopperud 2005; Midttun 2006; NOU 2008; Hagen 2009; Lafkiri 2009; Tjerbo 2010).

Some studies have analyzed the demand for and consumption of either public or private health care services e.g. (Iversen and kopperud 2002; Iversen and Kopperud 2002; Iversen and Kopperud 2005; Midttun 2006; NOU 2008; Hagen 2009; Lafkiri 2009; Tjerbo 2010). Others have investigated the relationship between primary and specialist provision of care (Nerland and Hagen 2008; NOU 2008; Hagen 2009). Midttun and Hagen (2006) have looked at political leanings and how they inform investment in either public or private specialists. However, there seems to be no studies done that either explicitly test the relationships inherent in a public-private provision of specialist services, or make use of a comprehensive

[1] In this thesis the term 'use' of specialist care will be used interchangeably with the terms 'usage' and 'consumption'.

data set to test the relationships. This might imply that assumptions are made that relationships detected at the primary care level - also apply to specialist health care services. Empirical evidence is therefore lacking on relationships between public and private provision of specialist care. Additionally, the provision of specialist health services in Norway is organized in such a way that it could be said to encompass three tiers; Publicly provided specialist services, private specialists and a third segment made up of private specialists that have operating agreements with Regional Health Enterprises. It is therefore interesting to find out what effect each of the tiers has on the consumption of specialist health care services i.e. to find out who uses which services? What factors can explain the choice of service provider? (Geography, age, education, income, preference, waiting times, monetary costs etc.). Is there substitution between private and public provision of specialist care? If not, is the relationship complementary? Or are there other explanations?

The Norwegian health care system is built on the principle of equality of access. All the inhabitants have the same right and opportunity to access health care services regardless of their social status, economic status or geographic location. Consequently this means that the demand for healthcare is driven by need. However, need is unobservable and therefore cannot be measured directly. Conversely, we can observe the utilization of health care services and use that as a proxy for expressing need. Still, utilization may not give the correct picture of need because of the effect of other factors such as socio-economic status, health status, demographic characteristics and the accessibility constraints of health care services. The demand model used in this thesis will approximate need while controlling for factors affecting access and utilization. In this way, we will be able to determine factors affecting the use of specialist health care services and explain the variation between public and private provision of specialist health care services.

Outpatient specialist consultations have been increasing every year while admissions and the length of hospital-stay have been decreasing. For instance, 2009 recorded an increase in outpatient consultations at public hospitals of about 25 000. In the same period, private specialists recorded an increase in outpatient consultations of 30 per cent (SSB 2010). This makes it interesting to investigate factors that explain the trend of increasing consumption and the variation between private and public specialists. We have therefore fashioned four dependent variables that can best explain the trends. The first variable will investigate total consumption of specialist outpatient care. The second and third variables will disaggregate total consumption into public and private segments. The last dependent variable will investigate whether there is a possibility for substitution between public and private specialist outpatient provision.

The data used for the analysis is cross-sectional and covers a period of two years (2006 and 2007). The data contains a comprehensive set of observations on different socio-economic, health status and demographic characteristics aggregated at the municipal level. Every piece of observation contains an aggregate unit that covers observations from each municipality based on gender and different age groupings. In this way, we will be able to collate and identify all factors that may explain the use of specialist outpatient services in Norway.

1.1 Thesis' structure

Section 1 has introduced the thesis. Section 2 discusses the institutional set up of the health care system in Norway. Section 3 covers the theoretical framework. Section 4 outlines the study method, data chosen for carrying out the analysis, the analytical tool and the empirical model. Section 5 presents the analysis while section 6 provides a discussion of the results. Section 7 concludes the thesis.

2 Institutional framework

2.1 Goals and mandate of the Norwegian health system

The Norwegian health care system's principles of solidarity, equality and justice are in line with the core values of health care provision as identified by the World Health Organization (WHO 2000; Johnsen 2006). These goals include achieving better health in terms of improved health outcomes and distributing good health status amongst the population. Additionally, the health care system aims to achieve fairness and equity in the access of health care services and in the sharing of risk. Another goal is to ensure that the system is responsive to the expectations of the society in terms of respecting people's dignity, autonomy and confidentiality of information(St.meld. 2002; Johnsen 2006).

2.2 Organizational structure

When compared to the centralized British NHS model, Scandinavian countries are characterized as having a decentralized model where local and county governments have an important role in the allocation of resources raised through taxes (Rice and Smith 2002). Decentralization is seen as a way of lessening bureaucracy, enhancing patient information access and improving the management of health care services. However, the Norwegian health care system has undergone changes from a decentralized to a semi-centralized NHS model following the Hospital Reform of 2002 (Hagen and Kaarbøe 2006). As a result of the reform, regional health authorities were given responsibility over specialized care while the responsibility for primary care was transferred to the municipalities.

The health care system in Norway is therefore organized under three levels; the national level, regional level and the local level. At the regional level four regional health authorities are responsible over the provision of specialist health care services. The local level is represented by 430 municipalities which in turn have the responsibility over both curative and preventative primary health care and nursing care (Johnsen 2006).

2.2.1 The national level

The Ministry of Health and Care services has the overall responsibility at the national level. The ministry outlines the national policy and prepares proposals for legislation, monitors their implementation and assists the government in making decisions. Furthermore, the ministry has the overall responsibility for public health, mental, dental, rehabilitative care, emergency planning, pharmaceuticals, coordination, food safety, nutrition, molecular biology and biotechnology services.

The ministry has the overall administrative responsibility over its subordinate agencies such as; the Directorate for Health and Social Affairs, the Institute for Public Health, the Board of Health, the Medicines Agency, the Patient Register, the Radiation Protection Agency and the Biotechnology Advisory Board. The ministry also has direct and indirect involvement in other ministries and agencies indirectly touching on health care services and personnel (Johnsen 2006). In addition to having the overall responsibility over policy formulation and all health care service provision, the state is also responsible for financing and/or subsidizing of the education and training of health care personnel (ibid).

2.2.2 The regional level

According to the Joint Committee Report (2004, sections 6.4 and 7.1), "the organization of the regional health authorities and the health enterprises is unique to Norway". This is because the regions principally perform dual roles concurrently i.e. the authority role and the enterprise role. On one hand the regions play a "care/sørge for" role in providing needed specialized care to the population in their regions, while on the other hand they act as suppliers and producers of specialized care since the regions themselves own the health enterprises (ibid).

The Principal health policy objectives and frameworks which form the basis for managing the Regional Health Enterprises are decided at the national level by the government. The general manager and the executive board of each RHE are responsible for the day-to-day running of their enterprise. The Norwegian Act relating to the Specialist Health Services of 1999 stipulates the organization and provision of specialist health care services (SSB 2010). The state owns the Regional Health Enterprises (RHEs) which are in turn responsible for provision of specialist health service at the regional level. Services provided by the RHEs include; patient treatment, training of health personnel, research and training of patients and their relatives. The services are provided and organized under hospitals, mental health care institutions, multidisciplinary specialist substance abuse treatment centres, the ambulance service, emergency services, and hospital pharmacies and laboratories. The RHEs are therefore responsible in ensuring that health policy objectives, resolutions, plans and laws relating to health policy, research and education specified at the national level are fulfilled within their geographic area of responsibility (SSB 2010). Additionally, they are also responsible over specialist health services provided by for – profit and non – profit private institutions in accordance with regulations set out by the state (ibid).

After the state took over the ownership and responsibility for the provision of specialist health services under the Hospital Reform of 2002, service provision was organized under five regional health enterprises. This changed on 1st June 2007 when the Eastern Norway Regional Health Authority and Southern Norway Regional Health Authority were merged into one regional health enterprise; South-Eastern Norway Regional Health Authority. The four regional health authorities responsible for providing specialized care as of 01.01.2010 are; the Northern Norway Regional Health Authority (Helse-Nord) which has responsibility over 465 621 inhabitants, a bed capacity of 4.4 beds per 1000 inhabitants and covers Nordland, Troms and Finnmark areas. The Central Norway Health Authority (Helse-Midt) is responsible for 673 364 inhabitants, has a bed capacity of 3.9 beds per 1000 inhabitants and covers the following areas; Møre OG Romsdal, Sør-Trøndelag and Nord-Trøndelag. The Western Norway Regional Health Authority (Helse-Vest) is responsible for 1 012 202 inhabitants, a bed capacity of 3.9 beds per 1000 inhabitants and covers Rogaland, Hordaland and Sogn OG Fjordane. The South-East Norway Regional Health Authority (Helse-Sør-Øst) has responsibility over 2 707 012 inhabitants, a bed capacity of 3.7 beds per 1000 inhabitants and covers Østfold, Akershus, Oslo, Hedmark, Oppland, Buskerud, Vestfold, Telemark, Aust-Agder and Vest-Agder (SSB 2010).

Within each regional health enterprise, hospitals and institutions were divided into a number of health enterprises. Several regional health enterprises have subsequently modified their internal organization while some have been closed down and new ones established (Johnsen 2006; SSB 2010).

2.2.3 The municipal level

There are 430 municipalities of varying population and geographical sizes in Norway responsible for the provision of primary health care and social services. The Municipalities' Health Care Act defines the roles and responsibilities of the municipalities vis-à-vis provision of primary care and patients' rights. For instance, all citizens have a right to access health services in their community. Municipalities are therefore responsible for the provision of services such as; Promotion of health activities and prevention of illness and injuries, including organization and running school health services, health centres, child health care provided by health visitors, midwives and physicians. Municipal health centres have a responsibility to offer pregnancy check-ups and provide vaccinations according to the recommended immunization programs. Additionally, the municipalities should provide general medical treatment (including emergency services), physiotherapy and nursing (including health visitors and midwives) (Johnsen 2006; SSB 2010).

Unlike the RHEs, municipalities have a greater degree of autonomy in their provision of health care services. The main aim of primary health care provision by each municipality is to improve the general health of the population, treat diseases and deal with health problems that do not require hospitalization. Each municipality is therefore free to choose how best to serve its inhabitants in achieving the goals of primary care provision. Most of municipal spending on health care is geared towards somatic, nursing and mental health care interventions (ibid). Most of the health care providers at the municipal level are publicly owned which means that most of the personnel are salaried employees. However, GPs are in practice self - employed even though they are financed by the municipalities, the National Insurance Scheme (NIS) and out – of – pocket user fees paid by the patients (Johnsen 2006).

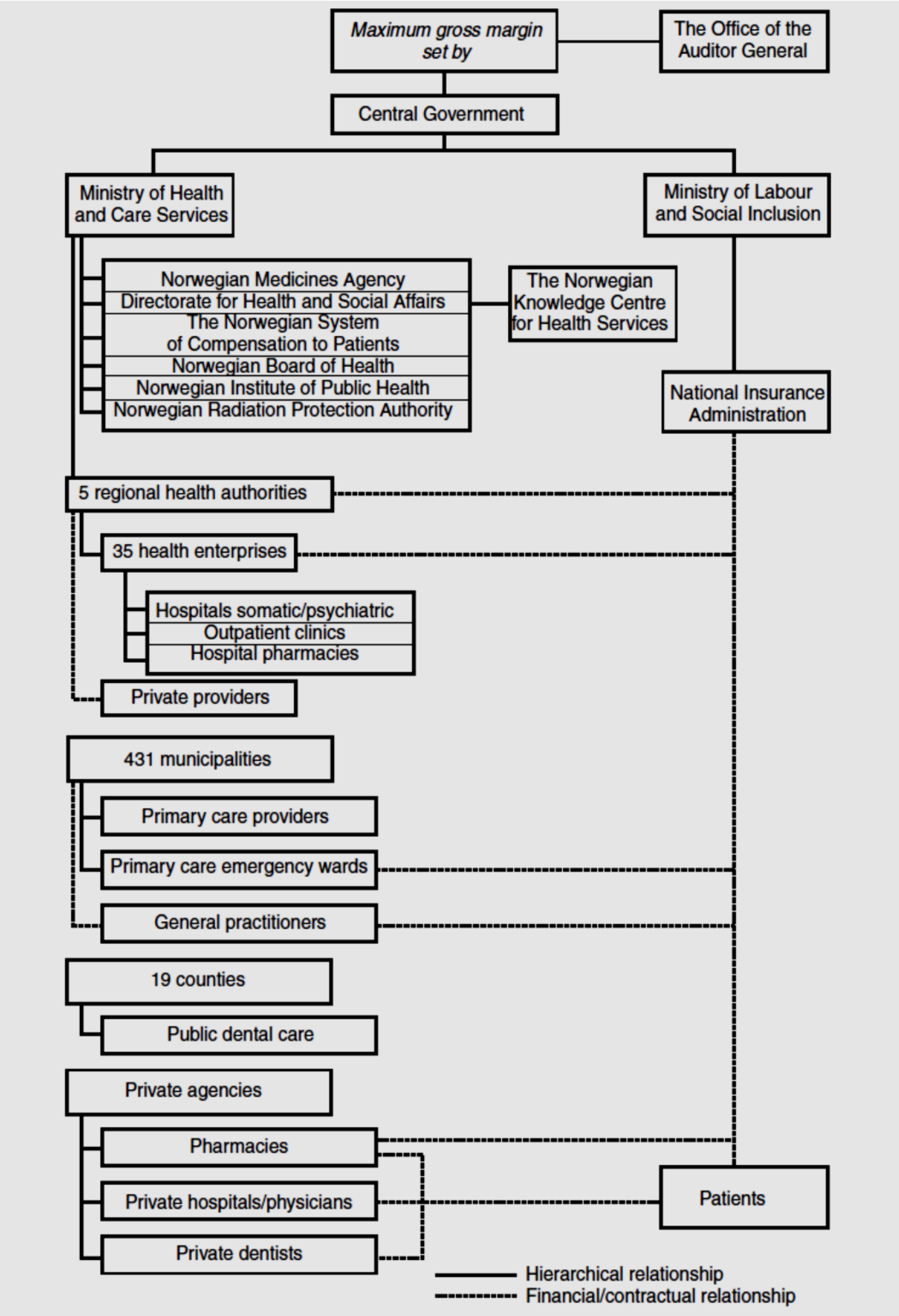


Figure 1: An overview of the Norwegian health system (Johnsen 2006; 2).

2.3 Public - private provision

As part of their provider responsibility, RHEs can enter into long-term, binding framework agreements with private health enterprises and/or non-profit organizations in the operation of private hospitals, institutions and private specialists (Johnsen 2006; RHF 2006; SSB 2010). Each RHE can either produce health services internally, or buy them from other regions (or from abroad) or private specialists and institutions. The Patients' Rights Act stipulates that patients are entitled to choose which hospital they will be treated at. However, this is not always the case since the relationship with private hospitals, non-profit institutions and specialists is regulated by operating and sales contracts. These operating agreements and contracts are organized in such a way that all health services provided can be regarded as forming part of the region's regular health care. This means that statistics on activities and details on personnel, capacity and activity from private and non-profit institutions are collected and published the same way as state hospitals and institutions (SSB 2010).

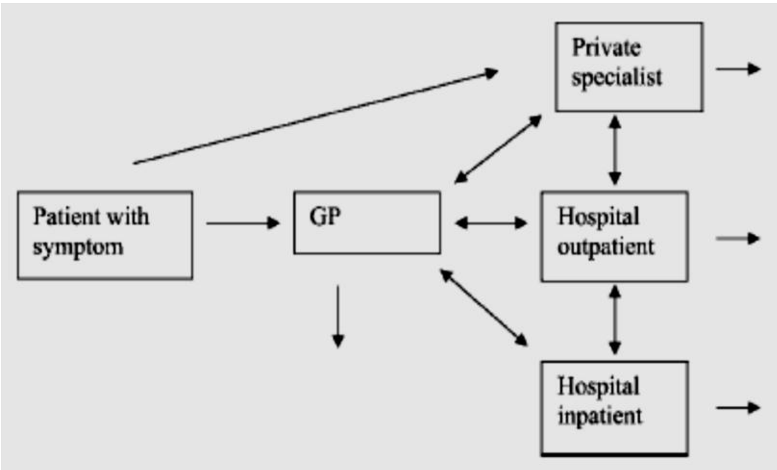


Figure 2: Patient pathways into and out of the specialist health care services (Iversen and kopperud 2002).

2.4 Financing of the health system

The Norwegian health care system is primarily funded through state taxes. Municipalities are also allowed to levy taxes proportional to the income of their inhabitants. Regional health authorities are funded by the state through transfers in the form of block grants, earmarked grants and Activity - Based Funding (ABF) based on the DRG system and other fee – for – service arrangements. In addition to levying local taxes, municipalities' health care financing is also supplemented by state grants, earmarked grants and user fee charges. User charges are normally set by the state and subsidized by the Norwegian Health Economics Administratioin (HELFO) which is a sub-ordinate organization under the Directorate of Health (Johnsen 2006; NOU 2008). HELFO also has the mandate of administering individual reimbursements to patients, reimbursements to different health care providers and overall responsibility over the regular GP scheme (Johnsen 2006).

Regional Health Authorities have an internal financing system that mirrors the state's own transfers to RHAs. This means that the different health enterprises in each RHA receive funding that contains the following elements; an activity-based financing element, an in-patient and out-patients payment scheme element, needs-equalization grants, other earmarked grants and an out of pocket user fee element. The needs-equalization grants are given in the form of block grants calculated according to diverse socio-demographic characteristics such as the age composition of inhabitants in each RHEs catchment area. Still, the needs-equalization grant is not contingent on the health services produced. The user fee element is paid by the patient directly but only covers 2% of the total cost of treatment. Additionally, there are no out of pocket payments for inpatient specialist health care services (helsedirektoratet 2007).

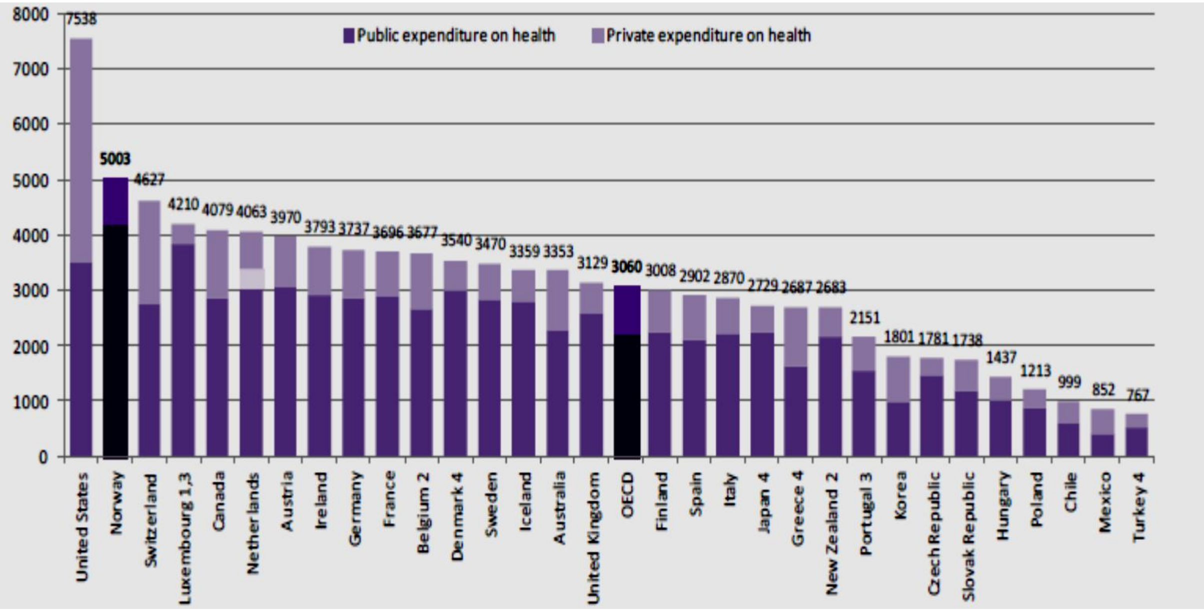
The funding of outpatient health services provision such as clinics, laboratories and radiology services is done through an ABF element. Payment of the ABF element is based on a tariff reimbursement system that is administered by the Norwegian Labour and Welfare Organisation (ibid).

The NIS manages the social insurance system which provides financial security in case of disability and sickness. However, contrary to the practice in other European countries, the NIS does not have a specifically defined "coverage package" for the health care system (Johnsen 2006; xiv).

According to Johnsen (2006), the growth of Norway's health expenditure is similar to that taking place in other developed western countries. This trend is explained by the increasing amount of the elderly in western societies, higher societal expectations about health care provisions and outcomes, growth in real GDP and the increased pace in implementation of new technologies in the health care sector.
However, according to the OECD data and the European Health for All databases, Norway has the highest health care expenditure per capita amongst the Nordic countries ($5003)

followed by Denmark ($3540), Sweden ($3470), Iceland ($3359) and Finland ($3008). Norway's spending is much higher than the OECD average ($3060) and it's only second to the USA ($7538). The data is expressed in US dollars and adjusted for purchasing power parities (PPPs) – a method for comparing spending between countries through currency conversion that equalizes the costs of a given "basket" of goods and services. Among the Nordic countries, Finland has the lowest costs – which are even lower than the OECD average. Finland's health care personnel are paid less than in the other Nordic countries which could explain their relative lower health care spending (Kittelsen, Anthun et al. 2009).

Figure 3: OECD countries' public and private health expenditure per capita (OECD 2010).



It is important to note however, that cross country comparisons are often problematic. This is because definitions about what is covered and what is measured are often different from one country to another. For instance, personnel are calculated as man-years in Norway, while in many other European countries a "head count" measurement is done. In addition, figures are usually not corrected for differences in real income and other natural cost differences between countries. According to Johnsen (2006) and Jensen et al. (2010), comparison data should therefore be treated with caution.

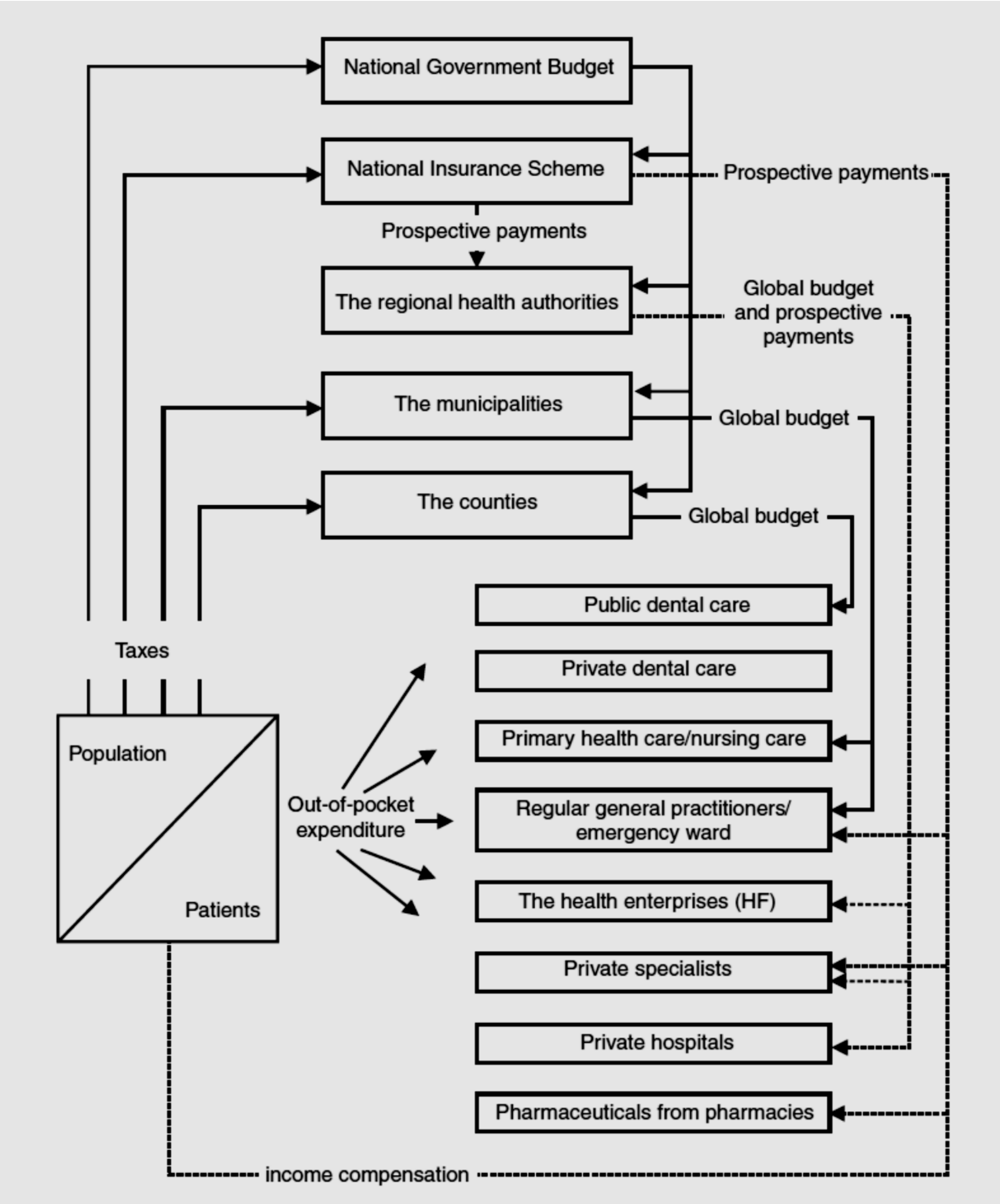


Figure 4: Movement of funds in the Norwegian Health care system (Johnsen 2006; 37)

2.5 History of reforms

The Norwegian health care sector has undergone tremendous change in the last decades. Numerous reforms have been carried out aiming at better organization, financial management, efficiency, increased patient role and better outcomes. The reforms have targeted the provision of health care services at both the primary and specialist levels. The most recent reform is called the coordination reform which is in the process of being carried out. Some of the main goals of this reform involve creating a clearer patient role so that patients can participate and cope better; reorganizing the responsibilities and roles played by primary and specialist providers in order to reduce the number of patients receiving interventions at the specialist level (substitution); providing financial incentives for better organization and quicker treatment of patients (Omsorgsdepartement 2008). However, some studies have found that the planned increase of GPs as a means of substituting the use of services at the specialist level does not have the desired effect (Perez 2010; Seim 2010).

Table 1: Some major reforms undertaken from 1984 to 2004 adapted from Johnsen (2006).

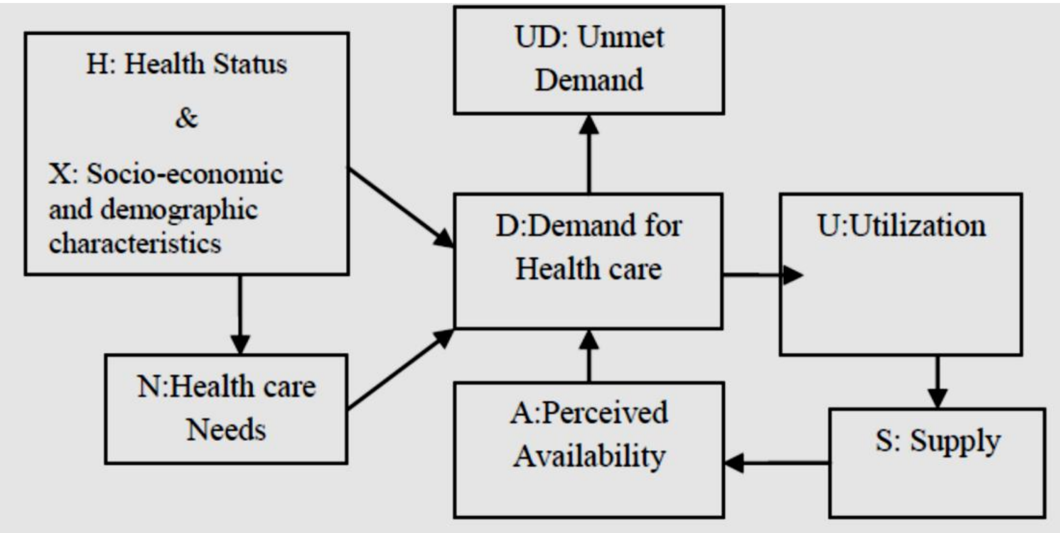
Year	Reform	Purpose
1984	Municipalities health care reform	Better local coordination of primary health care and social services
1992	HVPU	Downsize institutions for people with developmental disabilities
1997	Activity based financing	Give economic incentives to increase the patient flow
1998	Action plan for elderly	Strengthen the housing and services to elderly locally
1999	Escalation plan for mental health	Strengthen and transform of mental health services both locally and regionally
2001	New health legislations	Strengthen patients' rights
2001	The medical overseas project	Decrease hospitals waiting times by sending patients abroad
2001	The Regular General Practitioners' scheme	Improve the quality of the local medical service and the patient to doctor relationship
2001	Liberalisation of the pharmacy market	Increase availability of pharmacies and medicines
2001	Individual plan	A tool to improve coordination of patients in need of long-term care services
2002	Reorganization of central government	Increase the efficiency and the coordination of national central bodies
2002	The hospital reform	Improve specialist health care services by reorganization and change of ownership
2003	A Broad Policy for Public Health, White Paper	Increase and strengthen public health
2004	Substance abuse treatment reform	Strengthen the treatment and accessibility to specialist health care for substance abusers

3 Theoretical framework

3.1 The relationship between need, demand and utilization

A model depicting the demand for Specialist health services will enable us test the potential for substitution and any other relationships arising between public and private provision of specialist health services. The demand model aims to recreate the relationship of need, demand and utilization. In this way, we are able to correct traditional challenges such as information problems inherent in markets. In the provision of specialist health care services, this is done by modeling the coherence between health status, socio-economic characteristics, need, supply side restrictions and the consumption of the services. The basic model is provided in figure 5.

Figure 5: The demand model for health care adapted from Carr-Hill et al. (1994).



Need/demand is unobservable hence an underlying assumption is that perceived need/demand depends on the actual current health status of an individual in addition to current available medical technology. However, an individual's health status and their ability to benefit from available health services may be constrained by other factors such as socio-economic status or demography (Carr-Hill, Sheldon et al. 1994; NOU 2008). In addition, usage of specialist services may be constrained by supply factors. For instance, so long as demand is greater than the supply of services, usage will be restricted by the available supply. Need is also affected by supply side factors such as the availability of preventative health programs which in turn limit the amount of need. These relationships can be summarized as;

Need = Demand [if there are no supply side restrictions and there is perfect information]

Demand = Use [if supply > demand]

The above relationships can be presented as an equation

$$U_i = f(N_i , S_i , SD_i , A_i)$$

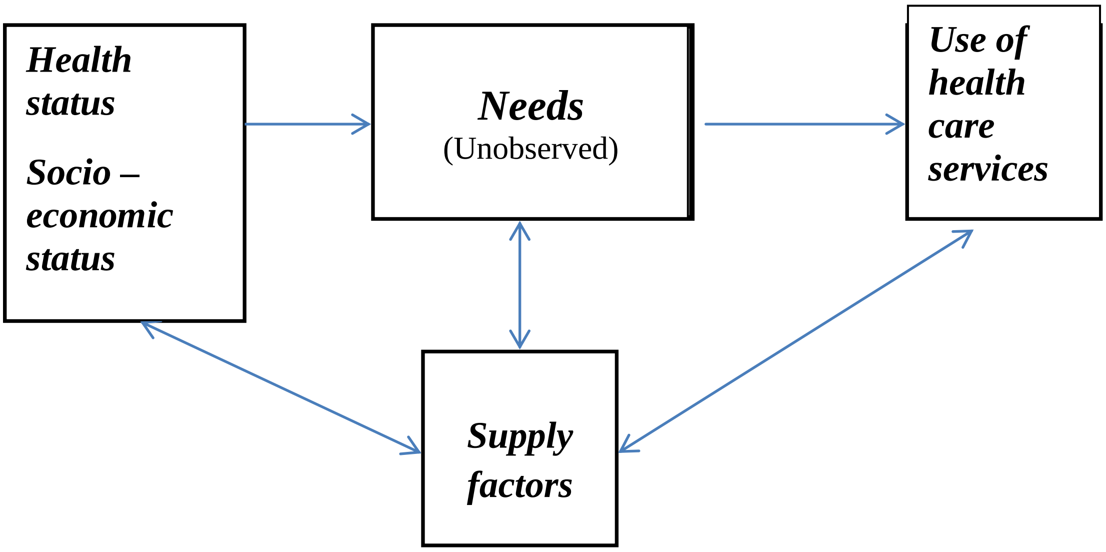
The degree of usage of specialist health care services (U_i) is a function of health needs (N_i), supply of health services (S_i), socio-economic and demographic factors (SD_i), and the perceived availability of the services (A_i).

The above model can be simplified further because perceived availability is a function of both the supply of health services and variation in demographic and socio-economic factors (Carr-Hill, Sheldon et al. 1994). The equation then becomes;

$$U_i = f(S_i , SD_i) , N_i = f(SD_i) \longrightarrow U_i = f(N_i , SD_i)$$

An additional model called fixed effects will be added to the main model in order to ensure that the relationship between need and use is measured correctly by removing effects of supply variation in different health enterprise catchment areas[2]. This will mean estimating a unique constant term for every health enterprise catchment area (*j*) and calculating their means. This enables us to go "within" each catchment area of a Health Enterprise and correctly estimate its unique (supply) characteristics, hence avoid ecological fallacy. The fixed effects model will be discussed further in the empirical model's chapter.

Figure 6: A simplified demand model for specialist care adapted from Magnussen (2008).



[2] Health Enterprises are responsible for providing specialized care to people living in their designated catchment areas. These areas may cover one or several municipalities.

4 Methods and data

4.1 Study design

As discussed in the theory section, the need for specialist health services and the supply of these will determine the type of utilization function. However, since the need for health care is unobservable, proxies that determine need will be used. These include social economic and demographic characteristics.

Small area cross-sectional data has been the main type of data used for analyzing the relationships between primary care and the consumption of specialist health care services (Iversen and Kopperud 2002; Midttun 2006; Midttun and Hagen 2006; Peter 2006; Atella and Deb 2008; Hagen 2009; Kalseth, Kalseth et al. 2009; Lafkiri 2009). This is mainly due to lack of availability of data at the individual level, as well as the resources involved in collecting such huge amounts of data repeatedly over a short period of time, and privacy/confidentiality and legal requirements. Tranmere and Steel (1998), argue that the use of small area (municipal level) data can be justified as being a rough approximation of individual characteristics. In keeping with this tradition, a cross-sectional dataset covering 2006 and 2007 is used. Nevertheless, this dataset contains more detailed information across all municipalities than that contained in previous similar studies. For instance, every piece of observation represents an aggregate unit covering a specific municipality, gender and age group. Further, a comprehensive amount of explanatory variables describing socio-economic status, health status and supply side factors have been used. This is in addition to disaggregating all observations into 10 year level age groups (0 – 09, 10 – 19, 20 – 29 etc.). This will enable the capture of a more detailed picture of the unobservable relationships between private and public specialist services and hence enhance the predictive power of the findings.

Norway is administratively organized under 19 counties and 430 municipalities. There are wide population and geographic variations between the municipalities. For instance, more than half of the municipalities have a population of less than 50 000 while only 12 municipalities have a population of more than 50 000. In addition, Oslo which is the capital city, has a population of about 600 000 and is both a municipality and a county (regionaldepartementet 2011). Structural changes the last years have resulted in mergers, abolition and creation of new municipalities. Municipalities that have undergone these changes during the period of the study are excluded in order to avoid overlapping and missing observations bias. These include; Vindafjørd, Ølen, Frei, Aure, Sande, Tustna, Kristiansund, Sør-Varanger and Skjerstad. Additionally, Sirdal municipality has been excluded due to missing information of some variables. Municipalities whose boundaries were changed, or those that were merged with others before onset of the study period, such as Bodø (2004), Sande and Vanylven (2002), have been kept.

4.2 Data sources and limitations

Social economic data and data explaining supply side factors have been collected from Statbank Norway which is operated by Statistics Norway (SSB). The data covering the use of public hospitals has been collected from the Norwegian Patient Registry (NPR). Data on the use of private specialists has been collected from both the Norwegian Labour and Welfare Service (NAV) and the Norwegian Health Economics Administration (HELFO).

Originally, we intended to include data collected for the year 2005 in the analysis. However, due to limited amounts of data for most of the variables in the analysis, it was decided to drop observations from 2005.

Individual level data is ideal for the type of analyses carried out in this thesis as it provides the actual individual picture of need and utilization (Peter 2006). The Norwegian Patient Registry is currently in the process of making available data collected at the individual level (Godager 2010). However, data collected at the small area level and used in this analysis is the next best approximation of individual characteristics.

Data representing people in the age group 50 – 59 is missing. We have therefore made an assumption that this group does not have significantly different characteristics from parts of the age groups 40 – 49 and 60 – 69. Ideally, it would have been better to have had the data and therefore avoid making assumptions.

4.3 Statistical analytic tool (weighted least squares regression)

The main principle behind Ordinary Least Squares Regression (OLS) is to minimize the sum of squared differences between observed values of the dependent variable (y_i) and its expected value [$E(y_i)$]. However, the OLS procedure is inadequate for our type of data because it assumes a constant variance of residuals across all predicted independent values (homoscedasticity). This is because regression coefficients can have unduly large or too small ranges on the dependent variable. This then reduces the power of significance tests and produces inefficient estimates.

Norwegian municipalities vary greatly in terms of population sizes. OLS estimation would therefore be inadequate because small changes in the regression coefficients of municipalities with smaller population sizes would be assigned bigger weights. Municipalities with bigger populations would be assigned smaller weights even though they might have stronger changes of the regression coefficients.

Weighted least squares (WLS) regression compensates for the violation of the above homoscedasticity assumption by weighting each case differently. Hence cases whose value on the dependent variable correspond to large variation on the independent variable will count less while those with smaller variances will count more when estimating the regression coefficients (Newbold, Carlson et al. 2007; Hill, Griffiths et al. 2008). In our dataset this will mean that municipalities that have greater weight will contribute more in fitting the regression line. Rather than using OLS which minimizes the residual sum of squares;

$$RSS\ (\beta) = \sum_{i=1}^{n} (y_i - \vec{x}_i \times \beta)^2$$

we instead use WLS to minimize the weighted sum of squares by including OLS as the special case where all weights (w_i) = 1;

$$\text{WSS}\ (\beta, \vec{w}_i) = \sum_{i=1}^{n} (y_i - \vec{x}_i \times \beta)^2$$

In this way, the regressions carried out will be able to match the actual data in the regions and hence calculate an efficient maximum likelihood estimate (MLE) (Willet and Singer 1987). This is because the noise variance σ_i^2 at each measurement (i) = $1/\sigma_i^2$.

The population in each municipality has therefore been weighed relative to the total population for all municipalities, over the analysis time period. Municipalities with bigger population sizes such as Oslo receive greater weight and influence than smaller municipalities that have few inhabitants.

A multiple Weighted Least Squares regression model will be constructed on four levels in order to explain variation on the dependent variables; total utilization of specialist care, public provision of specialist care, private provision of specialist care and a public/private mix provision of specialist care.

4.4 Empirical model

In general multiple regression models, the dependent variable (y) is related to a number of explanatory variables ($x_1, x_2, \ldots\ldots, x_n$) through a linear equation that can be summarized as:

$$y_i = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots\ldots\ldots\ldots\ldots \beta_n x_{in} + e_i$$

The Betas $\beta_1, \beta_2, \ldots\ldots, \beta_n$ represent unknown coefficients that correspond to the explanatory variables $x_1, x_2, \ldots\ldots x_n$. this means that a single parameter such as (β_2) will measure the effect of change in variable (x_2) on the expected value of the dependent variable (y) when all the other variables are held constant. In terms of derivatives the relationship can be summarized as:

$$\beta_2 = \frac{\Delta E(y)}{\Delta x_2} \quad (other\ x's\ held\ constant) = \frac{\partial E(y)}{\partial x_2}$$

The parameter ($\boldsymbol{\alpha}$) is a constant term showing the intercept point. The parameter ($_n$) is used to denote the number of unknown variables.

As mentioned earlier, a fixed effects model is added into the regression model in order to enable us to go “into” each RHE catchment area and decipher variation within the health enterprises. This is done in two steps; disaggregating the error term to reflect specific RHE characteristics then computing the RHE catchment area means (Godager 2010).

The error term (e_i) therefore becomes $ƙ_j + e_j$

The regression equation for health enterprise (j) therefore becomes;

$$y_{ij} = \alpha + \beta_1 x_{j1} + \beta_2 x_{j2} + \ldots\ldots\ldots\ldots\ldots \beta_n x_{jn} + ƙ_j + e_j$$

However, we know that ($ƙ_j$) could be correlated to some of the explanatory variables (problems of endogeneity). For instance, if the explanatory variable is age and ($ƙ_j$) is doctor density, we could assume that health enterprises with a larger share of elderly inhabitants, will have a larger share of doctors. To remove the effect of ($ƙ_j$) on ($\beta_i x_i$) we compute the HE catchment area mean. The equation then becomes;

$$\bar{y} = \alpha + \beta\bar{x} + ƙ_j + \bar{e}$$

In order to remove the correlation of ($ƙ$) on ($\beta_i x_i$), we subtract the new model from the "true" model;

$$[y_{ij} = \alpha + \beta_i x_{ij} + ƙ_j + e_{ij}] - [\bar{y} = \alpha + \beta\bar{x} + ƙ_j + \bar{e}]$$

The final equation where ($ƙ_j$) has been removed and where both the variables (y) and (x) are measured from HE catchment area means, then becomes;

$$y_{ij} - \bar{y} = \beta(x_{ij} - \bar{x}) + e_{ij}$$

Our empirical model will be done on four levels which mean that we will have four equations;

I. Model testing the effect of explanatory variables (representing need and supply) on the total utilization of specialist health care services in Norway (y_{total})

$$y_{total} = w_i\,[\beta_1 + \beta_2 \text{Need}_j + \beta_3 \text{Supply}_j + \beta_4 F_4 + e_j]$$

II. Model testing the effect of explanatory variables (representing need and supply) on public provision of specialist care (y_{pub})

$$y_{pub} = w_i\,[\beta_1 + \beta_2 \text{Need}_j + \beta_3 \text{Supply}_j + \beta_4 F_4 + e_j]$$

III. Model testing the effect of explanatory variables (representing need and supply) on private provision of specialist care (y_{priv})

$$y_{priv} = w_i\,[\beta_1 + \beta_2 \text{Need}_j + \beta_3 \text{Supply}_j + \beta_4 F_4 + e_j]$$

IV. Model testing the effect of explanatory variables (representing need and supply) on the relationship between private and public provision ($\frac{y_{pub}}{y_{priv}}$)

$$\frac{y_{pub}}{y_{priv}} = w_i\,[\beta_1 + \beta_2 Need_j + \beta_3 Supply_j + \beta_4 F_4 + e_j]$$

w_i is a weight estimate that captures population variation in each of the different municipalities.

β_1 represents the constant term while the term (j) represents the HEs.

The term e_j represents the residuals

F_4 is a vector variable (fixed effects variable) that represents the health enterprise catchment area dummies and private provision dummies.

$Need_j$ represents explanatory variables that explain need.

$Supply_j$ represents supply side explanatory variables

4.5 fixed effects

As mentioned in the previous section, it is usually impossible to capture all variables that may have an impact on usage of specialist care services. In addition, Regional Health Enterprises' specific characteristics such as level of efficiency, administrative routines, access to resources and services and the internal culture inherent in each health enterprise, may differ and consequently introduce differing supply side restrictions on the levels of specialist health services provided. As mentioned previously, a fixed effects model enables us to go "within" each health enterprise and exclude any of these "unwanted" supply side variation components that are un-accounted for (Hagen 2009). This will be done through inclusion of all health enterprises (minus 1) as dummy variables. The excluded health enterprise will act as the reference unit. This practical method enables us to ascertain the heterogeneity present in municipalities within the catchment area of the different health trusts i.e. control for the average differences across the different health trusts' catchment areas. This is in line with recommendations by Smith (2006) and Hagen (2009). Additionally, dummies representing private provision will be used depending on the model being tested i.e. when testing the effect of needs and supply variables on public provision; we will use the dummy representing private provision.

4.6 Statistical assumptions

For the empirical econometric model presented earlier to function properly, some assumptions about the probability distribution of the error term, both independent and dependent variables have to be made (Newbold, Carlson et al. 2007; Pallant 2007). Assumptions made in this study are in line with the classical least squares regression assumptions. For instance, in order to be able to generalize our results to other samples, a fairly large sample size of approximately 7000 aggregated units of observations per variable covering all the 430 municipalities, male and female categories and having 10 year age groups has been chosen.

Multicollinearity occurs when independent variables are highly correlated with each other while singularity occurs when one independent variable is actually a combination of some other independent variables. The Pearson's correlation function will be used to correct for multicollinearity and singularity. Variables with a correlation value (r = .7 or higher) will be screened further. Diagnostic methods that will be used for screening include the Variance Inflation Factor value (VIF) and the tolerance test. The tolerance test measures a variable's collinearity by setting the tolerance value using the formula ($1 – R^2$). A very small tolerance ($\leq .1$) indicates an almost perfect linear combination which dictates that the variable should not be included in the regression equation. The Variance Inflation Factor (VIF) measures the impact of collinearity among the variables included in the regression model and is represented by the formula (1/Tolerance). The VIF value should always be greater than 1 but not more than 10.

Abnormally high or very low scores indicate the presence of outliers which may have an undue effect on the results. If detected, the outlier effect will be corrected through screening and use of the standardized residual plots where observations with residual values above (3.3) or less than (-3.3), will be excluded from the analysis.

The assumption on homoscedasticity which states that the variance of the residuals about the predicted dependent variable scores should be the same for all predicted scores, has been met through weighting all the municipalities relative to their population sizes and through the inclusion of the fixed effects model in the analysis. This will enable us derive “true” scores by measuring correctly the specific RHE characteristics that differ from other health enterprises.

Normality of residual distribution around the dependent variables has been checked using scatterplots. Even though all the independent variables are positively skewed (which indicates that scores are clustered to the left at their low values) the sample size is adequate enough to ensure that the mean will be approximately normally distributed as per the Central Limit Theorem (Pallant 2007).

Two further assumptions have been made about the independent variables. The first assumption is that the independent variables are not random variables. This simply means that we know the values of the independent variables prior to observing their effect on the dependent variables. Secondly, we assume that none of the independent variables are an exact linear function of the other variables. This means that we assume no one variable is redundant and therefore avoid the problem of exact collinearity (Pallant 2007).

4.7 The variables

Socio-economic and demographic variables describing the need for health care services have been selected based on suggestions from NOU (2008:2) and practice from other similar empirical studies such as Nerland and Hagen 2008, Gravelle et al. and Carr-Hill et al.

The utilization of health care services normally varies depending on the age, gender and place of stay of the population (Kalseth, Kalseth et al. 2009). In order to take account of this fact, a standardized rate has been created where one unit of observation represents municipality of residence, gender and any of the eight age-group levels. The rate is based on the number of outpatient consultations (our dependent variable) divided by the number of inhabitants of the municipality the patient comes from. This is then standardized per 1 000 inhabitants and the formula looks as follows:

$$\mathrm{SR_k} = \sum_{i=1}^{9} \left[\left(\frac{\mathrm{S_{ik}}}{\mathrm{N_{ik}}}\right)\right] 1\,000$$

S_{ik} = the number of outpatient consultations (*S)* for gender-and-age groups (*i)*; *i* = 1, 2….. 8, for area (*k)*

N_{ik} = the number of inhabitants (*N*) for the gender-and-age groups (*i)*; *i* = 1, 2….. 8, for area (*k)*

SR_k = gender-and-age group standardized rate (*i)* for area (*k)*.

4.7.1 Dependent variables

Total reimbursements (Total_utilization): the average total amount reimbursed to both public and private specialists in the years 2006 and 2007 as a share of the population, per 1 000 inhabitants.

Reimbursement to public specialists (Andel_taksref_sum): the average amount reimbursed by the state to public specialists in the years 2006 and 2007 as a share of the population, per 1 000 inhabitants.

Reimbursement to private specialists (Andel_refusjon): the average amount reimbursed by individuals upon usage of private specialist services as a share of the population in the years 2006 and 2007, per 1 000 inhabitants.

Public – private mix (pub_priv): the amount of public specialists given the amount of private specialists and vice versa. As is the custom in Norway, the number of specialists is calculated in man-hours. Additionally, the variable is not standardized because population counts are found on both sides of the equation and therefore cancel each other out. The *(pub_priv)* variable will enable us to test whether there is a potential for substitution between private and public provision of outpatient specialist health care services.

4.7.2 Explanatory variables describing need

Different age groups as a share of the population: five variables have been created in order to test the effect of each age group on the dependent variables. These age group variables represent the share of the population *(Andel_0_15, Andel_16_44, Andel_45_66, Andel_67_79 and Andel_80 og over)* every year, per 1 000 inhabitants.

We assume that the utilization of specialist health services is greatest during infancy and when the population gets old.

Disabled (Andel_ufør): the share of population disabled per year, per 1 000 inhabitants. Additionally, three extra variables representing different age groups have been created in order to test whether age of the disabled person has an effect. The variables created are; *(Andel_uføre18_39, Andel_uføre20_66 and Andel_uføre40_69)* In line with findings by Hagen (2009) of a positive correlation between disability and use of specialist services, we assume that the higher the number of the disabled, the higher the use of specialist health care services.

Population 80 years and above living alone (Andel_alenebo80): the share of inhabitants who are either 80 years or older living on their own and not in an institution per year, per 1 000 inhabitants. We assume that the higher the number of people within this age group, the higher the usage of specialized care. This is in accordance with findings by Nerland and Hagen (2008).

Divorces (Andel_skilsmisser): share of the population divorced every year, per 1 000 inhabitants. We assume that the higher the number of divorcees, the larger the use of specialist health care services.

Gross Income (Brutto inntekt): represents the average gross income of inhabitants in each municipality per year. In line with findings by Carlsen (2006), we assume that the higher the share of inhabitants there are with lower gross income, the higher the usage of specialist care services and vice versa.

Mortality (Andel_dødelighet): share of population that dies every year, per 1 000 inhabitants. In line with findings by Hagen (2009), we assume a higher mortality rate increases the utilization of specialist care services. Additionally, an extra variable *(dødelighet_20_og over)* has been created to enhance understanding on whether mortality distribution between children and adults, has varying effect on the dependent variables.

Social rehabilitation (Andel_attføring): share of the population undergoing social program trainings to enable them get back to work every year, per 1 000 inhabitants.

We assume the higher the number of this group is, the higher the utilization of specialist care services.

Medical rehabilitation (Andel_rehab): share of the population undergoing medical rehabilitation every year, per 1 000 inhabitants. We assume the higher the number of inhabitants in this group, the higher the utilization of specialist care. An additional variable for the age group 20 – 66 years (*Andel_rehab_20_66*) has been created in order to test whether there is a difference in the usage of specialist care between different age groups undergoing rehabilitation.

Single parents (Andel_ensligeforsøgere): share of population that are single parents per year, per 1 000 inhabitants. We assume that the higher the number of single parents, the higher the utilization of specialist care services.

The Unemployed (Andel_arbeidsøkere): share of the population unemployed per year, per 1 000 inhabitants. We assume the higher the share of unemployed, the higher the usage of specialist care.

Non-western immigrants (Andel_ikkevinnv): share of the population representing first and second generation immigrants from countries other than Europe. We make an assumption that the higher the share of inhabitants in this group, the higher the utilization of specialist health care services. However, Peter C. Smith (2006) and Ingebretsen and Nergård (2007), document that similar groups of minorities usually under – consume health care services and therefore represent (unmet need) in society. Caution should therefore be practiced when interpreting results.

Population with low education (Andel_kungrskole): share of population with only primary education per year, per 1 000 inhabitants. In line with the findings of Carlsen (2006), we assume that the bigger the share of population in this group, the higher the use of specialist services. In addition, the variable has been disaggregated further in order to get a better understanding of the distribution and effect of inhabitants with low education in different age groups and their utilization of health care services. This has been done by creating further variables representing the share of inhabitants with low education for the following age groups; 20 – 29 years (*Andel_grskole_20_29*), 20 – 59 years (*Andel_grskole_20_59*) and 30 – 59 years (*Andel_grskole_30_59*).

Psychological disability (Andel_psykuføre): share of the population that is mentally disabled every year, per 1 000 inhabitants. We assume that the higher the number of people in this group, the higher the usage of specialist services.

Social benefit (Andel_sosialhjelp): share of the population receiving social support/benefits every year, per 1 000 inhabitants. Additionally, another variable describing people aged between 18 and 49 years in this group has been created *(Andel_sosialhjelp_18_49)*. This will enable us to test any variation based on age. We assume the higher the number of inhabitants in this group, the higher the utilization of specialist care services.

Child welfare services (Andel_barnevernstiltak): share of the population receiving or using child welfare support every year, per 1 000 inhabitants. We assume the larger the number of children in this group, the higher the usage of specialist care services.

Sickness benefits (Andel_sykepenger): share of the population receiving sick benefits every year, per 1 000 inhabitants. We assume the higher the number of people on sick benefits, the higher the utilization of specialist care.

Sickness leave (Andel_sykefravær): share of the population on sickness leave every year, per 1 000 inhabitants. We assume the higher the number of people on sick leave, the higher the usage of specialist health care services.

4.7.3 Explanatory variables describing supply

Travel time to public hospital (reisetid_pub): the average travel time measured in minutes the inhabitants use to the nearest public specialist hospital every year, per 1 000 inhabitants. In line with findings by Nerland and Hagen (2008), we assume that the longer the travelling time, the fewer the utilization of specialist health care services.

Travel time to private hospital (reisetid_priv): the average time measured in minutes the inhabitants use to the nearest private hospital every year, per 1000 inhabitants. Same assumptions as those made for *(reisetid_pub)* apply.

Private man – years (Andel_avtaleaarsverk): the average number of man – years for private specialists every year as a share of the population, per 1 000 inhabitants. We assume the higher the number of man – years, the higher the utilization of outpatient specialist services.

Public man – years (Andel_offaarsverk): the average number of man – years for specialists working in public hospitals every year as a share of the population, per 1 000 inhabitants. We assume the higher the number of man – years, the higher the utilization of specialist services.

Travel distance to local hospital (kmloksh): the average distance measured in kilometers (km) that inhabitants travel to the nearest local hospital every year, per 1 000 inhabitants. In line with Nerland and Hagen (2008), an assumption is made that longer distances reduce the usage of specialist services.

Travel distance to regular hospital (kmregsh): the average distance in km it takes the inhabitants to travel to the nearest regular hospital every year, per 1000 inhabitants. Same assumption as (*kmloksh*) applied.

Travel distance to the central hospital (kmssh): the average distance in km travelled by inhabitants to the nearest central hospital every year, per 1 000 inhabitants. Same assumption as (*kmloksh*) applied.

General practitioners (Andel_fastleger): share of doctors in the population every year, per 1 000 inhabitants. GPs in Norway have a gatekeeping role which means that they play a role in controlling access to specialist health care services (Claussen 1999). In addition, one of the main goals envisaged by the coordination reform was to increase the number of GPs and therefore enhance substitution between primary and specialist level care (Omsorgsdepartement 2008). We therefore assume that the higher the number of GPs, the lower the consumption of specialist care services. However, it is important to note that some studies undertaken in Norway have shown that increasing the number of GPs increases the usage of specialist services while weakening the gatekeeping role (Iversen and kopperud 2002; Godager, Iversen et al. 2007; Nerland and Hagen 2008; Tjerbo 2010).

State grants (Andel_tilskudd): state grants given to specialists every year as a share of the population, per 1 000 inhabitants. We assume the higher the grants the higher the utilization of specialist outpatient health care services.

4.7.4 Fixed effects variables (dummies)

Health Enterprise dummies (hfbo07_first): dummies representing the 22 Norwegian health care enterprises' catchment areas. These are; Sykehuset Østfold HF, Sykehuset Asker og Bærum HF/Oslo sykehusområde, Akershus universitetssykehus HF, Sykehuset Innlandet HF, Ringerike sykehus HF, Sykehuset Buskerud HF, Blefjell sykehus HF, Sykehuset i Vestfold HF, Sykehuset Telemark HF, Sørlandet sykehus HF, Helse Stavanger HF, Helse Fonna HF, Helse Bergen HF, Helse Førde HF, Helse Sunnmøre HF, Helse Nordmøre og Romsdal HF, St Olavs Hospital HF, Helse Nord Trøndelag HF, Helgelandssykehuset HF, Nordlandssykehuset HF, Universitetssykehuset i Nord-Norge HF and Helse Finnmark HF. The catchment area dummy variables (minus1) will be used to correct for supply side variation. The excluded dummy variable *(Akershus universitetssykehus HF)* will act as the reference[3].

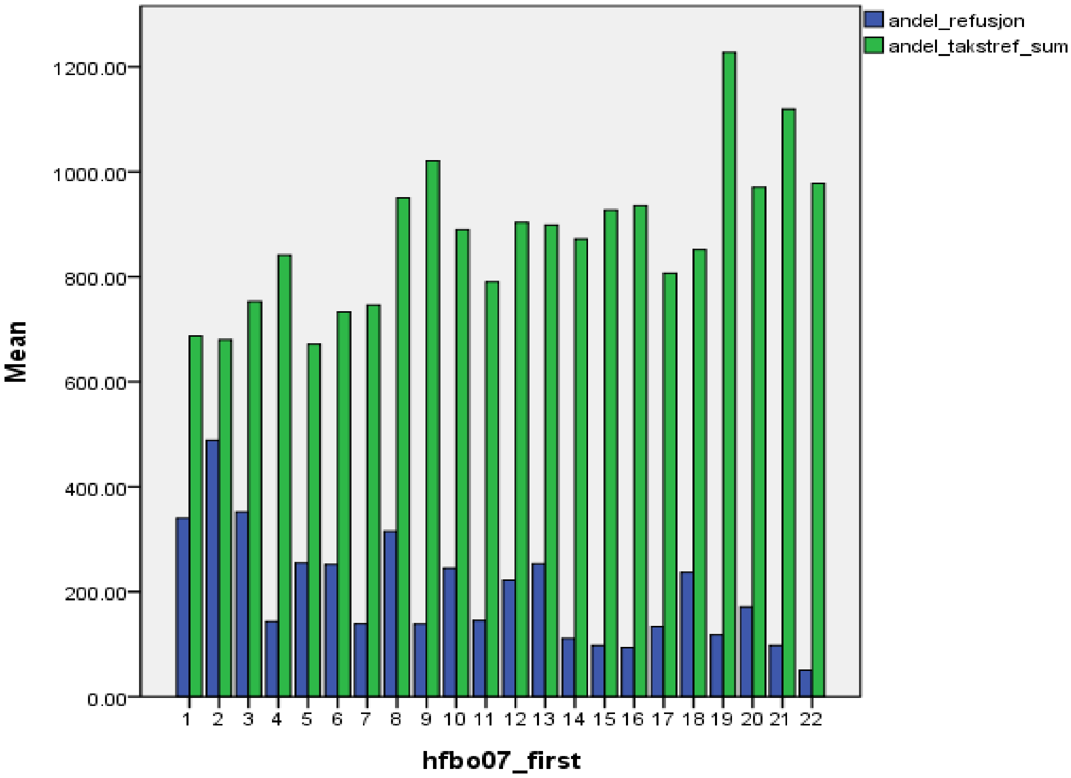
Private specialists dummy (dummy_priv): dummy variable that takes the value = 1 when private outpatient specialist services are available in the municipality and the value = 0 otherwise. This variable will be used as a "fixed effects" measure to control for supply side variation when testing the effect of independent variables on utilization of public specialist services. We assume that the higher the number of private specialists in a municipality, the greater the utilization of outpatient specialist services. A dummy variable representing availability of public specialists has not been created because the Norwegian health system is a public-based system where public provision is the default *'modus operandi'.*

[3] For a list of the health enterprises and their assigned numbers, see the appendix table: 9.4 on page xii.

4.8 Descriptive statistics

Figure 7 presents differences in utilization between public and private specialists while figure 8 shows the population distribution with regard to health enterprise dummies. The Oslo, Asker and Bærum region (also the most populated region) consumes the highest amount of private outpatient services. Additionally, the difference in utilization of either public or private outpatient services is much more even in this region. All the other regions have an uneven distribution of utilization where private outpatient care plays only a minor role compared to public outpatient health care services. A general pattern emerges where highly populated regions have higher consumption of private outpatient services. This is in line with findings by both Johnsen (2006) and Iversen and Kopperud (2002), who found that consumption of private specialists is higher in cities and higher in southern Norway (highly populated region) when compared to the north.

Figure 7: Differences in utilization of public and private specialists



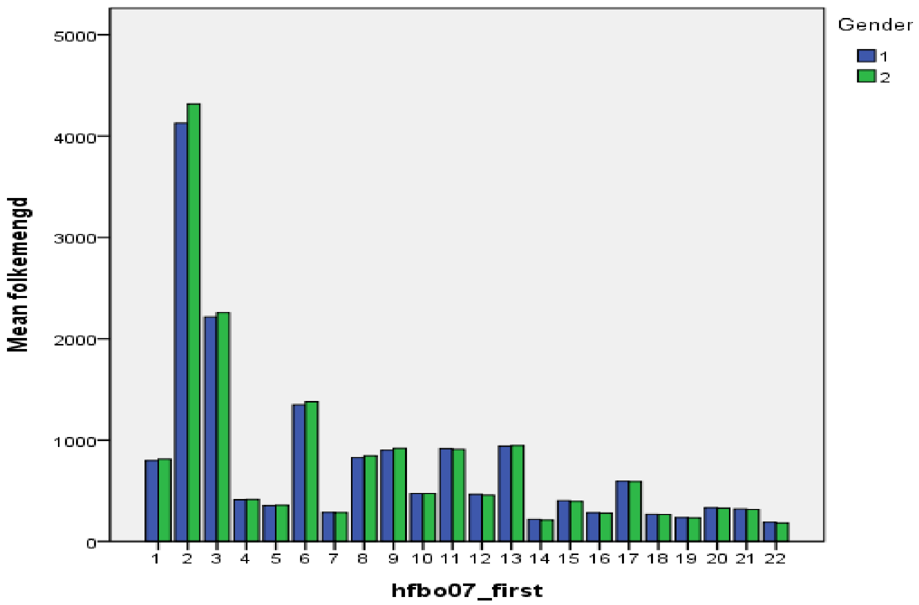


Figure 8: Population distribution with regards to Health Enterprise dummies.

Descriptive statistics have been divided into dependent, independent, supply and age variables. This will enable us to compare variables in similar groupings, describe the characteristics of the data set and finally check whether the underlying assumptions we have made about the data, have been met. Information about the mean, trimmed mean, missing data, standard deviation, skewness and kurtosis will be provided.

The trimmed mean value is calculated by removing the top and bottom 5% observations in each variable and then recalculating a new mean value. When compared to the original mean value, the new trimmed mean enables us to check whether extreme scores (outlier values) have a strong influence on the mean. If the values do not have huge differences, then we can proceed with the analysis knowing that our assumptions are not violated (Pallant 2007).

The skewness value indicates distributional symmetry while the kurtosis value indicates the distributional "peakedness" where a perfectly normal skewness and kurtosis distribution = value 0. According to Pallant (2007, 56) and Tabachnick & Fidell (2007, 80), positive skewness values will indicate positive skew where the scores are clustered to the left at their low values while negative skewness indicates a clustering of scores at the high end (right-hand side of the graph). Further, positive kurtosis values indicate a distribution that is rather peaked (clustered in the centre) with long thin tails. Kurtosis values below 0 indicate a distribution that has too many cases in the extremes (relatively flat). However, our data set contains a large sample such that the sensitivity to skewness and kurtosis will not affect the analysis (Pallant 2007).

All variables (except gross income, travel time to either public or private institutions and travel distance to local, regional or central hospitals) have been standardized per 1 000 inhabitants as a means of controlling the effect of population size differences. The gross income variable is measured at the individual level and therefore does not need standardization. The variables depicting travel times and distances give municipal averages that explain the variation inherent in each municipality in terms of supply/access; hence do not need standardization.

Table 2: Descriptive statistics for the dependent variables; *Total reimbursements specialist health care provision (Total_utilization*), *Reimbursement to public specialists (Andel_taksref_sum)*, *Reimbursement to private specialists (Andel_refusjon)* and *Public – private mix (pub_priv)* standardized per 1 000 inhabitants for the years 2006 – 2009 for all municipalities (Valid N = 6799).

Variable	Mean	Min	Max	Std. Dev	Skewness	Kurtosis
Total_Utilization	1070.0652	37.55	22647.67	970.34625	7.365	104.477
andel_takstref_sum	888.6867	26.98	21976.42	886.19084	9.109	142.092
andel_refusjon	175.8203	.00	2057.22	245.60111	3.152	12.859
pub_priv	18.7974	10.10	27.57	6.18865	.011	-1.279

As expected, reimbursements to public specialists (888.6867) clearly outnumber reimbursements to private specialists (175.8203). As pointed out earlier, the sample size is relatively large such that we can assume normality even though the skewness and kurtosis values for the public-private mix are negative (-1.279) depicting a relatively flat distribution, and positive for the other two variables. Further, the sample size argument also applies to the 5% trimmed mean output for reimbursements to public specialists = 801.2084, and the 5% trimmed mean for reimbursements to private specialists = 142.3991. The mean for the public-private mix = 18.7974 (trimmed mean = 18.7914). This is very high as it shows that on average, it is 18 times more likely for one to use public specialists over private specialists. However, this is not unexpected since the Norwegian health system is mainly public. The table shows a minimum value of zero for private reimbursements. This is as a result of specialist health care services being provided 100% publicly in some small municipalities.

Table 3: Descriptive statistics for the needs variables; *Disabled (Andel_ufør, Andel_uføre18_39, Andel_uføre20_66 and Andel_uføre40_69)*, *Population 80 years and above living alone (Andel_alenebo80)*, *Divorces (Andel_skilsmisser)*, *Gross Income (Brutto inntekt)*, *Mortality (Andel_dødelighet, dødelighet_20_og over)* , *Social rehabilitation (Andel_attføring)*, *Medical rehabilitation (Andel_rehab)*, *Single parents (Andel_ensligeforsøger)*, *The Unemployed (Andel_arbeidsøkere)*, *Non-western immigrants (Andel_ikkevinnv)*, *Population with low education (Andel_kungrskole, Andel_grskole_20_29*, *Andel_grskole_20_59*, *Andel_grskole_30_59*), *Psychological disability (Andel_psykuføre)*, *Social benefit (Andel_sosialhjelp)*, *Child welfare services (Andel_barnevernstiltak)*, *Sickness benefits (Andel_sykepenger)*, *Sickness leave (Andel_sykefravær)* and *Different age groups as a share of the population (Andel_0_15, Andel_16_44, Andel_45_66, Andel_67_79 and Andel_80 og over)*. The variables are standardized per 1 000 inhabitants for all municipalities and cover the years 2006 – 2007.

Variables	N	Min	Max	Mean	5%T.Mean	Std. Dev	Skew	Kurtosis
Andel_0_15	6800	0	0	.01	0.0100	.009	5.126	44.775
Andel_16_44	6800	0	0	.01	0.0100	.015	4.407	34.742
Andel_45_66	6800	0	0	.01	0.0100	.013	3.310	18.874
Andel_67_79	6800	0	0	.00	0.0000	.005	2.969	12.309
Andel_80ogover	6800	0	0	.00	0.0000	.003	4.438	34.892
andel_rehab	7645	0	8	.05	0.0200	.276	17.976	390.236
andel_sykefrav	6800	0	0	.02	0.0200	.004	-.022	-.291
andel_ufør	6800	0	0	.00	0.0000	.005	2.451	8.227
andel_uføre_18_39	6800	.00	.00	.0025	0.0024	.00071	1.653	2.982
andel_uføre_20_66	6800	.00	.06	.0007	0.0005	.00133	14.400	465.434
andel_uføre_40_69	6800	.01	.02	.0142	0.0141	.00259	.576	-.052
andel_alenebo80	7645	.01	.06	.0299	0.0297	.00922	.264	-.208
andel_skilsmisser	7663	.00	.01	.0020	0.0020	.00081	-.088	1.366
andel_dødelighet	7650	.00	.57	.0183	0.0170	.03856	2.923	12.146
andel_dødelighet_20ogover	6800	.00	21.84	.0193	0.0001	.39157	34.617	1592.060
andel_attføring	7630	.00	10.04	.0408	0.0156	.28711	21.721	572.560
andel_rehab_20_66	6800	.00	.02	.0108	0.0107	.00343	.422	.309
andel_ensligeforsørgere	7663	.00	.06	.0256	0.0255	.00644	.360	1.321
andel_arbeidsokere	7648	.00	47.82	.1883	0.0812	1.34431	24.339	720.474
andel_ikkevinnv	7650	.00	1.05	.0312	0.0237	.04237	6.838	115.170
andel_kungrskole	6800	.00	1.16	.3469	0.0353	.16436	1.015	.847
andel_grskole_20_29	6800	.01	.06	.0290	0.0286	.00769	.692	1.325
andel_grskole_20_59	6800	.06	.28	.1275	0.1258	.03061	1.075	2.363
andel_grskole_30_59	6800	.05	.23	.0986	0.0972	.02559	1.007	2.090
andel_psykuføre	7596	.00	4.74	.0202	0.0069	.14062	23.081	631.447
andel_sosialhjelp	7645	.00	18.17	.0632	0.0280	.48343	25.574	782.497
andel_barnevernstiltak	7663	.00	.02	.0075	0.0073	.00258	.805	1.143
andel_sykepenger	7646	.00	70.25	.2588	0.1100	1.61700	23.127	714.099
andel_sosialhjelp_18_49	6800	.00	.06	.0232	0.0227	.00879	.947	1.831
Valid N (listwise)	5867							

The above table shows no significant difference between the variable means and the 5% trimmed means. This shows that extreme scores do not impact wrongly on our data (do not have a strong influence). However, the variable (*andel_dødelighet_20ogover*) has big differences between the mean (0.0193) and the 5% trimmed mean (0.0001). This could be explained by the fact that the top and bottom 5% quartiles of the variable represent a part of the population (the elderly and the young) that have a significantly higher death rate. The same is true for the variable (kungrskole) which has a mean= 0.3469 and a 5% trimmed mean= 0.0353. The difference might be explained by the fact that a bigger proportion of those with low education are the elderly. Some municipalities have so few inhabitants such that some variables will have minimum values = 0.

Table 4: Descriptive statistics for the supply side variables per 1 000 inhabitants for all municipalities in the period 2006 – 2007. The variables are; *Travel time to public hospital (reisetid_pub)*, *Travel time to private hospital (reisetid_priv)*, *Private man – years (Andel_avtaleaarsverk)*, *Public man – years (Andel_offaarsverk)*, *Travel distance to local hospital (kmloksh)*, *Travel distance to regular hospital (kmregsh)*, *Travel distance to the central hospital (kmssh)*, *General practitioners (Andel_fastleger)* and *State grants (Andel_tilskudd)*

Variables	N	Min	Max	Mean	5%T.mean	Std. Dev	Skew	Kurtosis
andel_avtaleaarsverk	6816	0	47,87	0,8686	0,6339	1,62761	8,826	151,662
andel_offaarsverk	6816	0,05	706,67	14,1324	10,7405	24,78418	9,572	169,965
Kmloksh	6816	0	567	69,11	60,27	73,047	2,518	9,647
Kmregsh	6816	0	1005	238,1	222,38	177,515	1,305	2,162
KMssh	6816	0	903	139,92	118,44	162,42	2,284	5,61
reisetid_pub	6816	0	488	71,74	64,57	68,829	1,875	5,237
Reisetidpriv	6816	0	372	55,63	48,6	60,598	1,845	4,634
andel_tilskudd	6816	3,51	42314,67	758,1001	554,756	1417,837	9,014	159,077
andel_fastleger	6816	0	0,8	0,0266	0,0273	0,03025	6,25	92,946
Valid N (listwise)	6816							

5 Results

This chapter presents results on the utilization of specialist health services with the aim of explaining variation and the choice of specialist providers using four analysis levels; total utilization of specialist services, public utilization, private utilization and public-private utilization mix. Multiple regressions using Weighted Least Squares have been carried out. Interpretations will be based on output values for R^2, β coefficients, F test values and the statistical significance values of each variable. The R^2 describes the variation in our dependent variables that our models explain. The F test describes the significance of the whole model i.e. whether all the coefficients sum up to zero or not. The signs of the β coefficients indicate whether a variable has a positive or negative impact on our dependent variables. The statistical significance of each variable will be measured at 1%, 5% or 10% ($p<0.01$; $p<0.05$; $p<0.1$). This will enable us ascertain whether a coefficient is significantly different from zero (Pallant 2007). However, since we are interested in studying the choice and variation in use of specialist outpatient services, it is important to note that we are mostly interested in the coefficients and the direction they are pointing towards. The units of measurement for the coefficients contain a cell that represents municipalities, gender and eight age group observations each.

The models presented in this chapter represent the final models after highly correlated variables have been dropped. All the explanatory variables explaining need and supply were included in the preceding models. The variables *kmloksh*, *kmregsh* and *kmssh* representing distances to hospitals have been dropped from the analyses. Instead, variables representing time taken to travel to either a public or private hospital (*reisetid_pub* and *reisetid_priv*) will be used. Variables representing personnel distribution (*Andel_avtaleaarsverk* and *Andel_offaarsverk*) have been dropped because their effect/ role are represented by the Health Enterprise catchment area dummies. The variable representing additional state grants (*Andel_tilskudd*) has been dropped due to the fact that the grants and their recipients fluctuate every year such that they cannot be used as stable predictors of effect. Additionally, the age-group variable *Andel_16_44* has been dropped from all analyses because it is the reference age-group variable. However, all the other age group variables are kept in all the models despite the fact that they might be correlated with other variables. This is because we are interested in finding out the effect of the dependent variables on the different age-groups. Health Enterprise dummies have been kept in all models even though some show statistically insignificant effect. This is because of the strong theoretical argument that the dummies (Fixed Effects variables) enhance the robustness of our findings (Peter 2006). As mentioned earlier in the methods chapter, different diagnostic approaches have been employed to test the viability of each variable's inclusion in any of the models. The tolerance and VIF values for each variable will be provided.

5.1 Total utilization of specialist health services

The average utilization of specialist health care services in Norway is 1 070.0652, measured as the total number of reimbursements as a share of the population per 1 000 inhabitants. The explanatory power of our model is at an acceptable level of $R^2 = 0.174$.

5.1.1 Total specialists' reimbursement without disaggregated variables

The following variables were dropped for being highly correlated with other variables, *Andel_rehab* (Tolerance= 0.018; VIF= 57.079), *Andel_ufør* (Tolerance= 0.064; VIF= 15.644), *Andel_attføring* (Tolerance= 0.050; VIF= 20.004), and *Andel_arbeidssøkere* (Tolerance= 0.012; VIF=80.265).

The supply side variable representing number of GPs (*Andel_fastleger*) is insignificant with an estimate of 35365.858. This means that the number of GPs, has no effect on the total consumption of specialist outpatient services. This is in conflict with our earlier stated hypothesis that an increase in number of GPs leads to a decrease in the use of specialist health services. In addition, the result contrasts other Norwegian findings such as Iversen (2002), Godager (2007), Nerland (2008) and Tjerbo (2010) who find that increasing the number of GPs weakens their gatekeeping role and hence increases use of specialist health services.

There are negative effects of travel time to both public and private hospitals (*reisetid_pub; reisetid_priv*). However, only the variable representing travel time to public hospitals is significant ($p<0.01$). This is interpreted to mean that longer travelling times to a public hospital will lead to less utilization of specialist health services. This is in line with our hypothesis and in line with findings by Nerland and Hagen (2008). Even though the insignificant effect of the variable representing travel time to private specialists is surprising, it is not entirely unexpected given the fact that public provision of specialist care is dominant and available in most places where private specialists may be situated.

The variable representing gross income (*Bruttoinntekt*) has insignificant effect and an estimate 0.001 on the total utilization of specialist health services. This is in conflict with findings by Carlsen (2006) and our stated hypothesis which assumed that the share of the population with lower income would have higher utilization of specialist health care services.

All the age-groups (*Andel_0_15, Andel_45_66 and Andel_80ogover*) have negative effects except (Andel_67_79) which has a positive estimate (25527.831). In addition, the age group variable (*Andel_67_79*) is the only one that has significant effect ($p<0.05$) on the dependent variable. This means that an increase by one of the share of population in the age group 67 to 79 years, will lead to an increase in the total usage of specialist health services by 25527.831 when measured against the reference age variable *Andel_16_44*. Again, this is in conflict with our stated hypothesis that utilization of specialist health services is greatest during infancy and old age (0-15 and 80 years and above).

The variable representing sickness leave (*Andel-sykefravær*) has a positive estimate (9246.008) and a significant effect on the usage of specialist health care services ($p<0.05$). This means that an increase of one in the share of the population represented by this group per 1 000 inhabitants, will lead to an increase in the total utilization of specialist care equal to the estimate. The finding is in line with our stated hypothesis that there is positive correlation between sickness leave and utilization of specialist health care services.

The variable representing the age group 80 years and above living alone (*Andel_alenebo80*) has an insignificant effect on the total utilization of specialist outpatient care with a positive estimate of 3082.363. This result contradicts our hypothesis and other findings by Nerland and Hagen (2008). When this variable is evaluated in relation to the other variable representing old age (*Andel_80ogover*), we see that the elderly do not have a significant effect on the use of specialist care. This may be explained by the availability of a wide range of treatment possibilities at the municipal level for people in this age group, therefore limiting utilization of specialist outpatient care.

The variable representing mortality (*Andel_dødelighet*) has a significant effect on the total use of specialist outpatient care ($p<0.01$) with a positive estimate (7241.262). This means that an increase in mortality will increase the utilization of specialist health services. This findings are in line with our hypothesis and findings by Hagen (2009) who found that a higher mortality rate increases the use of specialist health care services.

The variable representing non-European immigrants (*Andel_ikkevinnv*) is highly significant ($p<0.01$) with a negative estimate of (2302.613). This means that for every increase of non-Europeans by one, there will be a decrease in the utilization of specialist health care services of 2302.613. This result is somewhat surprising and contrasts our hypothesis and other Norwegian findings such as by Perez (2010) and Seim (2010). However, Peter C. Smith (2006) and Ingerbretsen & Nergård (2007) have documented that minority groups such as immigrants usually under-consume health care services. This would then mean that the negative estimate represents “unmet needs” in society and not real utilization considerations.

The variable representing low education (*Andel_kungrskole*) is highly significant ($p<0.01$) with a positive estimate of 362.925. This is interpreted to mean that increase of the share of population by one, per 1 000 inhabitants will lead to an increase of 362.925 in the total usage of specialist health care services. This is in line with our hypothesis and findings by Carlsen (2006) that the larger the share of population with low education, the higher the utilization of specialist health services.

The variable representing psychological disability (*Andel_psykuføre*) is significant ($p<0.05$) with a positive estimate of 198.810. This means that an increase by one of the share of population with psychological disability, per 1 000 inhabitants will lead to an increase in the total utilization of specialist health care services by 198.810. This finding is in line with our hypothesis.

The variables representing share of the population receiving social benefit (*Andel-sosialhjelp*), the share receiving sickness benefits (*Andel_sykepenger*), the share of the population that is divorced (*Andel_skilsmisser*) and the share using child welfare services (*Andel_barnevernstiltak*) all have insignificant effect on the utilization of specialist health services and also have negative estimates (-10.175, -12.395, -3005.804 and -849.419).

The variable representing single parents (Andel_ensligeforsørgere) has an insignificant effect on the utilization of specialist outpatient care (estimate= 1141.872). This result contradicts our hypothesis.

The significance of the variables representing the 22 fixed effects health enterprise dummies are interpreted in relation to the reference dummy variable representing Akershus health enterprise. The following variable representing NordnorgeHF_dummy (estimate=7.217) is significant at $p<0.1$. In addition, the variables VestfoldHF_dummy (estimate=20.096), StOlavsHF_dummy (estimate= -8.382), InnlandetHF_dummy (estimate= -25.412) and HelgelandHF_dummy (estimate=11.844) are significant at $p<0.05$. Only BlefjellHF_dummy (estimate= -31.857) is significant at $p<0.01$. All the other dummy variables are insignificant. Positive estimates mean that the health enterprises in question receive more money (in Norwegian Kroner) than AkershusHF as a share of the population, per 1 000 inhabitants. The opposite is true for dummy variables with negative estimates. Differences in the amounts reimbursed between health enterprises in big towns (mostly negative estimates/less money) and health enterprises in rural areas (positive estimates) may be explained by Norway's grants system that favour's rural areas (Sørensen 2006; Straume and Shaw 2010).

Table 5: Total utilization of specialized outpatient health services without disaggregation

Model 1A: Total Utilization of specialist health services (without disaggregation)	β (Std. Error)	Tolerance	VIF
(Constant)	**512.484** (625.513)*		
andel_fastleger	**35365.858** (31363.250)	.716	1.397
reisetid_pub	**-1.011** (.344)***	.290	3.448
Reisetidpriv	**-0.200** (.450)	.229	4.363
Bruttoinnt	**0.001** (.001)	.276	3.627
Andel_0_15	**-1189.323** (5992.414)	.050	19.824
Andel_45_66	**-5996.086** (7839.410)	.017	59.358
Andel_67_79	**25527.831** (12834.339)**	.039	25.748
Andel_80ogover	**-26941.070** (18363.986)	.046	21.835
andel_sykefravær	**9246.008** (4218.087)**	.456	2.193
andel_alenebo80	**3082.363** (2189.236)	.341	2.928
andel_skilsmisser	**-3005.804** (19055.579)	.642	1.558
andel_dødelighet	**7241.262** (373.930)***	.552	1.811
andel_ensligeforsørgere	**1141.872** (2991.650)	.425	2.354
andel_ikkevinnv	**-2302.613** (269.758)***	.825	1.212
andel_kungrskole	**362.925** (103.726)***	.490	2.042
andel_psykuføre	**198.810** (97.297)**	.619	1.616
andel_sosialhjelp	**-10.175** (35.085)	.257	3.887
andel_barnevernstiltak	**-849.419** (5250.190)	.810	1.234
andel_sykepenger	**-12.395** (12.097)	.223	4.478
Dummy_priv	**47.061** (36.905)	.506	1.974
ØstfoldHF_dummy	**-100.710** (61.316)	.347	2.882
AskerBærumOsloHF_dummy	**44.454** (71.943)	.676	1.479
InnlandetHF_dummy	**-37.206** (15.972)**	.235	4.248
RingerikeHF_dummy	**-30.431** (17.596)*	.584	1.712
BuskerudHF_dummy	**-26.534** (18.023)	.833	1.201
BlefjellHF_dummy	**-35.003** (11.695)***	.476	2.100
VestfoldHF_dummy	**20.135** (9.994)**	.641	1.560
TelemarkHF_dummy	**1.624** (11.945)	.739	1.354
SørlandetHF_dummy	**8.537** (7.526)	.416	2.404
StavangerHF_dummy	**-10.006** (7.603)	.536	1.865
FonnaHF_dummy	**8.374** (7.224)	.520	1.922
BergenHF_dummy	**5.902** (6.147)	.549	1.822
FørdeHF_dummy	**-4.764** (5.768)	.454	2.202
SunmøreHF_dummy	**-2.986** (5.832)	.601	1.663
NordmøreRomsdalHF_dummy	**-2.769** (5.614)	.624	1.602
StOlavsHF_dummy	**-10.497** (4.788)**	.509	1.964
NordTrøndelagHF_dummy	**-0.844** (4.664)	.474	2.111
HelgelandHF_dummy	**14.108** (5.265)**	.516	1.938
NordlandHF_dummy	**3.029** (4.599)	.510	1.962
NordNorgeHF_dummy	**7.736** (4.101)*	.436	2.291
FinnmarkHF_dummy	**4.597** (5.177)	.406	2.464

*** = p<0.01   **=p<0.05   * = p<0.1 β = Beta coefficients

5.1.2 Total specialists' reimbursement with disaggregated variables

The following variables were dropped for being highly correlated, *Andel_ufør_18_39* (Tolerance= 0.007; VIF= 137.164), *Andel_ufør_40_69* (Tolerance= 0.095; VIF= 10.518), and *Andel_attføring* (Tolerance= 0.058; VIF= 17.160).

The new explanatory power of our model reduces slightly to $R^2 = 0.096$ after the following age-disaggregated categories are introduced for the variables; *Andel_grskole*, *Andel_rehab*, *Andel_Ufør*, *Andel_sosialhjelp* and *Andel_dødelighet.*

After disaggregation, two "new" variables are retained in the final regression. One of the "new" variables (estimate= 3066.374) represents a share of the population undergoing medical rehabilitation (*Andel_rehab_20_66*). The other "new" variable (estimate= -8.097) represents the share of the population that is unemployed (*Andel_arbeidssøkere*). Both variables have an insignificant effect on the utilization of specialist health services. This contradicts our hypotheses that assume increases in any of the groups would lead to higher utilization of specialist care.

Just as in the previous model (1A), the age group variables representing those aged between 0-15 years (*Andel_0_15*) and those aged between 45-66 years (*Andel_45_66*) have insignificant effect on the total utilization of specialist outpatient care. Additionally, the variable describing the age-group between 67-79 years (estimate= 22786.441) keeps its significant effect ($p<0.1$) on the dependent variable. This means that an increase of one in the share of population represented by this group, per 1 000 inhabitants will lead to an increase in the use of specialist health services corresponding to 22786.441. These results imply that individuals between the age-groups 0-15 and 45-66 consume less specialist outpatient services when compared to the reference group representing the age group 16-65. Consequently, individuals between 67-79 consume more than the reference group. The variable representing individuals in the age-group 80 years and over changes from being insignificant to significant ($p<0.1$) with an estimate of -30226.804. This means that an increase of one in the share of the population represented by this group per 1 000 inhabitants, will lead to a decrease in the total utilization of specialist outpatient corresponding to the estimate.

When the variable representing the share of the population with low education is disaggregated further to represent two groups (20-29 years and 30-59 years), the first group remains highly significant just like in model 1A ($p<0.01$). However, the second group representing the share of population with low education but aged between 30-59 becomes insignificant. This shows that age is important in differentiating what kind of impact a need characteristic (such as low education) will have on the utilization of specialist care.

All the other variables explaining need and supply do not change in terms of significance in both models.

The fixed effects dummy variable representing private specialists (*dummy_priv*) changes from being insignificant (estimate= 47.061) in the first model to becoming significant ($p<0.1$) with an estimate of 71.840. Likewise the dummy variable *VestfoldHF_dummy* (estimate= 6.680) change from being significant at ($p<0.05$) with corresponding estimates of 20.096 to become insignificant.

All the other fixed effects dummy variables do not change in terms of their significance levels in the two models.

Table 6 presents total reimbursements with disaggregated variables. As in all models, *** = $p<0.01$, **=$p<0.05$, * = $p<0.1$ and β = Beta coefficients.

Model 1B: Total reimbursements *(disaggregated variables)*	**β (Std. Dev)**	**Tolerance**	**VIF**
(Constant)	**776.907** (257.736)***		
andel_fastleger	**49467.418** (30678.700)	.672	1.489
reisetid_pub	**-1.287** (.328)***	.286	3.494
Reisetidpriv	**-0.264** (.432)	.223	4.475
Bruttoinnt	**0.001** (.001)	.266	3.758
Andel_0_15	**-8542.815** (6293.291)	.041	24.351
Andel_45_66	**2592.397** (7588.016)	.016	61.918
Andel_67_79	**22786.441** (12376.501)*	.038	26.659
Andel_80ogover	**-30226.804** (17960.405)*	.043	23.256
andel_rehab_20_66	**-3066.374** (4392.484)	.535	1.870
andel_sykefravær	**7683.931** (4438.663)*	.370	2.703
andel_alenebo80	**3265.186** (2128.096)	.325	3.078
andel_skilsmisser	**-2541.165** (18252.541)	.628	1.592
andel_dødelighet_20ogover	**108.838** (42.272)**	.526	1.902
andel_ensligeforsørgere	**-349.365** (3021.883)	.374	2.673
andel_arbeidsøkere	**-8.097** (18.449)	.126	7.906
andel_ikkevinnv	**-6020.984** (257.215)***	.872	1.147
andel_grskole_20_29	**8960.805** (2874.303)***	.297	3.362
andel_grskole_30_59	**-954.491** (741.710)	.352	2.838
andel_psykufore	**132.316** (103.047)	.565	1.771
andel_sosialhjelp_18_49	**2931.379** (2009.131)	.454	2.201
andel_barnevernstiltak	**-2147.044** (5098.872)	.772	1.296
andel_sykepenger	**-15.257** (18.002)	.103	9.691
Dummy_priv	**71.840** (36.233)*	.472	2.117
ØstfoldHF_dummy	**-120.052** (58.654)**	.340	2.938
AskerBærumOsloHF_dummy	**23.413** (68.766)	.664	1.506
InnlandetHF_dummy	**-56.418** (15.420)***	.227	4.406
RingerikeHF_dummy	**-40.281** (16.709)**	.581	1.720
BuskerudHF_dummy	**-7.743** (17.146)	.826	1.211
BlefjellHF_dummy	**-48.206** (11.258)***	.461	2.169
VestfoldHF_dummy	**6.680** (9.565)	.628	1.592
TelemarkHF_dummy	**-7.255** (11.420)	.725	1.379
SørlandetHF_dummy	**-.404** (7.335)	.394	2.539
StavangerHF_dummy	**-17.984** (7.401)**	.508	1.969
FonnaHF_dummy	-**5.726** (7.134)	.479	2.088
BergenHF_dummy	**-8.006** (6.045)	.511	1.958
FørdeHF_dummy	**-15.139** (5.724)***	.414	2.416
SunmøreHF_dummy	**-9.239** (5.728)	.560	1.787
NordmøreRomsdalHF_dummy	**-10.331** (5.411)*	.603	1.658
StOlavsHF_dummy	**-15.535** (4.661)***	.482	2.074
NordTrøndelagHF_dummy	**-6.715** (4.622)	.433	2.310
HelgelandHF_dummy	**6.084** (5.021)+	.511	1.957
NordlandHF_dummy	**-7.958** (4.541)*	.469	2.131
NordNorgeHF_dummy	**-1.563** (4.139)	.386	2.589
FinnmarkHF_dummy	**-4.439** (5.107)	.375	2.663

5.2 Utilization of Public specialist health services

The average utilization of public specialist health services is 888.6867, measured as the number of reimbursements to public specialists as a share of the population per 1 000 inhabitants. The number varies from a minimum of 26.98 to a maximum of 21976.42 reimbursements.

5.2.1 Public specialists' reimbursement without disaggregating variables

Table 6 presents the final regression after the following variables were dropped for being highly correlated; *Andel_rehab* (Tolerance= 0.020; VIF= 50.660), *Andel_ufør* (Tolerance= 0.062; VIF= 16.197), *Andel_attføring* (Tolerance= 0.052; VIF= 19.150), and *Andel_arbeidssøkere* (Tolerance= 0.014; VIF= 74.009). The explanatory power of this model is at an acceptable level of $R^2 = 0.121$ and an Anova *F* statistic estimate that is significant (sig. = 0.000).

The supply side variable representing the distribution of general practitioners (*Andel_fastleger*) is insignificant with a positive estimate of 27167.922. This means that the number of GPs is not important in explaining the level of utilization of specialist outpatient care. The finding is similar to the one in the previous model on total utilization. As mentioned earlier in the findings for the total utilization model, this contradicts our hypothesis that the number of GPs is negatively correlated to consumption of specialist care due to their role as gate-keepers. The finding therefore challenges the action plan proposed in the coordination reform that argues that increasing the number of GPs will reduce the utilization of specialist care. In addition, the finding contradicts other findings by Iversen (2002), Godager (2007), Nerland (2008) and Tjerbo (2010) who found that the number of GPs has a positive correlation to consumption of specialist care.

The variable representing travel time to a public hospital (*reisetid_pub*) is highly significant ($p<0.01$) with a negative estimate of -1.335. This is interpreted to mean that a one unit increase in time taken to travel to a public hospital will lead to a decrease in the usage of specialist health services by 1.335. This is in line with our hypothesis and findings by Nerland

and Hagen (2008). The variable representing travel time to private hospitals (*reisetid_priv*) also has a significant positive effect on the utilization of public specialist health services. These two findings are as expected and in line with our hypotheses.

As in the previous model on total utilization, the variable representing gross income has an insignificant effect on the use of public specialist health services. This contradicts our hypothesis and findings by Carlsen (2006).

The variables representing the age groups *Andel_0_15* (estimate= -8308.555), *Andel_45_66* (estimate= -2204.197) and *Andel_80ogover* (estimate= -26707.619) are all insignificant. As in the other models, the variable representing the age group between 67 and 79 is significant ($p<0.1$) with an estimate of 2924.408. This means that an increase by one, in the share of population represented by this group per 1 000 inhabitants, will lead to an increase in the use of public specialist health services corresponding to their estimates when measured in relation to the reference age variable *Andel_16_46*.

The variables representing sickness leave (Andel_sykefravær) and share above 80 but living alone (Andel_alenebo80) are both significant at $p<0.05$ and $p<0.1$. This means an increase in any of the groups will lead to an increase in the use of specialist outpatient care.

The variable representing divorces (*Andel_skilsmisser*) is insignificant and has a negative estimate of -12008.591. This is contrary to our hypothesis but corresponds to the findings about the overall (total) utilization of specialist services.

The variable representing mortality (Andel_dødelighet) is highly significant ($p<.001$) with an estimate of 4682.053. This is interpreted to mean that an increase of one, in the share of population represented by this group per 1 000 inhabitants, will lead to an increase in the use of public specialist outpatient services corresponding to the estimate. This is in line with our hypothesis and findings by Hagen (2009).

Just like in the previous models, the variable representing non-European immigrants (*Andel-ikkevinnv*) is highly significant ($p<0.01$) with an estimate of -3472.478. This means that an increase by one, in the share of population represented by this group per 1 000 inhabitants, will lead to a decrease in the use of public specialist outpatient services. This contradicts our hypothesis but is similar to findings in the previous model about total utilization. As mentioned earlier, Ingebretsen & Nergård (2007) and Peter C. Smith (2006) have documented that the negative estimate is due to under-consumption common amongst minority groups.

The variable representing persons with low education (*Andel_kungrskole*) is highly significant (p<.001) with an estimate of -295.822. This is interpreted to mean that an increase by one, in the share of population represented by this group per 1 000 inhabitants, will lead to a decrease in the use of public specialist outpatient services. This contradicts our hypothesis and findings in the previous model (total usage) where this group had a positive correlation with utilization of specialist services before disaggregation.

The variable representing persons with psychological disability (*Andel-psykuføre*) is significant (p<0.05) with an estimate of 270.406. This is in line with our hypothesis and findings from the previous model on total utilization. The findings mean that an increase of one, in the share of population represented by this group per 1 000 inhabitants, will mean an increase in the utilization of public specialist outpatient care by 270.406.

The variables representing share of population that are single parents (*Andel_ensligeforsørgere*), persons receiving social benefit (*Andel_sosialhjelp*), child welfare services (*Andel_barnevernstiltak*) and sickness benefits (*Andel_sykepenger*) are all insignificant. This contradicts our hypothesis but the results are similar to those from the first model on total utilization of specialist outpatient services.

The following dummy variables are significant; *ØstfoldHF* (p<0.01; estimate= -146.842), *RingerikeHF* (p<0.1; estimate= -26.389), *BlefjellHF* (p<0.01; estimate=-20.876), *TelemarkHF* (p<0.1; estimate= 13.141), *NordlandHF* (p<0.05; estimate= 6.669), *HelgelandHF* (p<0.01; estimate= 18.159), *NordNorgeHF* (p<0.01; estimate= 11.311) and *FinnmarkHF* (p<0.01; estimate= 12.743). Significant health enterprises with positive estimates mean that they receive more money than the reference dummy variable representing *AkershusHF*. Additionally, enterprises with negative estimates receive less money than the reference. Findings on the dummy variables are similar to those of the first model on total utilization.

Table 7: Public reimbursements without disaggregation

Model 2A: **Utilization of Public specialist services *(without disaggregation)***	***β*** (Std. Error)	Tolerance	VIF
(Constant)	**736,299** (212,352)***		
andel_fastleger	**27167,922** (31711,652)	,670	1,493
reisetid_pub	**#1,335** (0,270)***	,302	3,316
reisetidpriv	**0,581** (0,341)*	,242	4,130
Bruttoinnt	**,000** (,001)	,231	4,331
Andel_0_15	**#8308,555** (6636,375)	,052	19,403
Andel_45_66	**#2204,197** (8083,127)	,017	57,550
Andel_67_79	**2924,408** (14111,416)*	,036	27,959
Andel_80ogover	**#26707,619** (20026,320)	,047	21,466
andel_sykefravær	**7761,888** (3430,272)**	,441	2,265
andel_alenebo80	**3472,239** (1809,615)*	,326	3,063
andel_skilsmisser	**#12008,591** (17446,488)	,623	1,606
andel_dødelighet	**4682,053** (377,534)***	,582	1,718
andel_ensligeforsørgere	**3384,950** (2489,986)	,385	2,600
andel_ikkevinnv	**#3472,478** (243,946)***	,719	1,392
andel_kungrskole	**#295,822** (86,997)***	,526	1,900
andel_psykuføre	**270,406** (114,526)**	,603	1,657
andel_sosialhjelp	**#29,721** (40,633)	,261	3,836
andel_barnevernstiltak	**3061,171** (4314,604)	,822	1,216
andel_sykepenger	**#8,066** (13,847)	,226	4,432
Dummy_priv	**45,401** (27,640)	,421	2,377
ØstfoldHF_dummy	**#146,842** (55,759)***	,492	2,033
AskerBærumOsloHF_dummy	**#34,757** (47,283)	,546	1,832
InnlandetHF_dummy	**#5,713** (12,770)	,286	3,493
RingerikeHF_dummy	**#26,389** (14,694)*	,676	1,480
BuskerudHF_dummy	**1,507** (11,611)	,732	1,365
BlefjellHF_dummy	**#20,876** (9,435)***	,549	1,822
VestfoldHF_dummy	**7,891** (7,118)	,533	1,878
TelemarkHF_dummy	**13,141** (7,932)*	,642	1,557
SørlandetHF_dummy	**#2,660** (5,566)	,415	2,412
StavangerHF_dummy	**#0,455** (5,273)	,445	2,248
FonnaHF_dummy	**3,128** (5,258)	,484	2,068
BergenHF_dummy	**1,216** (4,171)	,476	2,103
FørdeHF_dummy	**2,249** (4,459)	,449	2,227
SunmøreHF_dummy	**5,835** (4,183)	,521	1,919
NordmøreRomsdalHF_dummy	**4,484** (4,089)	,580	1,724
StOlavsHF_dummy	**#4,545** (3,307)	,445	2,249
NordTrøndelagHF_dummy	**#4,101** (3,443)	,454	2,203
HelgelandHF_dummy	**18,159** (3,826)***	,529	1,891
NordlandHF_dummy	**6,669** (3,235)**	,459	2,179
NordNorgeHF_dummy	**11,311** (3,855)***	,413	2,420
FinnmarkHF_dummy	**12,743** (3,855)***	,397	2,517

*** = p<0.01 ** = p<0.05 * = p<0.1 β = Beta coef

5.2.2 Public specialists' reimbursement with disaggregated variables

The following variables (*Andel_grskole, Andel_rehab*, *Andel_Ufør*, *Andel_sosialhjelp and Andel_dødelighet*) have been disaggregated into various age groups in order to see whether their effect on the dependent variable is centered on age distribution. Variables dropped because of high correlation are, *Andel_ufør_18_39* (Tolerance=0.007; VIF= 151.597), *Andel_ufør_40_69 (*Tolerance= 0.078; VIF= 12.780), *Andel_attføring* (Tolerance= 0.059; VIF= 16.862). The explanatory power of the model increases slightly to $R^2 = 0.123$

After disaggregation, the variable representing time taken to travel to private hospitals (*resitid_priv*) increases its significance from $p<0.1$ to $p<0.05$. The interpretation is the same as before that an increase in the time taken to travel to a private hospital will lead to an increase in the consumption of public specialist outpatient services. This is in line with our hypothesis and general findings about travel time by Nerland and Hagen (2008).

The following variables change from being insignificant in the previous model, to being significant after disaggregation of some variables into age categories; Personal income ($p<0.1$; estimate= 0.001), share of population in age group 0-15 ($p<0.1$; estimate= 10982.087) and share receiving social benefit ($p<0.01$; estimate= 4645.021). This is a surprising finding which implies that a part of the explanation is centered on age distribution.

The variables representing share of the population aged between 67-79 and the share represented by mortality every year, change from being significant in the previous model to insignificant in this model.

The Health Enterprise dummy representing (*NordTrøndelagHF)* regions changes from being insignificant to significant ($p<0.1$) with an estimate of 6.448. Likewise, (*StOlavHF)* changes from being insignificant to significant ($p<0.05$; estimate= 3.074).

All the other variables remain the same after disaggregation.

Table 8 shows public utilization after disaggregation.

Model 2B: Utilization of Public specialist services *(disaggregated variables)*	*β* (Std. Error)	Collinearity Statistics Tolerance	VIF
(Constant)	**524.896** (199.784)***		
andel_fastleger	**32098.633** (29399.741)	,631	1,584
reisetid_pub	**-1.476** (.245)***	,297	3,365
reisetidpriv	**0.764** (.311)**	,237	4,224
Bruttoinnt	**0.001** (.000)*	,217	4,614
Andel_0_15	**-10982.087** (6648.501)*	,041	24,111
Andel_45_66	**-2766.962** (7496.934)	,016	61,009
Andel_67_79	**20795.099** (12928.175)	,035	28,875
Andel_80ogover	**-12662.467** (18609.487)	,044	22,869
andel_rehab_20_66	**-1747.580** (3658.129)	,488	2,050
andel_sykefravær	**4540.120** (3432.323)	,356	2,808
andel_alenebo80	**3783.966** (1666.263)**	,311	3,212
andel_skilsmisser	**-8851.717** (15949.314)	,603	1,658
andel_dødelighet_20ogover	**61.642** (72.567)	,632	1,582
andel_ensligeforsørgere	**759.184** (2406.729)	,333	3,004
andel_arbeidsøkere	-14.231 (20.603)	,126	7,948
andel_ikkevinnv	**-5478.857** (205.758)***	,776	1,289
andel_grskole_20_29	**6832.419** (2307.179)***	,276	3,627
andel_grskole_30_59	**-854.108** (594.523)	,330	3,028
andel_psykufore	**211.118** (115.352)*	,556	1,797
andel_sosialhjelp_18_49	**4645.021** (1524.194)***	,448	2,234
andel_barnevernstiltak	**-88.582** (3975.420)	,783	1,278
andel_sykepenger	**-1.497** (19.883)	,102	9,773
Dummy_priv	**63.959** (25.779)**	,390	2,561
ØstfoldHF_dummy	**-149.350** (50.811)***	,479	2,089
AskerBærumOsloHF_dummy	**-47.380** (42.710)	,534	1,872
InnlandetHF_dummy	**-18.150** (11.761)	,275	3,640
RingerikeHF_dummy	**-27.989** (13.255)**	,674	1,484
BuskerudHF_dummy	**15.545** (10.474)	,723	1,384
BlefjellHF_dummy	**-28.797** (8.660)***	,529	1,890
VestfoldHF_dummy	**-.628** (6.518)	,513	1,948
TelemarkHF_dummy	**6.956** (7.242)	,625	1,600
SørlandetHF_dummy	**-2.653** (5.252)	,376	2,661
StavangerHF_dummy	**-6.436** (4.966)	,399	2,505
FonnaHF_dummy	**-4.183** (4.966)	,435	2,297
BergenHF_dummy	**-5.901** (3.935)	,429	2,330
FørdeHF_dummy	**-3.098** (4.235)	,401	2,494
SunmøreHF_dummy	**2.571** (3.930)	,474	2,109
NordmøreRomsdalHF_dummy	**-.171** (3.766)	,553	1,809
StOlavsHF_dummy	**-7.081** (3.074)**	,415	2,409
NordTrøndelagHF_dummy	**-6.448** (3.281)*	,402	2,490
HelgelandHF_dummy	**10.089** (3.518)***	,512	1,952
NordlandHF_dummy	**-2.855** (3.082)	,410	2,440
NordNorgeHF_dummy	**3.884** (2.888)	,356	2,810
FinnmarkHF_dummy	**4.123** (3.645)	,363	2,758

*** = p<0.01 ** = p<0.05 * = p<0.1 *β* = Beta coefficients

5.3 Utilization of private specialist health services

The average utilization of private specialist care is 175.8203, measured as the number of reimbursements to private specialists as a share of the population per 1 000 inhabitants. Dependent on the level of usage by municipalities, utilization varies from 0 to 2057.22.

5.3.1 Private reimbursement without disaggregating variables

The following variables were dropped for having VIF values above 10 and Tolerance values below 0.1, meaning that they are highly correlated with other variables. These are, *Andel_arbeidssøker* (Tolerance= 0.014; VIF= 73.809), *Andel_rehab* (Tolerance= 0.020; VIF= 50.803), *Andel_attføring* (Tolerance= 0.052; VIF= 19.148), and *Andel_ufør* (Tolerance= 0.062; VIF=16.136).

The explanatory power of our model is very strong (R^2 = 0.584) which means that our model explains 58.4% of the variation in the utilization of private specialist outpatient health care services. The ANOVA estimate (sig. = 0.000) assesses the statistical significance of the results against the hypothesis that the multiple R in the population is equal to zero. The above model reaches the stated significance because our estimated sig. = 0.000 which means that our $p<.0005$.

The variable representing general practitioners (*Andel_fastleger*) is significant ($p<0.05$) with a positive estimate of 14328.352. This means that an increase of one in the share of population represented by this group per 1 000 inhabitants, will lead to an increase in the use of private outpatient services corresponding to the estimate. This result contradicts our hypothesis and the results from the previous models on total and public utilization. However, the results are in line with findings by Iversen (2002), Godager (2007), Nerland (2008) and Tjerbo (2010).

As expected, the variable representing time taken to travel to a private hospital (*reisetid_priv*) is significant ($p<0.01$) with an estimate of -0.337. This means that an increase by one unit of the time used travelling to the nearest private outpatient specialist, will lead to a decrease in the utilization of private specialists.

The variable representing travel time to a public specialist (*reisetid_pub*) has an insignificant effect on the use of private specialist outpatient services. In addition to contradicting our hypothesis, this finding is similar to the one in the previous model *(public utilization*) where travel time to a private specialist had an insignificant effect on the use of public specialists.

The variable representing gross income (*Brutto inntekt*) is highly significant (p<0.01) with an estimate of 0.001. This is interpreted to mean that an increase in income will generally lead to an increase in the use of private specialists. This finding contradicts our hypothesis and findings by Carlsen (2006). Additionally, the result is different from the first two models where the effect of income was insignificant before disaggregation.

The variables representing the age groups 45 -66 (*Andel_45_66*) and 67-79 (*Andel_67_79*) are both highly significant (p<0.01 and p<0.05) with estimates of -5723.983 and 6367.196. This means that, in comparison to the reference age group (*Andel_16_44*), an increase in the population represented by the age group 45-66 per 1 000 inhabitants, will lead to a decrease in the use of private outpatient services while an increase in the age group 67-79 will lead to an increase in utilization. The findings contrast our hypothesis that infants and the aged would generally consume more specialist health services when compared to the reference group.

The following variables have an insignificant effect on the use of private specialists; *Andel_0_15* (estimate=1763.388), *Andel_80ogover* (estimate= 3993.561), *Andel_sykefravær* (estimate= -349.111), *Andel_alenebo80* (estimate= 428.922) and *Andel_sosialhjelp* (estimate= -6.148).

The following variables are all significant at p<0.01; *Andel_dødelighet* (estimate= 4524.203), *Andel_ensligeforsørger* (estimate= 1961.017), *Andel_kungrskole* (estimate= 54.024), *Andel_ikkvinnv* (estimate= -1054.732) and *Andel_barnevernstiltak* (estimate= -3219.22). Interpretations are the same as those made in model 1 and 2. The variable representing psychological disability (*Andel_psykufør*), *Andel_skilsmisser* (estimate= 1552.516) and *Andel_sykepenger* (estimate=) are significant at p<0.05.

All the dummy variables are significant. Further, only *ØstfoldHF* and *AskerBærumOsloHF* have positive estimates which means that they receive more reimbursements on average for private specialists when compared to the reference health enterprise *(AkershusHF)*.

Table 9: Private utilization of specialist health services without disaggregation

Model 3: Private Utilization of Specialist Health Services *(without disaggregation)*	β **(Std. Error)**	**Tolerance**	**VIF**
(Constant)	**36.761** (46.594)		
andel_fastleger	**14328.352** (7061.143)**	,670	1,492
reisetid_pub	**-0.036** (.060)	,307	3,262
reisetidpriv	**-.337** (0.067)***	,318	3,148
Bruttoinnt	**0.001** (0.000)***	,243	4,114
Andel_0_15	**1763.388** (1472.643)	,052	19,259
Andel_45_66	**-5723.983** (1790.319)***	,018	56,907
Andel_67_79	**6367.196** (3088.238)**	,037	26,991
Andel_80ogover	**3993.561** (4460.970)	,047	21,469
andel_sykefravær	**-349.111** (762.993)	,443	2,259
andel_alenebo80	**428.922** (398.281)	,334	2,991
andel_skilsmisser	**9551.942** (3886.212)**	,623	1,606
andel_dødelighet	**4524.203** (83.824)***	,586	1,707
andel_ensligeforsørgere	**1961.017** (533.262)***	,416	2,402
andel_ikkevinnv	**-1054.732** (53.894)***	,731	1,369
andel_kungrskole	**54.024** (19.326)***	,529	1,890
andel_psykufør	**53.154** (24.568)**	,603	1,657
andel_sosialhjelp	**6.148** (9.051)	,261	3,837
andel_barnevernstiltak	**-3219.22** (960.573)***	,825	1,212
andel_sykepenger	**-6.683** (3.084)**	,226	4,432
ØstfoldHF_dummy	**27.889** (12.384)**	,495	2,021
AskerBærumOsloHF_dummy	**33.183** (7.903)***	,547	1,828
InnlandetHF_dummy	**-34.527** (2.844)***	,286	3,492
RingerikeHF_dummy	**-17.574** (3.271)***	,676	1,478
BuskerudHF_dummy	**-9.601** (2.567)***	,744	1,345
BlefjellHF_dummy	**-20.696** (2.101)***	,549	1,820
VestfoldHF_dummy	**-3.328** (1.584)**	,534	1,874
TelemarkHF_dummy	**-16.245** (1.762)***	,646	1,549
SørlandetHF_dummy	**-3.316** (1.226)***	,424	2,360
StavangerHF_dummy	**-11.895** (1.172)***	,447	2,238
FonnaHF_dummy	**-6.043** (1.171)***	,484	2,067
BergenHF_dummy	**-2.748** (.924)***	,480	2,082
FørdeHF_dummy	**-11.083** (.989)***	,453	2,208
SunmøreHF_dummy	**-10.453** (.930)***	,523	1,913
NordmøreRomsdalHF_dummy	**-11.323** (.911)***	,580	1,724
StOlavsHF_dummy	**-8.938** (.734)***	,448	2,232
NordTrøndelagHF_dummy	**-1.762** (.764)**	,457	2,187
HelgelandHF_dummy	**-8.455** (.849)***	,533	1,876
NordlandHF_dummy	**-5.663** (.718)***	,462	2,165
NordNorgeHF_dummy	**-7.714** (.658)***	,418	2,392
FinnmarkHF_dummy	**-8.223** (.846)***	,413	2,423

***** = p<0.01   ** = p< 0.05   * = p<0.1 β = Beta coefficients**

5.3.2 Private reimbursement with disaggregated variables

The variables (*Andel_grskole, Andel_rehab, Andel_Ufør, Andel_sosialhjelp and Andel_dødelighet*) have been disaggregated into various age groups in order to see whether their effect on the dependent variable is centered on age distribution.

The R^2 of the above model = 0.605 which means that our model explains 60.5% of the variation in the utilization of specialist health services while the Anova output has an estimate (sig. = 0.000). The following variables were dropped for being highly correlated, *Andel_ufør_18_39* (Tolerance= 0.007; VIF= 151.390), *Andel_ufør_40_69* (Tolerance=0.078; VIF= 12.768), *Andel_attføring* (Tolerance= 0.059; VIF= 16.861).

The variable representing those aged 80 years and above (*Andel_80ogover*) now changes to become significant (p<0.01) with an estimate of 4156.063 after age disaggregation on some need variables is introduced. Likewise, the variable representing those receiving social benefit (*Andel_sosialhjelp-18_49*) becomes significant (p<0.01; estimate= 1248.316) after it is disaggregated to cover only those between the ages of 18 to 49.

The variable representing travel distance to a public specialist changes to become significant (p<0.1) with an estimate of -0.137. This is a surprising finding that contradicts the previous findings.

The dummy variables representing *ØstfoldHF* and *Buskerud*HF both change to become insignificant. All the other need, supply and dummy variables retain the same level of significance and estimates as in model 3A.

Table 10: *Private utilization with disaggregated variables*

Model 3B: Private Utilization of Specialist Health Services (*disaggregated variables*)	**β (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**117.781** (57.593)**		
andel_fastleger	**18399.401** (8524.369)**	.632	1.582
reisetid_pub	**-.137** (.071)*	.303	3.304
reisetidpriv	**-.172** (.081)**	.297	3.367
Bruttoinnt	**0.001** (0.000)***	.225	4.437
Andel_0_15	**-1957.938** (1919.398)	.042	23.875
Andel_45_66	**-3850.644** (2164.315)**	.017	60.412
Andel_67_79	**8345.201** (376.842)	.036	27.749
Andel_80ogover	**4156.063** (5398.904)**	.044	22.869
andel_rehab_20_66	**-50.110** (1060.905)	.488	2.048
andel_sykefravær	**-1132.083** (994.719)	.357	2.802
andel_alenebo80	**1145.074** (479.752)**	.316	3.163
andel_skilsmisser	**11415.918** (4627.241)**	.603	1.658
andel_dødelighet_20ogover	**45.489** (21.011)**	.635	1.575
andel_ensligeforsøgere	**2068.005** (683.586)***	.347	2.878
andel_arbeidssøkere	**4.464** (5.977)	.126	7.948
andel_ikkevinnv	**-2306.150** (59.386)***	.784	1.276
andel_grskole_20_29	**2077.868** (666.810)***	.278	3.599
andel_grskole_30_59	**-535.961** (168.046)***	.348	2.874
andel_psykuføre	**32.229** (33.463)	.557	1.797
andel_sosialhjelp_18_49	**1248.316** (439.147)***	.455	2.199
andel_barnevernstiltakk	**-3265.577** (1151.513)***	.787	1.271
andel_sykepenger	**-13.890** (5.769)**	.102	9.773
ØstfoldHF_dummy	**17.950** (14.714)	.480	2.081
AskerBærumOsloHF_dummy	**23.834** (12.354)**	.537	1.861
InnlandetHF_dummy	**-43.782** (3.410)***	.275	3.635
RingerikeHF_dummy	**-25.023** (3.840)***	.676	1.480
BuskerudHF_dummy	**-1.241** (3.010)	.737	1.358
BlefjellHF_dummy	**-26.439** (2.512)***	.529	1.889
VestfoldHF_dummy	**-9.296** (1.882)***	.518	1.930
TelemarkHF_dummy	**-18.978** (2.100)***	.626	1.598
SørlandetHF_dummy	**-7.086** (1.521)***	.377	2.652
StavangerHF_dummy	**-15.113** (1.441)***	.399	2.504
FonnaHF_dummy	**-11.768** 1.439)***	.437	2.291
BergenHF_dummy	**-7.482** (1.142)***	.429	2.330
FørdeHF_dummy	**-14.972** (1.229)***	.401	2.494
SunmøreHF_dummy	**-13.000** (1.140)***	.474	2.109
NordmøreRomsdalHF_dummy	**-14.326** (1.091)***	.554	1.805
StOlavsHF_dummy	**-10.944** (0.892)***	.415	2.408
NordTrøndelagHF_dummy	**-5.104** (0.954)***	.402	2.490
HelgelandHF_dummy	**-11.355** (1.020)***	.513	1.949
NordlandHF_dummy	**-9.395** (0.894)***	.410	2.440
NordNorgeHF_dummy	**-10.807** (0.838)***	.356	2.810
FinnmarkHF_dummy	**-10.877** (1.053)***	.368	2.717

***** = p<0.01   ** = p< 0.05   * = p<0.1 β = Beta coefficients**

5.4 Substitution between public and private entities in the utilization of specialist health services

The previous three models have tested the factors explaining the variation in the total consumption of outpatient specialist care, and individual consumption at both the public and private levels. This new model will test whether there is a possibility for substitution between public and private outpatient specialist health services.

The following variables have been excluded because of high correlation with other variables, *Andel_arbeidsøkere* (Tolerance= 0.016; VIF= 62.244), *Andel_rehab* (Tolerance= 0.025; VIF= 40.580), *Andel_attføring* (Tolerance= 0.055; VIF= 18.140) and *Andel_ufør* (Tolerance= 0.064; VIF= 15.561). The explanatory strength of this model is extremely high (R^2 = 0.999) which is expected given that the dependent variables public and private reimbursements are compared against each other.

The following variables are significant at p<0.001; *Andel_fastleger* (estimate= 0.650), *reisetid_pub* (estimate=0.000), *Andel_45_66* (estimate= -0.016), *Andel_67_79* (estimate= -0.016) and *Andel_sykefravær* (estimate= 5.838), *Andel_skilsmisser* (estimate= -15.531) and *Andel_alenebo80* (estimate= -2.118). Additionally, the variable *Andel_ensligeforsørgere* (estimate= -1.303) is significant at p<0.05 while *Andel_80ogover* (estimate= -7.781) is significant at p<0.1. The interpretation for the above variables is that there is significant difference in the groups represented by the variables above and the choice of whether one uses public or private specialists. This means that no substitution is taking place between public and private specialists in relation to the above variables. Further, positive estimates mean that the share of the population in the group utilizes more public specialists when compared to private ones. This means that an increase by one of the variables representing share of population of general practitioners, travelling time to public hospitals, those on sick leave, and those aged between 45 and 66 years, will favor the increased utilization of public specialists. In the same line, an increase by one of individuals represented by significant variables with negative estimates will increase utilization of private specialists.

The following variables are insignificant *reisetid_priv*, *Brutto inntekt*, *Andel_0_15*, *Andel_dødelighet*, *Andel_ikkevinnv*, *Andel_kungrskole*, *Andel_psykuføre*, *Andel_sosialhjelp*, *Andel_barnevernstiltak* and *Andel_sykepenger*. Variables with an insignificant effect depict a situation where some form of substitution is taking place i.e. there is no significant difference between the share of the population represented by these variables and the type of outpatient specialist service they choose to consume (public or private). Positive estimates show substitution that favours public specialists while negative estimate portrays a situation where substitution favours private specialists.

All the dummy variables are significant except *AskerBærumOsloHF*. This means that there is no substitution between the reference health enterprise (*AkershusHF*) and all the health enterprises that are significant. This finding is logical in the sense that the catchment areas represented by *AskerBærumOsloHF* and *AkershusHF* are next to each other therefore increasing chances of substitution.

Table 11: Public-Private mix without disaggregation

Model 4A: Public-Private mix *(without disaggregation)*	**β (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**9.975** (0.063)***		
andel_fastleger	**44.213** (6.818)***	.717	1.394
reisetid_pub	**0.000** (0.000)***	.294	3.402
Reisetidpriv	**0.000** (0.000)	.238	4.195
Bruttoinnt	**0.000** (0.000)	.311	3.212
Andel_0_15	**-.306** (1.294)	.053	18.834
Andel_45_66	**7.050** (1.701)***	.017	57.348
Andel_67_79	**-15.807** (2.875)***	.038	26.486
Andel_80ogover	**-7.781** (4.060)*	.047	21.395
andel_sykefravær	**5.838** (.971)***	.489	2.046
andel_alenebo80	**-2.118** (0.514)***	.348	2.872
andel_skilsmisser	**-15.531** (4.214)***	.681	1.469
andel_dødelighet	**-.076** (0.088)	.552	1.811
andel_ensligeforsørgere	**-1.303** (0.655)**	.441	2.267
andel_ikkevinnv	**.005** (0.074)	.815	1.227
andel_kungrskole	**0.032** (0.024)	.486	2.059
andel_psykuføre	**-.014** (0.028)	.618	1.618
andel_sosialhjelp	**-.002** (0.010)	.284	3.520
andel_barnevernstiltak	**0.030** (1.194)	.820	1.220
andel_sykepenger	**-.001** (0.003)	.239	4.180
Dummy_priv	**0.013** (0.009)	.529	1.890
ØstfoldHF_dummy	**-0.042** (0.020)**	.491	2.035
AskerBærumOsloHF_dummy	**0.017** (0.023)	.777	1.287
InnlandetHF_dummy	**-0.015** (0.004)***	.235	4.250
RingerikeHF_dummy	**1.719** (0.005)***	.579	1.729
BuskerudHF_dummy	**1.444** (0.005)***	.787	1.271
BlefjellHF_dummy	**1.228** (0.003)***	.432	2.316
VestfoldHF_dummy	**1.082** (0.003)***	.552	1.812
TelemarkHF_dummy	**0.959** (0.003)***	.665	1.503
SørlandetHF_dummy	**0.862** (0.002)***	.331	3.023
StavangerHF_dummy	**0.424** (0.002)***	.433	2.310
FonnaHF_dummy	**0.387** (0.002)***	.414	2.415
BergenHF_dummy	**0.355** (0.001)***	.418	2.392
FørdeHF_dummy	**0.329** (0.001)***	.334	2.996
SunmøreHF_dummy	**0.859** (0.001)***	.456	2.192
NordmøreRomsdalHF_dummy	**0.805** (0.001)***	.471	2.123
StOlavsHF_dummy	**0.757** (0.001)***	.354	2.822
NordTrøndelagHF_dummy	**0.725** (0.001)***	.325	3.081
HelgelandHF_dummy	**0.915** (0.001)***	.378	2.648
NordlandHF_dummy	**0.870** (0.001)***	.356	2.806
NordNorgeHF_dummy	**0.828** (0.001)***	.289	3.461
FinnmarkHF_dummy	**0.791** (0.001)***	.291	3.438

***** = p<0.01 ** = p< 0.05 * = p<0.1 β = Beta coefficients**

In this section, the following variables; *Andel_grskole*, *Andel_rehab*, *Andel_Ufør, Andel_sosialhjelp and Andel_dødelighet* have been disaggregated into various age-groups in order to test whether their effect on the dependent variable is centered on age distribution. The explanatory power of this model is the same as that for model 4A (R^2 =0.999). Additionally, the following variables have been excluded due to high correlation with other variables, *Andel_ufør_18_39* (Tolerance= 0.008; VIF= 132.920), *Andel_attføring* (Tolerance= 0.061; VIF= 16.474) and *Andel_ufør_40_69* (Tolerance= 0.096; VIF= 10.463).

The following variables change from insignificance in the previous model to significance after disaggregation. They are; *Andel_0_15* (estimate= -2.821), *Andel_dødelighet_20ogover* (estimate= 0.029), *Andel_grskole_20_29* (estimate= 3.770) and *Andel_sosialhjelp_18_49* (estimate= -1.184). This is interpreted to mean that there is no form of substitution taking place between the public and private specialists in the treatment of the above groups. All the other need and supply variables remain the same with similar estimates.

All the dummy variables keep similar estimate values and significance levels as the previous model.

Table 12 shows public-Private mix with disaggregation.

Model 4B: Public-Private mix (disaggregated)	***β*** **(Std. Error)**	**Tolerance**	**VIF**
(Constant)	**9,941** (0,060)***		
andel_fastleger	**49,297** (6,574)***	,668	1,498
reisetid_pub	**0,000** (0,000)***	,290	3,450
Reisetidpriv	**0,000** (0,000)	,230	4,355
Bruttoinnt	**0,000** (0,000)	,301	3,319
Andel_0_15	**#2,821** (1,333)**	,043	23,074
Andel_45_66	**9,415** (1,615)***	,017	59,753
Andel_67_79	**#15,445** (2,716)***	,037	27,289
Andel_80ogover	**#11,418** (3,900)***	,044	22,806
andel_rehab_20_66	**#6,127** (1,033)*	,540	1,851
andel_sykefravær	**7,293** (0,997)***	,401	2,493
andel_alenebo80	**2,658** (0,488)***	,335	2,982
andel_skilsmisser	**#12,668** (4,006)***	,652	1,534
andel_dødelighet_20ogover	**0,029** (0,009)***	,526	1,900
andel_ensligeforsørgere	**#2,481** (0,651)***	,386	2,591
andel_arbeidsøkere	**#0,001** (0,005)	,139	7,190
andel_ikkevinnv	**#0,021** (0,067)	,883	1,133
andel_grskole_20_29	**3,770** (0,635)***	,281	3,558
andel_grskole_30_59	**0,043** (0,169)	,358	2,795
andel_psykuføre	**#0,016** (0,029)	,567	1,763
andel_sosialhjelp_18_49	**#1,184** (0,440)***	,449	2,225
andel_barnevernstiltak	**2,192** (1,137)*	,783	1,278
andel_sykepenger	**0,000** (0,005)	,113	8,888
Dummy_priv	**0,014** (0,009)	,506	1,976
ØstfoldHF_dummy	**#0,040** (0,019)**	,486	2,057
AskerBærumOsloHF_dummy	**0,020** (0,022)	,768	1,302
InnlandetHF_dummy	**#0,012** (0,004)***	,230	4,339
RingerikeHF_dummy	**1,717** (0,004)***	,577	1,733
BuskerudHF_dummy	**1,444** (0,005)***	,783	1,277
BlefjellHF_dummy	**1,228** (0,003)***	,422	2,368
VestfoldHF_dummy	**1,082** (0,002)***	,544	1,837
TelemarkHF_dummy	**0,959** (0,003)***	,656	1,525
SørlandetHF_dummy	**0,863** (0,002)***	,316	3,162
StavangerHF_dummy	**0,422** (0,002)***	,410	2,438
FonnaHF_dummy	**0,387** (0,002)***	,384	2,605
BergenHF_dummy	**0,353** (0,001)***	,391	2,556
FørdeHF_dummy	**0,329** (0,001)***	,306	3,264
SunmøreHF_dummy	**0,857** (0,001)***	,427	2,344
NordmøreRomsdalHF_dummy	**0,804** (0,001)***	,456	2,191
StOlavsHF_dummy	**0,758** (0,001)***	,339	2,953
NordTrøndelagHF_dummy	**0,726** (0,001)***	,300	3,336
HelgelandHF_dummy	**0,915** (0,001)***	,374	2,677
NordlandHF_dummy	**0,869** (0,001)***	,327	3,055
NordNorgeHF_dummy	**0,827** (0,001)***	,259	3,861
FinnmarkHF_dummy	**0,790** (0,001)***	,270	3,702

***** = p<0.01 ** = p< 0.05 * = p<0.1** ***β*** **= Beta coefficients**

6 Discussion

6.1 Study objectives

The purpose of this thesis was to explain the variation in the use of specialist outpatient health services. In this regard, four models were constructed to investigate the factors that explain total consumption, Public provision, private provision and the possibility for substitution in a public-private mix. The study aims to fill a gap that exists in the knowledge of factors explaining choice of specialist services (whether public or private). Additionally, Midttun and Hagen (2006) have found that political leanings in Norway have had an effect on the composition of medical specialists. For instance, they found that increased representation of the conservative political wing led to an increase in the proportion of private specialists. Given that there is a strong possibility that a different political coalition from the one today may head the next government, an analysis of the factors explaining use of either public or private specialist care may be used to better inform the choice of action when/if change takes place.

Our models have taken into use a comprehensive amount of explanatory variables describing socio-economic status, health status and supply side factors that act as proxies for explaining the need for specialist care. The weighted Least Squares regression method has been used for the analysis while all variables (except income and travel time) have been standardized as a share of the population, per 1 000 inhabitants. Population size of each municipality has been used to calculate weights for use as “fixed effects” for health enterprise catchment areas. Additionally, all variables represent a cell that includes information on municipality, gender and number of inhabitants.

6.2 Main findings

The first model gives a picture of the total usage of specialist care services while the second and third models present the factors affecting the choice of either public or private consumption. Model 4 gives findings on whether there is substitution between public and private provision of specialist outpatient services. The findings are divided into two groups (one for disaggregated variables and the other without disaggregation).

Table 13 presents the main findings when the variables are not disaggregated. Results from the first three models show that the distribution of general practitioners is only important in explaining the utilization of private specialist care. An increase in the number of GPs increases the amount of private specialist services consumed. The insignificant findings on the effect of GPs on utilization of total and public specialists clearly contradicts findings from recent Norwegian studies[4]. In addition, the findings are in contrast to the policy plan of the coordination reform - where a 50% increase in the number of GPs is envisaged as a way of reducing the use of specialist care. A possible explanation for these discrepancies between our results and those of previous studies, may be explained by the fact that different studies have not disaggregated utilization to private and public utilization levels. Increased competition amongst the GPs might explain the positive correlation with private specialists. In addition, increased patient freedom in choosing and changing their GPs, reduces the GPs gate-keeping role due to fear of losing "customers" if they don't give clearance for private specialist consultation. However, it is interesting that this is not replicated in the total and public consumption of specialist care.

According to our results, income is important in explaining the use of private specialist care but not public or total utilization of specialist care. This is an interesting finding that contradicts other Norwegian findings such as that by Midttun and Hagen (2006) who found that income had no significant effect on the use of either public or private specialists. Additionally, the finding is similar to those in countries with different health care systems.

Generally, travel time has a negative effect on the use of specialist services. An increase in the time taken to travel to specialist hospitals will reduce the utilization of specialist care both in absolute and relative terms. For instance, an increase in travel time to a public hospital reduces the consumption of public hospital outpatient care but not that of private specialists, and vice versa. However, the most interesting finding as concerns travel time is the fact that there is a possibility for substitution when the travel time to a private specialist increases. This is surprising since the substitution effect is not reciprocated when travel time to a public specialist increases. A possible explanation for this may be the conglomeration of private specialists in big towns which are also dominated by public specialists.

[4] See Iversen (2002), Godager (2007), Nerland (2008), Tjerbo (2010), Seim (2010) and Palacio (2010).

The age group 67-79 records a positive effect across the total, public and private utilization models. This implies that individuals in the reference age group (16-44) utilize less specialist services on average, when compared to this age-group. The age-groups; 0-15 and 45-69 record insignificant negative effects in the utilization of private and public specialists. This is an interesting finding as we had expected that infants (0-15) and the aged (above 67) would be the main consumption groups. Our results imply an even (flat) utilization of specialist outpatient care from birth up-to 66 years.

The variable representing share of the population above 80 years has an insignificant effect on the utilization of specialist care across the three utilization models. This is an interesting finding given that earlier Norwegian studies[5] have found that an increase in the share of population in this group leads to an increase in the utilization of public specialist services. The fact that this group has an insignificant effect may be explained by the presence of multidisciplinary treatment options targeting this group, at the municipal level. This may then reduce the demand for specialist outpatient care.

Immigrants from non-western European countries have a general negative effect on the utilization of specialist care. This finding is contrary to our expectations. However, the negative effect may be explained by what Smith (2006) calls "un-met need" where minority groups usually under-consume health care services.

Substitution between the public and private specialists takes place in the treatment of groups represented by the following variables; travel time to private specialists, personal income, share of the population aged 0 – 15, share mortality, share non-western immigrants, share low education, share psychological disability, share social welfare, share receiving child welfare and share receiving sickness benefits. However, the substitution effect is very weak as evidenced by the extremely low estimate values ranging from 0.000 to 0.032. This is an interesting finding that raises other questions about why the level is so low when the potential for substitution exists for the share of the population represented by the above groups.

[5] See Midttun & Hagen (2006), Seim (2010) and Palacio (2010).

Table 13: *Significant effects without disaggregation*

Variables	Model 1: Total consumption	Model 2: public specialists	Model 3: private specialists	Model 4: possibility of substitution
General practitioners	no	no	yes (+)	no
Travel time to public specialist	yes (-)	yes (-)	no	no
Travel time to private specialists	no	yes (+)	yes (-)	yes (+)
Gross income	no	no	yes (+)	yes (+)
share aged 0-15	no	no	no	yes (-)
share aged 45-66	no	no	yes (-)	no
share aged 67-79	yes (+)	yes (+)	yes (+)	no
share aged 80 & over	no	no	no	no
share sickness leave	yes (+)	yes (+)	no	no
80 year olds living alone	no	yes (+)	no	no
share Divorced	no	no	yes (+)	no
Mortality	yes (+)	yes (+)	yes (+)	yes (-)
share Single parents	no	no	yes (+)	no
share Non-western European immigrants	yes (-)	yes (-)	yes (-)	yes (+)
share Low education	yes (+)	yes (+)	yes (+)	yes (+)
share Psychological disability	yes (+)	yes (+)	yes (+)	yes (-)
share Social benefit	no	no	no	yes (-)
share Child welfare services	no	no	yes (-)	yes (+)
share Sickness benefit	no	no	yes (-)	yes (-)

Table 14 presents the results after disaggregation of some variables into different age groups. The share of population aged 67-79 now has a significant effect only on the total utilization of specialist outpatient care.

The variable representing time taken to travel to a private specialist now has a positive significance in the utilization of public specialists. However, this effect is not mirrored in the total utilization of specialist care. This implies that age may have an important effect on whether one chooses to travel longer distances to access the type of specialist care they want.

After disaggregating the variable representing mortality to only cover those aged 20 and above, the variable now becomes insignificant in the model representing public utilization of specialist care. However, it is difficult to draw conclusions on whether infancy has an effect on use considering that the variables remains significant in the other two utilization models.

Some form of substitution is now possible in the share of population represented by the following variables; travel time to a private specialist, gross income, share unemployed, share non-western Immigrants, share low education aged between 30-59, share psychological disability and the share receiving sickness benefits. However, a similar situation as in the previous model persists where the estimated level of substitution is extremely low. This may explain the change of some variables from no substitution to substitution when age groups are disaggregated.

In summary, model 4 shows that there is a definite possibility for substitution between public and private provision of outpatient specialist services. However, the low levels of substitution today present a surprising finding.

Table 14: *Significant effects after disaggregation*

Variables	Model 1: Total consumption	Model 2: public specialists	Model 3: private specialists	Model 4: possibility of substitution
General practitioners	no	no	yes (+)	no
Travel time to public specialist	yes (-)	yes (-)	yes (-)	no
Travel time to private specialists	no	yes (+)	yes (-)	yes (+)
Gross income	no	yes (+)	yes (+)	yes (+)
share aged 0-15	no	yes (-)	no	no
share aged 45-66	no	no	yes (-)	no
share aged 67-79	yes (+)	no	no	no
share aged 80 and over	yes (-)	no	yes (+)	no
share rehabilitation 20-66	no	no	no	no
share sickness leave	no	no	no	no
80 year olds living alone	no	yes (+)	yes (+)	no
share Divorced	no	no	yes (+)	no
Mortality 20 and over	yes (+)	no	yes (+)	no
share unemployed	no	no	no	yes (-)
share Single parents	no	no	yes (+)	no
share Non-western European immigrants	yes (-)	yes (-)	yes (-)	yes (-)
share with Low education 20-29	yes (+)	yes (+)	yes (+)	no
share with low education 30-59	no	no	yes (-)	yes (+)
share Psychological disability	no	yes (+)	no	yes (-)
share Social benefit 18-49	no	yes (+)	yes (+)	no
share Child welfare services	no	no	yes (-)	no
share Sickness benefit	no	no	yes (-)	yes (+)

6.3 Limitations

The data set used in this study contains a comprehensive set of explanatory socio-economic, health and demographic data aggregated at the municipal level. However, data collected at the individual level is still the most ideal for the type of analyses carried out in this thesis as it provides the actual individual picture of need and utilization. In the study, we used a fixed effects model to correct for errors that may occur due to the aggregation of observations at the municipal level. However, the fixed effects model may limit the scope of inferences as compared to a random effects model when individual level data is in use. When available, data collected at the individual level data may be able to improve the model.

Originally, we intended to include data collected for the year 2005 which would have increased our observational period to three years instead of two. However, due to limited amounts of data for most of the variables in the analysis, it was decided to drop observations from 2005. A dataset containing observations taken for longer periods may be able to capture changes and trends taking place over time.

Data representing people in the age group 50 – 59 is missing in our data set. We have therefore assumed that the age groups slightly below and above the missing set can correctly approximate their impact in our analysis. Observations covering the missing values may improve the model.

The effect of some of the explanatory variables on the dependent variables changed after disaggregation was undertaken in order to take into consideration some specific age-groups. However, the disaggregation was only done on five of the explanatory variables. Increasing the number of variables disaggregated may improve the model

7 Conclusion

The results from this study suggest that income has a differentiated influence on the demand of specialist outpatient services. An increase in personal income increases the demand for private specialist services despite the fact that out-of-pocket charges in Norway are minimal due to public sponsoring of the health care services.

Findings on the effect of general practitioners contradict findings of recently published studies investigating the policy implications of increasing GP coverage by 50 per cent as aspired to by the looming coordination reform. We find that GPs only have a positive correlation with the utilization of private specialist outpatient care.

The study finds a surprisingly insignificant effect of the elderly's consumption of specialist health care services in most of the models. However, the findings may be explained by the structural organization of the Norwegian health system that offers a multidisciplinary treatment set up for this group at the municipal level.

We find that there is a definite potential for substitution between public and private outpatient services. However, the analysis only finds weak forms of substitution on a surprisingly high number of variables representing different needs. This is an interesting finding that needs further investigation in order to understand why the levels of substitution are at such low levels. A scarcity of studies on this issue both in Norway and internationally means that we cannot make comparisons on typical outcomes.

Future research should also make use of longer study periods that increase the possibilities of capturing long-term changes and trends which cannot be discovered in shorter lengths of time. Additionally, information collected at the individual level should be taken into use if and when they become available.

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9 Appendix

9.1 Table showing Municipalities, Regional Health Authorities and Health Enterprises catchment areas

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Sør-Øst	0236 Nes	Innlandet HF-område (385298)	Sykehuset Innlandet HF
	0402 Kongsvinger		Sykehuset Innlandet, Lillehammer
	0403 Hamar		Sykehuset Innlandet, Gjøvik
	0412 Ringsaker		Sykehuset Innlandet Elverum/Hamar
	0415 Løten		Sykehuset Innlandet, Kongsvinger
	0417 Stange		Sykehuset Innlandet, Tynset
	0418 Nord-Odal		Granheim lungesenter
	0419 Sør-Odal		Valdres fødestogo
	0420 Eidskog		Lom helseheim, fødestuen
	0423 Grue		Solås rehabiliteringssenter
	0425 Åsnes		Barnehabiliteringstjenesten Sangenhagen
	0426 Våler		
	0427 Elverum		
	0428 Trysil		
	0429 Åmot		
	0430 Stor-Elvdal		
	0432 Rendalen		
	0434 Engerdal		
	0436 Tolga		
	0437 Tynset		
	0438 Alvdal		
	0439 Folldal		
	0441 Os		
	0501 Lillehammer		
	0502 Gjøvik		
	0511 Dovre		
	0512 Lesja		
	0513 Skjåk		
	0514 Lom		
	0515 Vågå		
	0516 Nord-Fron		
	0517 Sel		
	0519 Sør-Fron		
	0520 Ringebu		
	0521 Øyer		
	0522 Gausdal		
	0528 Østre Toten		
	0529 Vestre Toten		
	0533 Lunner		

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Sør-Øst	0534 Gran 0536 Søndre Land 0538 Nordre Land 0541 Etnedal 0542 Nord-Aurdal 0543 Vestre Slidre 0544 Øystre Slidre 0545 Vang	Forts. Innlandet HF-område (385 298)	Forts. Sykehuset Innlandet HF
	0219 Bærum 0220 Asker 0532 Jevnaker 0540 Sør-Aurdal 0602 Drammen 0604 Kongsberg 0605 Ringerike 0612 Hole 0615 Flå 0616 Nes 0617 Gol 0618 Hemsedal 0619 Ål 0620 Hol 0621 Sigdal 0622 Krødsherad 0623 Modum 0624 Øvre Eiker 0625 Nedre Eiker 0626 Lier 0627 Røyken 0628 Hurum 0631 Flesberg 0632 Rollag 0633 Nore og Ulvdal 0711 Svelvik 0713 Sande	Vestre Viken HF-område (447 732)	Vestre Viken HF Ringerike sykehus Hallingdal sjukestugu Sykehuset Buskerud Kongsberg sykehus Sykehuset Asker og Bærum
	0701 Horten 0702 Holmestrand 0704 Tønsberg 0706 Sandefjord 0709 Larvik 0714 Hof 0716 Re 0719 Andebu	Vestfold HF-område (216 517)	Sykehuset i Vestfold HF Sykehuset i Vestfold, Horten Sykehuset i Vestfold, Larvik Sykehuset i Vestfold, Sandefjord Sykehuset i Vestfold, Tønsberg

Region	Kommune	Foretaksområde	Helseforetak og enheter
Helse Sør-Øst	0720 Stokke 0722 Nøtterøy 0723 Tjøme 0728 Lardal	Forts. Vestfold HF-område	Forts. Sykehuset i Vestfold HF
	0805 Porsgrunn 0806 Skien 0807 Notodden 0811 Siljan 0814 Bamble 0815 Kragerø 0817 Drangedal 0819 Nome 0821 Bø 0822 Sauherad 0826 Tinn 0827 Hjartdal 0828 Seljord 0829 Kviteseid 0830 Nissedal 0831 Fyresdal 0833 Tokke 0834 Vinje	Telemark HF-område (168 231)	Sykehuset Telemark HF Sykehuset Telemark Sykehuset Telemark, Kragerø Sykehuset Telemark, Notodden Sykehuset Telemark, Rjukan Tinn fødestue
	0901 Risør 0904 Grimstad 0906 Arendal 0911 Gjerstad 0912 Vegårdhei 0914 Tvedestrand 0919 Froland 0926 Lillesand 0928 Birkenes 0929 Åmli 0935 Iveland 0937 Evje og Hornnes 0938 Bygland 0940 Valle 0941 Bykle 1001 Kristiansand 1002 Mandal 1003 Farsund	Sørlandet HF-område (278 876)	Sørlandet sykehus HF Sørlandet sykehus, Lister Sørlandet sykehus, Mandal Sørlandet sykehus, Arendal Sørlandet sykehus, Kristiansand

Region	Kommune	Foretaksområde	Helseforetak og enheter
Helse Sør-Øst	1004 Flekkefjord 1014 Vennesla 1017 Sogndalen 1018 Søgne 1021 Marnardal 1026 Åseral 1027 Audnedal 1029 Lindesnes 1032 Lyngdal 1034 Hægebostad 1037 Kvinesdal 1046 Sirdal	Forts. Sørlandet HF-område	Forts. Sørlandet sykehus HF
Helse Vest	1101 Eigersund 1102 Sandnes 1103 Stavanger 1111 Sokndal 1112 Lund 1114 Bjerkreim 1119 Hå 1120 Klepp 1121 Time 1122 Gjesdal 1124 Sola 1127 Randaberg 1129 Forsand 1130 Strand 1133 Hjelmeland 1141 Finnøy 1142 Rennesøy 1144 Kvitsøy	Stavanger HF-område (326 556)	Helse Stavanger HF Stavanger universitets-sjukehus Rehabiliteringstjenesten Rogaland
	1106 Haugesund 1134 Suldal 1135 Sauda 1145 Bokn 1146 Tysvær 1149 Karmøy 1151 Utsira 1160 Vindafjord 1211 Etne 1216 Sveio 1219 Bømlo 1221 Stord 1222 Fitjar 1223 Tysnes	Fonna HF-område (170 432)	Helse Fonna HF Haugesund sjukehus Stord sjukehus Odda sjukehus

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Vest	1224 Kvinnherad 1227 Jondal 1228 Odda 1231 Ullensvang 1232 Eidfjord	Forts. Fonna HF-område	Forts. Helse Fonna HF
	1201 Bergen 1233 Ulvik 1234 Granvin 1235 Voss 1238 Kvam 1241 Fusa 1242 Samnanger 1243 Os 1244 Austevoll 1245 Sund 1246 Fjell 1247 Askøy 1251 Vaksdal 1252 Modalen 1253 Osterøy 1256 Meland 1259 Øygarden 1260 Radøy 1263 Lindås 1264 Austrheim 1265 Fedje 1266 Masfjorden	Haukeland HF-område (408 134)	Helse Bergen HF Haukeland universitets-sykehus Kysthospitalet i Hagevik Voss sjukehus Nordåstunet
	1401 Flora 1411 Gulen 1412 Solund 1413 Hyllestad 1416 Høyanger 1417 Vik 1418 Balestrand 1419 Leikanger 1420 Sogndal 1421 Aurland 1422 Lærdal 1424 Årdal 1426 Luster 1428 Askvoll 1429 Fjaler 1430 Gaular	Førde HF-område (107 080)	Helse Førde HF Førde sentralsjukehus Førde sentralsjukehus, Florø Lærdal sjukehus Nordfjord sjukehus

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Vest	1431 Jølster 1432 Førde 1433 Naustdal 1438 Bremanger 1439 Vågsøy 1441 Selje 1443 Eid 1444 Hornindal 1445 Gloppen 1449 Stryn	Forts. Førde HF-område	Forts. Helse Førde HF
Helse Midt-Norge	1504 Ålesund 1511 Vanylven 1514 Sande 1515 Herøy 1516 Ulstein 1517 Hareid 1519 Volda 1520 Ørsta 1523 Ørskog 1524 Norddal 1525 Stranda 1526 Stordal 1528 Sykkylven 1529 Skodje 1531 Sula 1532 Giske 1534 Haram	Sunnmøre HF-område (133 322)	Helse Sunnmøre HF Ålesund sjukehus Volda sjukehus Nevrohjemmet rehabiliteringssenter Mork rehabiliteringssenter
	1502 Molde 1505 Kristiansund 1535 Vestnes 1539 Rauma 1543 Nesset 1545 Midsund 1546 Sandøy 1547 Aukra 1548 Fræna 1551 Eide 1554 Averøy 1557 Gjemnes 1560 Tingvoll	Nordmøre og Romsdal HF-område (115 899)	Helse Nordmøre og Romsdal HF Molde sjukehus Kristiansund sykehus

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Midt-Norge	1563 Sunndal 1566 Surnadal 1571 Halsa 1573 Smøla 1576 Aure	Forts. Nordmøre og Romsdal HF-område	Forts. Helse Nordmøre og Romsdal HF
	1567 Rindal 1601 Trondheim 1612 Hemne 1613 Snillfjord 1617 Hitra 1620 Frøya 1621 Ørland 1622 Agdenes 1624 Rissa 1627 Bjugn 1630 Åfjord 1634 Oppdal 1635 Rennebu 1636 Meldal 1638 Orkdal 1640 Røros 1644 Holtålen 1648 Midtre Gauldal 1653 Melhus 1657 Skaun 1662 Klæbu 1663 Malvik 1664 Selbu 1665 Tydal	St. Olavs Hospital HF-område (290 556)	St. Olavs Hospital HF St. Olavs Hospital Orkdal sjukehus Røros sykehus
	1632 Roan 1633 Osen 1702 Steinkjer 1703 Namsos 1711 Meråker 1714 Stjørdal 1717 Frosta 1718 Leksvik 1719 Levanger 1721 Verdal 1723 Mosvik 1724 Verran 1725 Namdalseid	Nord-Trøndelag HF-område (133 587)	Helse Nord-Trøndelag HF Sykehuset Namsos Sykehuset Levanger

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Midt-Norge	1729 Inderøy 1736 Snåsa 1738 Lierne 1739 Røyrvik 1740 Namsskogan 1742 Grong 1743 Høylandet 1744 Overhalla 1748 Fosnes 1749 Flatanger 1750 Vikna 1751 Nærøy 1755 Leka	Forts. Nord-Trøndelag HF-område	Forts. Helse Nord-Trøndelag HF
Helse Nord	1811 Bindal 1812 Sømna 1813 Brønnøy 1815 Vega 1816 Vevelstad 1818 Herøy 1820 Alstahaug 1822 Leirfjord 1824 Vefsn 1825 Grane 1826 Hattfjelldal 1827 Dønna 1828 Nesna 1832 Hemnes 1833 Rana 1834 Lurøy 1835 Træna 1836 Rødøy	Helgeland HF-område (77 135)	Helgelandssykehuset HF Helgelandssykehuset, Sandnessjøen Helgelandssykehuset, Mosjøen Helgelandssykehuset, Rana Brønnøy fødestue Sømna rehabilitering
	1804 Bodø 1837 Meløy 1838 Gildeskål 1839 Beiarn 1840 Saltdal 1841 Fauske 1845 Sørfold 1848 Steigen 1849 Hamarøy 1850 Tysfjord	Nordland HF-område (133 235)	Nordlandssykehuset HF Nordlandsykehuset, Bodø Nordlandsykehuset, Lofoten Nordlandssykehuset, Vesterålen Steigen fødestue

Region	*Kommune*	*Foretaksområde*	*Helseforetak og enheter*
Helse Nord	1856 Røst 1857 Værøy 1859 Flakstad 1860 Vestvågøy 1865 Vågan 1866 Hadsel 1867 Bø 1868 Øksnes 1870 Sortland 1871 Andøy 1874 Moskenes	Forts. Nordland HF-område	Forts. Nordlandssykehuset HF
	1851 Lødingen 1805 Narvik 1852 Tjeldsund 1853 Evenes 1854 Ballangen 1901 Harstad 1902 Tromsø 1911 Kvæfjord 1913 Skånland 1915 Bjarkøy 1917 Ibestad 1919 Gratangen 1920 Lavangen 1922 Bardu 1923 Salangen 1924 Målselv 1925 Sørreisa 1926 Dyrøy 1927 Tranøy 1928 Torsken 1929 Berg 1931 Lenvik 1933 Balsfjord 1936 Karlsøy 1938 Lyngen 1939 Storfjord 1940 Kåfjord 1941 Skjervøy 1942 Nordreisa 1943 Kvænangen	UNN HF-område (182 395)	Universitetssykehuset i Nord-Norge HF Universitetssykehuset i Nord-Norge, Tromsø Universitetssykehuset i Nord-Norge, Harstad Universitetssykehuset i Nord-Norge, Narvik Fødestua Midt-Troms Helsesenteret Sonjatun

Region	Kommune	Foretaksområde	Helseforetak og enheter
Helse Nord	2002 Vardø	Finnmark HF-område (72 856)	Helse Finnmark HF
	2003 Vadsø		Helse Finnmark, Hammerfest
	2004 Hammerfest		Helse Finnmark, Kirkenes
	2011 Kautokeino		Nordkapp helsesenter
	2012 Alta		Alta helsesenter
	2014 Loppa		
	2015 Hasvik		
	2017 Kvalsund		
	2018 Måsøy		
	2019 Nordkapp		
	2020 Porsanger		
	2021 Karasjok		
	2022 Lebesby		
	2023 Gamvik		
	2024 Berlevåg		
	2025 Tana		
	2027 Nesseby		
	2028 Båtsfjord		
	2030 Sør-Varanger		

9.2 Table showing Private Hospitals

Private Hospitals	Location
Aleris	Oslo, Bergen, Trondheim Kristiansand and Romerike (Akershus)
Drammen Privat sykehus	Drammen
Feiringklinikken	Akershus
Glittreklinikken	Nittedal, Akershus
Hjertesenteret Oslo	Oslo
Medi 3 Molde	Molde
Medi 3 Ålesund	Ålesund
Sykehus og spesialistklinikk	Oslo
Volvat medisinske senter	Vestre Aker, Oslo

9.3 Table showing Municipalities excluded from the analysis

	Vindafjord (t.o.m. 2005):
	Fra 1. januar 2006 ble kommunene 1154 Vindafjord og 1159 Ølen i Rogaland fylke slått sammen til en ny kommune 1160 Vindafjord.
	Ølen (t.o.m. 2005):
	Fra 1. januar 2006 ble kommunene 1154 Vindafjord og 1159 Ølen i Rogaland fylke slått sammen til en ny kommune 1160 Vindafjord.
	Vindafjord:
	Fra 1. januar 2006 ble kommunene 1154 Vindafjord og 1159 Ølen i Rogaland fylke slått sammen til en ny kommune 1160 Vindafjord.
	Kristiansund (t.o.m. 2007):
	Fra 1. januar 2008 er kommunene 1503 Kristiansund og 1556 Frei i Møre og Romsdal fylke slått sammen til ny kommune 1505 Kristiansund.
	Kristiansund:
	Fra 1. januar 2008 er kommunene 1503 Kristiansund og 1556 Frei i Møre og Romsdal fylke slått sammen til ny kommune 1505 Kristiansund.
	Vanylven:
	Ved grenseregulering 1. januar 2002 ble ca. 380 personer overført fra 1514 Sande kommune til 1511 Vanylven kommune.
	Sande (M. og R.):
	Ved grenseregulering 1. januar 2002 ble ca. 380 personer overført fra 1514 Sande kommune til 1511 Vanylven kommune.
	Frei (t.o.m. 2007):
	Fra 1. januar 2008 er kommunene 1503 Kristiansund og 1556 Frei i Møre og Romsdal fylke slått sammen til ny kommune 1505 Kristiansund.
	Aure (t.o.m. 2005):
	Fra 1. januar 2006 ble kommunene 1569 Aure og 1572 Tustna i Møre og Romsdal fylke slått sammen til ny kommune 1576 Aure.
	Tustna (t.o.m. 2005):
	Fra 1. januar 2006 ble kommunene 1569 Aure og 1572 Tustna i Møre og Romsdal fylke slått sammen til ny kommune 1576 Aure.
	Aure:
	Fra 1. januar 2006 ble kommunene 1569 Aure og 1572 Tustna i Møre og Romsdal fylke slått sammen til ny kommune 1576 Aure.
	Bodø:
	Fra 1. januar 2005 er 1804 Bodø og 1842 Skjerstad i Nordland fylke slått sammen til en kommune 1804 Bodø.
	Skjerstad (t.o.m. 2004):
	Fra 1. januar 2005 er 1804 Bodø og 1842 Skjerstad i Nordland fylke slått sammen til en kommune 1804 Bodø.

9.4 Table showing Health Enterprises (HF) and their assigned numbers in the analysis

HE number	Health Enterprise (HF)
1	Sykehuset Østfold HF
2	Sykehuset Asker og Bærum HF/ Oslo sykehusområde
3	Akershus universitetssykehus HF
4	Sykehuset Innlandet HF
5	Ringerike sykehus HF
6	Sykehuset Buskerud HF
7	Blefjell sykehus HF
8	Sykehuset i Vestfold HF
9	Sykehuset Telemark HF
10	Sørlandet sykehus HF
11	Helse Stavanger HF
12	Helse Fonna HF
13	Helse Bergen HF
14	Helse Førde HF
15	Helse Sunnmøre HF
16	Helse Nordmøre og Romsdal HF
17	St Olavs Hospital HF
18	Helse Nord-Trøndelag HF
19	Helgelandssykehuset HF
20	Nordlandssykehuset HF
21	Universitetssykehuset i Nord-Norge HF (UNN)
22	Helse Finnmark HF

9.5 Tables showing results of the analyses

9.5.1 Results of Total Utilization of specialized health care services

Model 1A: Total Utilization of specialist health services (without disaggregation)	B (Std. Error)	Tolerance	VIF
(Constant)	**1486.434** (625.513)**		
andel_fastleger	**2955.287** (775.126)***	.239	4.180
reisetid_pub	**-1.098** (.329)***	.308	3.248
reisetidpriv	**-0.263** (.439)	.233	4.284
Bruttoinnt	**0.000** (.001)	.251	3.986
Andel_0_15	**-19.506** (13.577)	.154	6.503
Andel_45_66	**-10.104** (9.961)	.317	3.155
Andel_67_79	**16.307** (12.526)	.235	4.247
Andel_80ogover	**-53.820** (14.701)***	.235	4.253
andel_ufør	**6.427** (6.789)	.284	3.516
andel_alenebo80	**260.071** (49.134)***	.106	9.476
andel_skilsmisser	**1340.998** (346.727)***	.214	4.673
andel_dødelighet	**-208.260** (701.685)	.152	6.578
andel_ikkevinnv	**-2722.350** (268.245)***	.809	1.236
andel_kungrskole	**498.642** (103.642)***	.476	2.103
andel_psykuføre	**205.435** (95.782)**	.619	1.615
andel_sosialhjelp	**-14.753** (34.525)	.258	3.882
andel_barnevernstiltak	**-50.184** (118.906)	.179	5.596
andel_sykepenger	**-12.600** (11.875)	.225	4.450
Dummy_priv	**52.203** (35.256)	.538	1.858
ØstfoldHF_dummy	**-103.358** (60.137)*	.350	2.859
AskerBærumOsloHF_dummy	**89.133** (71.467)	.664	1.506
InnlandetHF_dummy	**-25.412** (15.445)*	.244	4.096
RingerikeHF_dummy	**-24.537** (17.135)	.597	1.674
BuskerudHF_dummy	**-18.412** (17.635)	.843	1.186
BlefjellHF_dummy	**-31.857** (11.076)***	.515	1.943
VestfoldHF_dummy	**20.096** (9.874)**	.637	1.570
TelemarkHF_dummy	**3.568** (11.703)	.746	1.340
SørlandetHF_dummy	**7.101** (7.684)	.387	2.584
StavangerHF_dummy	**-10.509** (7.079)	.600	1.667
FonnaHF_dummy	**6.576** (6.717)	.584	1.713
BergenHF_dummy	**8.837** (5.898)	.578	1.730
FørdeHF_dummy	**-0.227** (5.442)	.495	2.021
SunmøreHF_dummy	**1.211** (5.611)	.630	1.587
NordmøreRomsdalHF_dummy	**0.566** (5.404)	.654	1.530
StOlavsHF_dummy	**-8.382** (4.706)**	.511	1.957
NordTrøndelagHF_dummy	**0.761** (4.557)	.481	2.079
HelgelandHF_dummy	**11.844** (4.992)**	.557	1.797
NordlandHF_dummy	**1.845** (4.411)	.537	1.861
NordNorgeHF_dummy	**7.217** (4.248)*	.394	2.535
FinnmarkHF_dummy	**0.830** (5.007)	.421	2.376

Model 1B: Total reimbursements *(disaggregated variables)*	***β* (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**2359.100** (563.091)***		
andel_fastleger	**2908.718** (731.857)***	.238	4.208
reisetid_pub	**-1.204** (.291)***	.311	3.213
reisetidpriv	**-0.073** (.392)	.233	4.301
Bruttoinnt	**-0.000** (.001)	.270	3.708
Andel_0_15	**-31.802** (12.345)**	.148	6.771
Andel_45_66	**-17.667** (8.648)**	.334	2.996
Andel_67_79	**9.729** (11.187)	.234	4.269
Andel_80ogover	**-60.915** (13.287)***	.228	4.376
andel_rehab_20_66	**164.213** (91.248)*	.123	8.115
andel_alenebo80	**318.413** (39.863)***	.141	7.090
andel_skilsmisser	**1169.425** (373.591)***	.164	6.095
andel_dødelighet_20ogover	**-0.055** (.129)	.949	1.053
andel_arbeidsøkere	**-14.522** (17.072)	.127	7.902
andel_ikkevinnv	**-4204.942** (243.971)***	.830	1.205
andel_psykuføre	**197.317** (95.291)**	.566	1.768
andel_sosialhjelp_18_49	**-60.338** (41.170)	.128	7.823
andel_barnevernstiltak	**-45.829** (118.175)	.161	6.217
andel_sykepenger	**-3.396** (16.652)	.103	9.679
Dummy_priv	**60.579** (31.432)*	.538	1.860
ØstfoldHF_dummy	**-71.163** (51.921)	.372	2.687
AskerBærumOsloHF_dummy	**89.371** (63.626)	.664	1.505
InnlandetHF_dummy	**-29.405** (813.658)**	.248	4.035
RingerikeHF_dummy	**-26.761** (15.257)*	.597	1.674
BuskerudHF_dummy	**-5.791** (15.733)	.840	1.190
BlefjellHF_dummy	**-35.228** (9.830)***	.518	1.930
VestfoldHF_dummy	**16.707** (8.519)*	.678	1.474
TelemarkHF_dummy	**3.781** (10.353)	.756	1.323
SørlandetHF_dummy	**5.696** (6.290)	.459	2.179
StavangerHF_dummy	**-10.549** (6.375)*	.586	1.705
FonnaHF_dummy	**0.433** (5.978)	.584	1.711
BergenHF_dummy	**4.500** (5.277)	.574	1.741
FørdeHF_dummy	**-5.368** (4.804)	.503	1.987
SunmøreHF_dummy	**-1.149** (4.956)	.640	1.562
NordmøreRomsdalHF_dummy	**-0.816** (4.808)	.655	1.528
StOlavsHF_dummy	**-10.340** (4.146)**	.522	1.916
NordTrøndelagHF_dummy	**-1.003** (4.034)	.487	2.054
HelgelandHF_dummy	**10.802** (4.369)**	.578	1.729
NordlandHF_dummy	**1.521** (3.863)	.555	1.800
NordNorgeHF_dummy	**6.847** (3.472)**	.470	2.127
FinnmarkHF_dummy	**3.187** (4.432)	.427	2.342

***** = p<0.01 ** p<0.05 * = p<0.1**

β **= Beta coefficients**

9.5.2 Results of Public Utilization of specialized health care services

Model 2A: **Utilization of Public specialist services *(without disaggregation)***	***β*** (Std. Error)	Tolerance	VIF
(Constant)	**2572.188** (379.216)***		
andel_fastleger	**3982.917** (946.216)***	.210	4.771
reisetid_pub	**-1.335** (0.260)***	.320	3.127
reisetidpriv	**0.226** (0.294)	.323	3.098
Bruttoinnt	**.000** (.001)	.200	4.991
Andel_0_15	**-39.769** (7.980)***	.265	3.778
Andel_45_66	**-22.506** (7.156)***	.354	2.823
Andel_67_79	**2.449** (10.330)	.219	4.560
Andel_80ogover	**-32.242** (12.594)**	.212	4.721
andel_ufor	**14.396** (5.604)**	.247	4.050
andel_skilsmisser	**-29.589** (395.842)	.188	5.311
andel_dødelighet	**1728.648** (617.367)***	.213	4.696
andel_ikkevinnv	**-3338.556** (227.619)***	.608	1.645
andel_kungrskole	**-250.444** (86.982)***	.515	1.940
andel_psykuføre	**270.942** (114.263)**	.604	1.655
andel_sosialhjelp	**-38.418** (40.549)	.261	3.833
andel_barnevernstiltak	**162.521** (126.273)	.179	5.602
andel_sykepenger	**-6.185** (13.782)	.227	4.406
Dummy_priv	**44.502** (26.645)*	.227	2.225
ØstfoldHF_dummy	**-189.996** (55.796)**	.489	2.044
AskerBærumOsloHF_dummy	**-49.557** (36.754)	.393	2.545
InnlandetHF_dummy	**-12.885** (12.674)	.289	3.461
RingerikeHF_dummy	**-31.242** (14.689)*	.674	1.484
BuskerudHF_dummy	**6.094** (11.469)	.757	1.321
BlefjellHF_dummy	**-24.416** (9.294)***	.564	1.774
VestfoldHF_dummy	**3.151** (7.058)	.538	1.858
TelemarkHF_dummy	**10.080** (7.711)	.650	1.538
SørlandetHF_dummy	**-4.561** (5.614)	.383	2.610
StavangerHF_dummy	**-4.794** (4.977)	.486	2.056
FonnaHF_dummy	**0.799** (4.863)	.526	1.902
BergenHF_dummy	**1.022** (4.029)	.470	2.128
FørdeHF_dummy	**3.174** (4.160)	.468	2.139
SunmøreHF_dummy	**6.739** (3.939)*	.536	1.865
NordmøreRomsdalHF_dummy	**5.397** (3.925)	.593	1.687
StOlavsHF_dummy	**-5.308** (3.196)*	.437	2.286
NordTrøndelagHF_dummy	**-3.430** (3.180)	.461	2.169
HelgelandHF_dummy	**16.012** (3.550)***	.557	1.795
NordlandHF_dummy	**4.860** (3.011)	.495	2.021
NordNorgeHF_dummy	**9.486** (2.994)***	.394	2.539
FinnmarkHF_dummy	**11.115** (3.596)***	.454	2.200

***** = p<0.01 ** =p<0.05 * = p<0.1**

β **= Beta coefficients**

Model 2B: Utilization of Public specialist services *(disaggregated variables)*	***β*** **(Std. Error)**	**Collinearity Statistics** Tolerance	**VIF**
(Constant)	**2825.155** (346.921)***		
andel_fastleger	**4326.222** (896.894)***	.209	4.779
reisetid_pub	**-1.394** (.233)***	.317	3.152
reisetidpriv	**0.526** (.306)**	.237	4.211
Bruttoinnt	**-0.001** (.000)	.209	4.790
Andel_0_15	**-47.148** (7.620)***	.230	4.355
Andel_45_66	**-21.890** (6.273)***	.366	2.732
Andel_67_79	**-3.301** (9.269)	.216	4.619
Andel_80ogover	**-26.758** (11.436)**	.204	4.900
andel_rehab_20_66	**98.636** (98.170)	.124	8.041
andel_skilsmisser	**-53.131** (447.096)	.133	7.492
andel_dødelighet_20ogover	**-0.068** (.249)	.988	1.012
andel_ikkevinnv	**-3868.525** (187.479)***	.618	1.619
andel_psykuføre	**267.381** (109.526)*	.605	1.653
andel_sosialhjelp_18_49	**10.363** (42.866)	.125	8.027
andel_barnevernstiltak	**193.963** (126.117)	.161	6.194
andel_sykepenger	**-12.091** (8.105)	.603	1.657
Dummy_priv	**48.818** (24.143)**	.423	2.364
ØstfoldHF_dummy	**-156.600** (48.779)***	.509	1.967
AskerBærumOsloHF_dummy	**87.628** (32.816)***	.389	2.568
InnlandetHF_dummy	**-13.853** (11.264)	.292	3.422
RingerikeHF_dummy	**-30.348** (13.102)**	.676	1.480
BuskerudHF_dummy	**9.339** (10.227)	.743	1.346
BlefjellHF_dummy	**-25.864** (8.267)***	.569	1.759
VestfoldHF_dummy	**5.651** (6.098)	.574	1.742
TelemarkHF_dummy	**9.619** (7.003)	.655	1.527
SørlandetHF_dummy	**-2.163** (4.832)	.435	2.301
StavangerHF_dummy	**-3.593** (4.529)	.470	2.128
FonnaHF_dummy	**-1.394** (4.463)	.528	1.895
BergenHF_dummy	**-1.675** (3.743)	.464	2.153
FørdeHF_dummy	**-0.333** (3.846)	.476	2.100
SunmøreHF_dummy	**3.600** (3.614)	.549	1.821
NordmøreRomsdalHF_dummy	**3.387** (3.590)	.596	1.678
StOlavsHF_dummy	**-7.081** (2.940)**	.444	2.252
NordTrøndelagHF_dummy	**-3.938** (3.041)	.460	2.173
HelgelandHF_dummy	**13.121** (3.313)***	.566	1.767
NordlandHF_dummy	**2.106** (2.770)	.497	2.012
NordNorgeHF_dummy	**8.062** (2.553)***	.445	2.249
FinnmarkHF_dummy	**8.225** (3.307)**	.431	2.318

***** = p<0.01 ** = p<0.05 * = p<0.1**

β **= Beta coefficients**

9.5.3 Results of Private Utilization of specialized health care services

Model 3: Private Utilization of Specialist Health Services *(without disaggregation)*	***β*** **(Std. Error)**	**Tolerance**	**VIF**
(Constant)	**369.734** (81.536)***		
andel_fastleger	**654.181** (203.463)***	0.21	4.771
reisetid_pub	**-0.056** (.056)	0.32	3.128
Reisetidpriv	**-0.330** (0.063)***	0.323	3.097
Bruttoinnt	**0.001** (0.000)***	0.2	4.991
Andel_0_15	**-5.875** (1.716)***	0.265	3.779
Andel_45_66	**-7.622** (1.539)***	0.354	2.823
Andel_67_79	**2.385** (2.221)	0.219	4.560
Andel_80ogover	**-1.620** (2.708)	0.212	4.719
andel_ufør	**0.017** (1.205)	0.247	4.051
andel_skilsmisser	**1552.516** (85.119)***	0.188	5.312
andel_dodelighet	**2800.781** (132.754)***	0.213	4.697
andel_ikkevinnv	**-1119.818** (48.948)***	0.608	1.645
andel_kungrskole	**98.934** (18.707)***	0.515	1.941
andel_psykufør	**53.154** (24.568)**	0.604	1.655
andel_sosialhjelp	**3.909** (8.719)	0.261	3.833
andel_barnevernstiltak	**-177.337** (27.155)***	0.178	5.604
andel_sykepenger	**-6.900** (2.963)	0.227	4.406
ØstfoldHF_dummy	**32.245** (11.998)***	0.489	2.044
AskerBærumOsloHF_dummy	**33.183** (7.903)***	0.393	2.546
InnlandetHF_dummy	**-32.186** (2.725)***	0.289	3.461
RingerikeHF_dummy	**-16.552** (3.159)***	0.674	1.484
BuskerudHF_dummy	**-9.671** (2.452)***	0.757	1.321
BlefjellHF_dummy	**-19.801** (1.998)***	0.564	1.774
VestfoldHF_dummy	**-2.536** (1.519)**	0.538	1.858
TelemarkHF_dummy	**-15.147** (1.692)***	0.65	1.538
SørlandetHF_dummy	**-3.287** (1.242)***	0.383	2.611
StavangerHF_dummy	**-12.770** (1.082)***	0.486	2.056
FonnaHF_dummy	**-5.328** (1.082)***	0.526	1.902
BergenHF_dummy	**-2.329** (0.900)**	0.47	2.128
FørdeHF_dummy	**-10.158** (0.938)***	0.467	2.139
SunmøreHF_dummy	**-10.192** (0.885)***	0.536	1.865
NordmøreRomsdalHF_dummy	**-10.238** (0.868)***	0.593	1.687
StOlavsHF_dummy	**-8.487** (0.715)***	0.437	2.286
NordTrøndelagHF_dummy	**-1.117** (0.733)	0.461	2.169
HelgelandHF_dummy	**-7.679** (0.800)***	0.557	1.795
NordlandHF_dummy	**-4.775** (0.669)***	0.495	2.021
NordNorgeHF_dummy	**-7.243** (0.653)***	0.394	2.539
FinnmarkHF_dummy	**-8.208** (0.775)***	0.456	2.191

***** = p<0.01   ** = p< 0.05   * = p<0.1**

β **= Beta coefficients**

Model 3B: Private Utilization of Specialist Health Services (*disaggregated variables)*	**B (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**757,570** (92,936)***		
andel_fastleger	**350,039** (206,204)**	,189	5,281
reisetid_pub	**#0,052** (0,050)	,324	3,085
Reisetidpriv	**#0,258** (0,057)***	,326	3,069
Bruttoinnt	**0,000** (0,000)***	,226	4,426
Andel_0_15	**#11,655** (1,905)***	,178	5,607
Andel_45_66	**#10,699** (1,453)***	,347	2,881
Andel_67_79	**#0,861** (2,104)	,205	4,885
Andel_80ogover	**#22,649** (2,658)***	,178	5,632
andel_rehab_20_66	**69,663** (21,914)***	,119	8,378
andel_alenebo80	**207,880** (9,922)***	,120	8,325
andel_skilsmisser	**1363,145** (97,076)***	,137	7,274
andel_dødelighet_20ogover	**#0,007** (0,054)	,987	1,013
andel_arbeidssøkere	**#2,974** (4,410)	,126	7,947
andel_ikkevinnv	**#1343,812** (45,717)***	,720	1,389
andel_psykufore	**50,978** (24,667)**	,558	1,794
andel_sosialhjelp_18_49	**#40,378** 9,620)***	,121	8,293
andel_barnevernstiltakk	**#185,581** (27,759)***	,159	6,276
andel_sykepenger	**#5,324** (4,255)	,102	9,770
ØstfoldHF_dummy	**16,571** (10,630)	,501	1,996
AskerBærumOsloHF_dummy	**54,580** (9,351)***	,511	1,958
InnlandetHF_dummy	**#35,891** (2,468)***	,286	3,499
RingerikeHF_dummy	**#21,504** (2,843)***	,671	1,490
BuskerudHF_dummy	**#5,771** (2,199)***	,751	1,331
BlefjellHF_dummy	**#22,105** (1,809)***	,556	1,800
VestfoldHF_dummy	**#5,516** (1,322)***	,571	1,750
TelemarkHF_dummy	**#15,873** (1,522)***	,648	1,542
SørlandetHF_dummy	**#4,762** (1,052)***	,429	2,331
StavangerHF_dummy	**#13,355** (0,983)***	,467	2,140
FonnaHF_dummy	**#8,295** (0,969)***	,523	1,911
BergenHF_dummy	**#4,101** (0,814)***	,460	2,175
FørdeHF_dummy	**#11,642** (0,833)***	,475	2,105
SunmøreHF_dummy	**#11,003** (0,784)***	,546	1,833
NordmøreRomsdalHF_dummy	**#10,941** (0,778)***	,593	1,686
StOlavsHF_dummy	**#9,316** (0,643)***	,434	2,302
NordTrøndelagHF_dummy	**#2,484** (0,658)***	,459	2,177
HelgelandHF_dummy	**#8,379** (0,718)***	,563	1,776
NordlandHF_dummy	**#5,725** (0,601)***	,494	2,025
NordNorgeHF_dummy	**#8,189** (0,555)***	,441	2,268
FinnmarkHF_dummy	**#7,939** (0,715)***	,435	2,299

***** = p<0.01 ** = p< 0.05 * = p<0.1**

***β* = Beta coefficients**

9.5.4 Results of Public-Private mix Utilization of specialized health care services

Model 4B: Public-Private mix (disaggregated)	**B (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**9.719** (0.144)***		
andel_fastleger	**0.574** (0.169)***	.265	3.776
reisetid_pub	**0.000** (0.000)***	.312	3.204
reisetidpriv	**-0.000** (0.000)	.241	4.149
Bruttoinnt	**-2.457** (0.000)	.296	3.382
Andel_0_15	**0.003** (0.003)	.152	6.576
Andel_45_66	**0.016** (0.002)***	.319	3.135
Andel_67_79	**-0.013** (0.003)***	.248	4.036
Andel_80ogover	**0.009** (0.003)***	.252	3.967
andel_rehab_20_66	**-0.040** (0.024)*	.122	8.171
andel_uføre_18_39	**-0.054** (0.116)	.103	9.687
andel_alenebo80	**0.002** (0.010)	.135	7.399
andel_skilsmisser	**-0.124** (0.099)	.171	5.832
andel_dødelighet_20ogover	**0.000** (0.000)	.947	1.056
andel_arbeidsøkere	**-0.000** (0.005)	.139	7.187
andel_ikkevinnv	**-0.020** (0.069)	.835	1.197
andel_psykuføre	**-0.006** (0.029)	.568	1.760
andel_sosialhjelp_18_49	**-0.000** (0.010)	.139	7.211
andel_barnevernstiltak	**0.031** (0.030)	.167	5.993
andel_sykepenger	**-0.002** (0.005)	.113	8.868
Dummy_priv	**0.018** (0.008)**	.540	1.852
ØstfoldHF_dummy	**-0.026** (0.019)	.494	2.024
AskerBærumOsloHF_dummy	**0.010** (0.022)	.768	1.302
InnlandetHF_dummy	**-0.008** (0.004)*	.237	4.214
RingerikeHF_dummy	**1.723** (0.005)***	.584	1.711
BuskerudHF_dummy	**1.445** (0.005)***	.787	1.270
BlefjellHF_dummy	**1.232** (0.003)***	.439	2.277
VestfoldHF_dummy	**1.082** (0.002)***	.544	1.840
TelemarkHF_dummy	**0.960** (0.003)***	.652	1.534
SørlandetHF_dummy	**0.865** (0.002)***	.289	3.466
StavangerHF_dummy	**0.424** (0.002)***	.457	2.189
FonnaHF_dummy	**0.387** (0.002)***	.446	2.245
BergenHF_dummy	**0.356** (0.001)***	.419	2.388
FørdeHF_dummy	**0.331** (0.001)***	.359	2.788
SunmøreHF_dummy	**0.861** (0.001)***	.479	2.089
NordmøreRomsdalHF_dummy	**0.805** (0.001)***	.491	2.037
StOlavsHF_dummy	**0.759** (0.001)***	.353	2.835
NordTrøndelagHF_dummy	**0.726** (0.001)***	.328	3.052
HelgelandHF_dummy	**0.917** (0.001)***	.415	2.410
NordlandHF_dummy	**0.871** (0.001)***	.381	2.625
NordNorgeHF_dummy	**0.829** (0.001)***	.307	3.253
FinnmarkHF_dummy	**0.791** (0.001)***	.305	3.274

***** = p<0.01   ** = p< 0.05   * = p<0.1**

β = Beta coefficients

Model 4A: Public-Private mix *(without disagggregation)*	**B (Std. Error)**	**Tolerance**	**VIF**
(Constant)	**9.613** (0.151)***		
andel_fastleger	**0.650** (0.173)***	.254	3.944
reisetid_pub	**0.000** (0.000)***	.312	3.207
reisetidpriv	**-0.000** (0.000)	.242	4.128
Bruttoinnt	**2.944** (1.746)*	.280	3.571
Andel_0_15	**0.004** (0.003)	.157	6.376
Andel_45_66	**0.009** (0.002)***	.295	3.392
Andel_67_79	**-0.016** (0.003)***	.245	4.074
Andel_80ogover	**0.009** (0.003)**	.258	3.874
andel_ufor	**0.018** (0.002)***	.281	3.553
andel_alenebo80	**-0.009** (0.012)	.110	9.068
andel_skilsmisser	**-0.243** (0.098)**	.173	5.777
andel_dødelighet	**-0.027** (0.161)	.162	6.165
andel_ensligeforsørgere	**-0.000** (0.009)	.115	8.658
andel_ikkevinnv	**-0.031** (0.074)	.805	1.242
andel_kungrskole	**0.007** (0.024)	.474	2.111
andel_psykuføre	**0.008** (0.028)	.618	1.617
andel_sosialhjelp	**0.005** (0.010)	.284	3.518
andel_barnevernstiltak	**0.013** (0.029)	.174	5.748
andel_sykepenger	**-0.003** (0.003)	.242	4.135
Dummy_priv	**0.018** (0.009)**	.541	1.848
ØstfoldHF_dummy	**-0.066** (0.020)***	.493	2.029
AskerBærumOsloHF_dummy	**0.005** (0.023)	.768	1.302
InnlandetHF_dummy	**-0.013** (0.004)***	.240	4.158
RingerikeHF_dummy	**1.726** (0.005)***	.584	1.711
BuskerudHF_dummy	**1.445** (0.005)***	.793	1.261
BlefjellHF_dummy	**1.23** (0.003)***	.453	2.209
VestfoldHF_dummy	**1.075** (0.003)***	.549	1.822
TelemarkHF_dummy	**0.955** (0.003)***	.669	1.494
SørlandetHF_dummy	**0.857** (0.002)***	.309	3.235
StavangerHF_dummy	**0.424** (0.002)***	.466	2.145
FonnaHF_dummy	**0.388** (0.002)***	.452	2.214
BergenHF_dummy	**0.357** (0.001)***	.431	2.321
FørdeHF_dummy	**0.333** (0.001)***	.354	2.824
SunmøreHF_dummy	**0.862** (0.001)***	.468	2.135
NordmøreRomsdalHF_dummy	**0.806** (0.001)***	.490	2.042
StOlavsHF_dummy	**0.758** (0.001)***	.353	2.832
NordTrøndelagHF_dummy	**0.724** (0.001)***	.327	3.057
HelgelandHF_dummy	**0.914** (0.001)***	.402	2.488
NordlandHF_dummy	**0.868** (0.001)***	.370	2.700
NordNorgeHF_dummy	**0.825** (0.001)***	.265	3.776
FinnmarkHF_dummy	**0.788** (0.001)***	.300	3.330

***** = p<0.01 ** = p< 0.05 * = p<0.1**

β **= Beta coefficients**

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