Inequality and inequity in physician service utilization in Norway

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Preface

I would like to thank my supervisor, Kari Eika, for her valuable comments and suggestions. I am very grateful to her for the help in shaping and guiding to write this thesis. Her timely constructive feedbacks and quick responses were also crucial inputs for the whole process.

I would also like to thank Norwegian Social Science Data services (NSD) for allowing me to use the dataset. Special thanks go to Helene Roshauw for her help in extracting the variables from the vast dataset and providing me with supplementary materials.

The analysis of the data and interpretations, and all remaining errors are my own responsibilities.

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1 Introduction

Equity in health and health care distribution is a primary concern for welfare states. In countries that have adopted universal health care coverage, health care is considered a social service that ought to be distributed according to need; not based on the ability to pay or other socioeconomic characteristics.

To measure and examine inequity, it is important to distinguish between need and non-need factors that determine health care utilization. In the empirical analysis of this paper, variables that measure health status, age, gender and lifestyle are categorized as need factors. The socio-economic and other factors such as income, education, regional variation, occupation, civil status and place of origin are categorized as non-need. This categorization is a subjective value judgment. Variation in health care use due to need variables can be taken as legitimate. If the use of health care varies with the non-need variables significantly, controlling for differences in need, it shows that there is inequity in the utilization of health care. These are unfair inequalities because they are caused by the factors beyond the sphere of individual responsibility or characteristics (Fleurbaey and Schokkaert, 2009).

Conceptually, equity can be divided into horizontal and vertical equity. Horizontal equity exists when individuals with equal needs are treated equally. Vertical equity exists when individuals with different needs are treated in proportion to differences between them (Culyer, 2001). In O'Donnell et al. (2008) it is stated that horizontal equity principle is given more attention both in policy and research since a deviation from this principle has an implication on the distribution of health care in a system. Further, researchers assume vertical equity is satisfied on average.

To measure equity, the distribution of need for medical care in the population should be determined. Empirically need is defined as the estimated demand for medical care conditional on some determinant factors using indirect standardization method.

Norway has a universal health coverage system. As one of the components of the National Insurance Scheme (NIS)[1], the health care system is financed predominantly by the general tax system (Van Noord et al., 1998). Thus the health care use is expected to be distributed according to the equity principle.

[1] The other components are public pension system and other income transfers such as sickness, disability, unemployment and rehabilitation benefits.

The aim of this paper is to test and measure the degree of income-related inequality and inequity of medical care utilization, in the use of general practitioner (GP), private specialist and hospital specialist outpatient services in the Norwegian health care system. Further I will try to identify the major determinant factors that contribute to the income-related inequality. The research questions are:

Does the utilization of medical care services differ between lower-income and higher-income individuals?

What are the major contributing factors to income-related inequality?

Concentration index (CI) is a methodological tool that is commonly used to measure the degree of income-related inequality and inequity in health and health care utilization. In this paper the measurement of the degree of inequality and inequity are illustrated by two approaches; a geometrical approach and a statistical approach. The two approaches are interrelated and consistent to each other. The geometric approach provides a quick intuitive understanding of the implication of the magnitudes and signs of the indices that measure the degree of inequality and inequity. Without a geometric illustration it would be a demanding task to interpret scalar values of the estimated indices. The statistical approach, particularly the "convenient regression" method, makes it possible to estimate concentration indices and their standard error conveniently, and thus to conduct statistical inferences.

Geometrically, CI can be computed based on concentration curve. A concentration curve plots the cumulative proportion of health care use against the cumulative proportion of population ranked by income beginning with the lowest. If the concentration curve lies below (above) the equality (45^0) line, it indicates pro-rich (pro-poor) distribution of the medical care. If it coincides with the equality line, it indicates equal distribution of medical care use across income groups. The horizontal inequity index (HI) can also be computed using concentration curves. It requires first, to plot a need concentration curve to compute need CI. Then the HI is obtained as the difference between actual use CI and need CI. The magnitude of the indices range between -1 and +1, and the interpretations depends on the signs. Positive (negative) values of CI indicate inequality favoring the rich (poor). Similarly, positive (negative) values of HI indicate inequity favoring the rich (poor). A zero or insignificant value of CI (HI) indicates health care use is distributed fairly equally (equitably) across income groups. The method I use to identify the major factors contributing to overall income-related inequality is

conceptually identical to the decomposition method used in Wagstaff et al. (2003), and it is based on the linear regression model. The decomposition method can also be used as a tool to identify policy relevant factors in a health care system.

To measure these indices the Norwegian level of living conditions cross-sectional survey data of the year 2005 are used. All the inequality and inequity indices and decomposed inequalities are estimated using STATA software.

The paper finds that the lower income groups are more likely to use GP and hospital specialist services intensively than the higher income groups. Moreover, lower income groups have higher need for the medical care. After controlling for need differences, no evidence of horizontal inequity is found in these two services. That is, GP and hospital specialist services are distributed fairly across income groups. However the result for the probability of private specialist indicates that there is horizontal inequity favoring the better-off.

Decomposition results show that the most important variables that contribute to the overall pro-poor income-related inequality in the probability of GP and hospital specialist visit are need variables. The contributions of non-need explanatory variables to the inequality are very low. The decomposition results support the findings that assert the absence of horizontal inequity in the distribution of these medical care services. The results for the probability of private specialist visit show different outcomes. The largest percentage share of the pro-rich inequality is caused by non-need variables, particularly income and education.

This study finds no evidence that the equity principle is violated in the hospital specialist and GP service utilization. However, the distribution of private specialist services favors the well-off. The fact that the lower income groups have higher need for medical care, and are more intensive users of hospital specialist and GP services suggest inequity in health in the society.

The rest of the paper is organized as follows. Part two reviews theoretical and empirical literatures. In part three, methods of measuring inequality and inequity, and decomposition are discussed in detail. Part four provides an overview of the Norwegian health care system. In part five the data and variables used in empirical analysis are described. Part six presents the results and discussions. Finally, part seven provides some conclusions and remarks.

2 Literature Review

2.1 The rationale for equity in health care

In the welfare states medical service is commonly considered a social service that ought to be distributed according to need; not based on ability to pay or other socioeconomic characteristics. Following the introduction of National Health Service (NHS) in Britain in 1948, other developed countries have also adopted universal health insurance coverage. These were achieved through several health care reforms at different time that replaced partial coverage and subsidies. Nowadays most of the Organization for Economic Cooperation and Development (OECD) countries follows the universal coverage system (Cutler, 2002). There are several rationales for equity in health care services from different angles like legal and philosophical reasons. This paper is restricted to equity in health care services from the welfare economics point of view.

Hurley (2000) takes health care as an economic good that is different from other commodities in a way that it creates market failure. Consequently, it requires a formulation of public policy to be distributed efficiently in the society. One public policy to achieve this is by introducing universal health insurance financed by general tax where each individual contributes according to his/her ability, and benefits from the health system equally (Blomqvist, 2008).

Health care is also important for distributive justice. It is obvious that people live in different social strata. That is, people differ in their income, occupation, education and so on. If health care services are to be distributed through free markets it is, undoubtedly, the well-off people that can afford the most. People recognize that health is important because it is the well-being that enables other aspects of life to function. Thus they attach value to health and also accept the right of others to basic health care from the moral point of view. Kornai and Eggleston (2001) state that no one could declare that, for example, the rich should be saved and the poor is left to death for the lack of ability to pay for the medical services when both suffer from the same level of illness.

The rationale behind universal coverage of medical services as a means for equitable distribution in health care stem from the specific characteristics of medical care services compared to other commodities. Hurley (2000) describes some distinctive features of health

care which include externalities and uncertainty of demand for health care. These characteristics cause market failure in health care market, and make the health sector one of the sectors that requires extensive government intervention.

Externalities associated with health care services can lead to public involvement for the provision of the services efficiently. Some health care services such as vaccination to prevent communicable diseases have external effects. A preventive action taken by one person generates health benefits for other individuals without any compensation from these individuals to that person. This type of health services tend to be under-produced in an economy based on competitive markets as long as he/she is not compensated for the positive externalities generated. These services are better produced when the government takes the responsibility to produce them by itself or subsidize them.

Market mechanism will not provide efficient allocation even in medical services that do not generate external effects. The uncertainty of events is the main cause for the invention of insurances. According to Arrow (1963) the demand for medical care, unlike for other commodities, is irregular and unpredictable because the uncertainty of the occurrences of most illness and injuries as well as the associated expenditures are unpredictable. People are aware that their future health is uncertain and they try to buy medical insurance to avoid financial risk of the bad days. Insurance has welfare improving effects in such a way that by pooling together the risk of different groups of people who buy insurance each individual can be protected against the financial risk of ill health. However, insurance markets themselves are subject to market failures because of the asymmetric information between the insurers and the buyers.

Under commercial insurance, it is expected that individuals with greater risk requires full insurance coverage and the premium would be higher. If the insurer and the insured have exactly the same information about the risk of loss, the premium can be set to charge the insured to the amount that cover exactly the loss, other things being constant. However, if there is asymmetric information, the premium charged can be lower or higher than the cost of the loss. The asymmetric information causes adverse selection and risk selection (cream skimming) problems that lead to market failure in insurance market (Kornai and Eggleton, 2001). Moral hazard in health care is also another problem induced by insurance. These phenomena of health insurance markets are described shortly in the following paragraphs.

Their implications for public policy related to universal coverage are given at the end of this subsection.

Adverse selection arises when the insurer is unable to distinguish between high-risk and low-risk medical insurance buyer individuals and then the insurer charges all individuals an average premium. At this level of premium some low-risk individuals will not buy the insurance and only high-risk individuals remains in the pool. This increases the cost of reimbursement. If the insurer raises the premium further in order to adjust to the high-risk individuals, the insurance may become so expensive. This again leads to that another segment of individuals with lower-risk leave the market. This process may go until individuals with the highest risk remain in the market; even until the market disappears. On the other hand, if the insurer is able to get information on the health status of individuals, he can cream-skim or pick only the low-risk individuals. He makes higher profit from insurance contracts leaving the high-risk group. In this case, the market is unable to offer insurance contracts to all buyers and fails to achieve efficient allocation of resources under uncertainty.

Moral hazard in health insurance can occur at two levels. An individual who has full coverage of health insurance may not make an effort to avoid illness or injury; that is ex-ante moral hazard. This may not be the main cause of moral hazard in health insurance as the occurrence of illness may lead to some health risks and sufferings from pain. Thus no one wants to expose himself to such risks. The main source of moral hazard in health insurance is that after the illness has occurred the fully insured individual has no incentive to spare the use of any possible medical care whatever it costs as long as the marginal utility from the treatment is positive since medical care is paid by the insurer. This is known as ex-post moral hazard. This problem creates overconsumption of the medical services and leads to inefficiency in resource allocation.

It can be seen from the discussions above that it is hard to achieve equity and efficiency of resource allocation in health care through free health insurance markets and this calls for some forms of government interventions. Blomqvist (2008) proposes public health insurance as one of possible alternatives and states that the most important advantage of universal health coverage is that it enables to eliminate the problems of adverse selection and cream-skimming. Equity in medical care services can be achieved by the universal health insurance coverage where the government finances health care expenditures through general tax so that the risks of all individuals are pooled across all tax payers. Blomqvist states further that a well

designed and functioning public insurance can be evaluated by its strength to control and address the cost, equity and efficiency problems created by moral hazard and risk selection better than the private insurance.

2.2 Determinants of health care utilization and their role in income-related inequality

In welfare states where universal health insurance system is adopted, health care services are expected to be distributed based on the needs of the individuals for the services.

It is obvious that people can naturally have different level of need for medical care according to their age, gender, health level as well as the choice of life-style. In practical measurement of inequity these variables are labeled as 'need' variables and socioeconomic factors such as income, occupation, level of education and place of residence can be labeled as 'non-need' variables. Thus by implication, in the horizontal equity principle, socioeconomic factors shouldn't affect the utilization of medical care (Morris et al, 2003).

In empirical analysis need for medical services comprises several factors and is considered as variable that cannot be measured directly rather proxied by demographic variables (age and gender) and morbidity variables (O'Donnell et al., 2008). Morbidity is measured by self assessed health, number of chronic conditions and level of effect of the chronic diseases on daily activities. Thus in a broad sense need for medical care is related to health status, morbidity, demographic and lifestyle factors. The computation of need for medical care in relation to need factors, using indirect standardization method, is presented in section 3.1.

Life-style factors such as smoking, drinking alcohol and physical training can also be considered as the cause of fair inequalities in use as people should be held responsible for their behavioral choices. Flurbaey (2008, p. 2) states the responsibilities of individuals that "once rights and resources are equally allotted to all individuals, the difference in well-being that follow from different views of good life and from the subsequent different uses of the rights and resources are down to individuals' responsibility".

The term lifestyle can have a broader meaning than the way it is used in this paper. World Health Organization (1989) takes it as a general way of living condition of an individual where the behavior of the individual is determined by socio-cultural factors and personal

characteristics. In this paper lifestyle is perceived like it is stated in Contoyannis and Jones (2004) as some personal set of behaviors that are considered to influence health and eventually the use of health care and to reflect only individual's free choice to practice.

As this paper is all about the measurement and interpretation of the degree of inequality and inequity, it is important to make clear these concepts and the differences and relations between them. In the utilization of health care, inequality can arise either for the reason that individuals have different need for health care which is considered to be fair inequality or that they are treated unequally when they deserve to be treated equally. Inequity has a sense of unfair distribution of medical resources when they ought to be distributed fairly among those individuals need it. It is worth to quote Gravelle et al. (2006, p. 193) to make the two concepts more clear. “There is inequality in consumption when different individuals receive different amounts of care. Inequity, on the other hand, implies that individuals do not receive the amounts of care that they need”.

2.3 Empirical literature

There are several empirical literatures at international level that test and examine to what length those countries with universal health care coverage have in practice realized the equity principle. Most of the literatures apply concentration index (CI) which is known as standard method for the income-related inequality measurement. This method is also applicable in countries without universal health care system as a tool to examine the severity of inequity in health care utilization across income groups.

Van Doorslaer et al. (2000), Van Doorslaer, Masseria et al. (2004) and Lu et al. (2007) focus on comparing income-related inequity in the utilization of health care across-countries using cross-sectional data. Applying a similar method, Morris et al. (2003), Allin and Hurley (2009), Grasdal and Monstad (2008) examine country specific inequity. Countries are different in their health care system, in the amounts and type of resources they use. But the cross-country equity studies are believed to help policy makers to learn from the experience of different systems for the improvement of health sector performance. One of the challenging areas for policy makers is the equitable distribution of health care services according to need.

In Norway there are only a few studies of income-related inequalities in health care that are based on concentration index. Van Doorslaer, Masseria et al. (2004) study income-related

inequality in the use of medical care in 21 OECD countries. In this study Norway is included with living condition survey data of the year 2000. The study investigates equality by dividing the physician services into three parts, i.e. all physicians, general practitioner and specialists. Accordingly, the results from the study indicate that the probability of all physician visit concentration index is negative but not significantly different from zero. When need difference is controlled, the resulting horizontal inequity index is positive and statistically significant indicating total physician service is distributed in favor of the rich.

When the utilization of medical care is investigated separately by GP and specialist services, the horizontal index shows that the distribution of GP visits is almost equitable across the income groups. However, access to specialist services does not appear to be distributed like GP service does. The horizontal inequity index is positive and statistically significant implying pro-rich inequity.

Applying similar methods to the OECD study, Grasdal and Monstad (2008) investigate the change of inequities in the utilization of physician services over time based on data from the Surveys of Living Conditions for the years 2000, 2002 and 2005. The results from the investigation show that there is no evidence of horizontal inequity in the utilization of GP and hospital outpatient services. However there exist significant inequities in the probability of private specialist services but the inequity indices are declining over time. The reason is that the marginal effect of income has decreased over time and income is the major factor that contributes to inequality in the probability of private specialist visit. It is believed that the role of income decreased as using private specialist, to bypass waiting lists, might have decreased following the introduction of patient list system of 2001 and the 2002 reform in the hospital ownership.

One of the objectives of the reforms was to ensure equal accessibility of health care services. Godager et al. (2007) evaluate the introduction of patient list system in terms of use access and satisfaction of patients. The evaluation result shows that improvement in the capacity of GP services in a municipality affects the number of contacts with specialists positively. The reason is that the rise in the number of GP per municipality increases the referral to specialists because of the doctors compete for patients.

Based on only regression analysis in the study of the impact of accessibility on the use of specialist health care in Norway, Iversen and Kopperud (2005) investigate the relationship

between use of the private specialist medical care service and socioeconomic variables and geographical accessibility. They found that use of private specialist service is positively related to educational level of individual, household income and geographical accessibility to the specialists. They also compare how self-assessed health status is related to the use of private specialist service and hospital outpatient services. The results show that self assessed health was closely related to the hospital outpatient services and not to private specialist services. From this they conclude that the ambition of equitable delivery of health care services in public hospitals are fulfilled but that of private specialist services financed by public fund does not meet the goal of equity in health care services. The study thus indicates the prevalence of socioeconomic-related inequity in the Norwegian health care system.

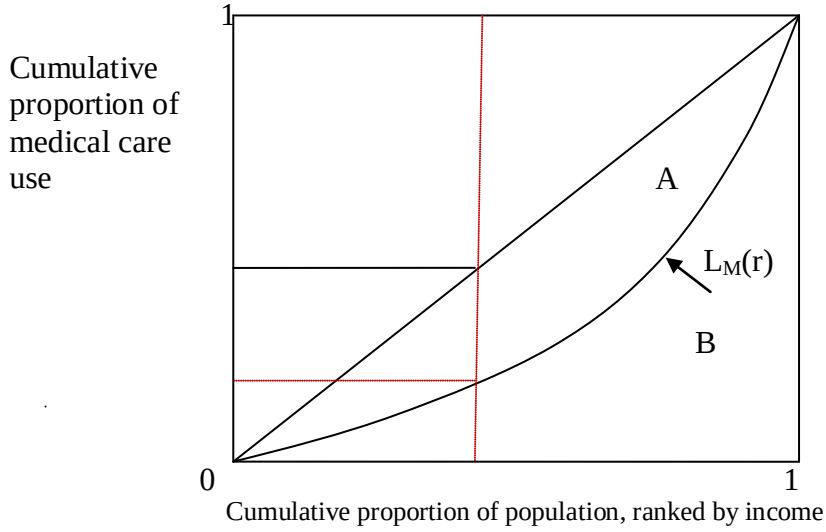
3 Measuring income-related inequality and inequity

Most studies in health sector use concentration index as a standard tool in the measurement of the degree of inequalities and inequities in health and health care. Researchers are attracted to it for its intuitive geometric interpretation and statistical computability from individual level sample data. In the following we will see how the concentration index of health care is computed and interpreted geometrically and statistically. The two methods are interrelated and are consistent with one another as they can be computed using results from same sample data. At the end of this section the decomposability of the concentration index into health care use determinant factors will be discussed. These methods of inequality and inequity measurements will be used in the empirical part of this paper.

3.1 Geometric approach

Geometrically, a measure of degree of income-related inequality in the utilization of medical care can be obtained by computing concentration index based on a concentration curve. The concentration curve $L_M(r)$ in figure 3.1.1 plots cumulative proportion of medical care use against the cumulative proportion r of the population ranked by income beginning with the least advantaged (Van Doorslaer, 2008). It is analogous to a Lorenz curve which is commonly used as an indication of income distribution in a given population for a given period.

Figure 3.1.1 Concentration curve of medical care utilization



In figure 3.1.1 the concentration index, denoted by C_M, in the utilization of medical care can be defined as the ratio of the area between the concentration curve and the equality ($45^{0)}$ line and the total area below the equality line. Since the area below the equality line is exactly 1/2, in the unit box, C_M would be twice the area between the concentration curve and the equality line. It can also be written as:[2]

(1) $$C_M = 1 - 2\int_0^1 L_M(r)\,dr$$

The distance of the concentration curve from line of equity in both sides will tell the level and direction of inequality. When $L_M(r)$ coincides with the equality line, there is no income-related inequality in the utilization of medical care and C_M would be zero. That is, the poorest $k\%$ of the population obtains $k\%$ of of total medical care services. When $L_M(r)$ lies below the equality line it indicates that the poorest $k\%$ of the population obtains less than $k\%$ of the total medical care services. The remaining larger percentage goes to the richer group favoring the rich and C_M is positive. On the other hand when $L_M(r)$ lies above the equality line the distribution of medical care is pro-poor and C_M takes negative value. The range of the C_M lies between -1 and +1. In the extreme cases when C_M is -1, all medical care utilization is concentrated in the hands of the most disadvantaged person while +1 indicates all utilization is concentrated in the hands of the most well-off person.

As it is mentioned earlier, horizontal inequity is observed when utilization of medical care varies significantly with socioeconomic factors after variation due to need factors is corrected for. The degree of this variation can be measured by horizontal inequity index (HI). Horizontal inequity can be illustrated geometrically using concentration curves. To measure horizontal inequity index we need first to compute the need for medical care. One way to compute need is by indirect standardization method (O'Donnell, O. et al, 2008).

Suppose that the actual medical care received by an individual in a given period is denoted by m_i. The indirect standardization method generates the need for medical care,m_i^* by first estimating actual medical care use, m_i, on the vectors of need x_j and non-need z_k factors. For linear regression model it is defined as

(2) $$m_i = \alpha + \sum_j \beta_j x_{ji} + \sum_k \gamma_k z_{ki} + \varepsilon_i$$

[2] Area under concentration curve is obtained by integration equation, $B = \int_0^1 L(r)\,dr$. $C_M = \frac{A}{A+B}$ by definition, and since A+B =1/2, $C_M = 2A = 1 - 2B$. Then $C_M = 1 - 2\int_0^1 L(r)\,dr$.

where α, β_j, γ_k are vectors of parameters and ε_i is an error term.

In some studies like Van Doorslaer et al. (2000) only need factors are included in the regression. Gravelle, 2003 criticizes the exclusion of non-need variables for it creates omitted variable bias. The bias occurs when an omitted variable is correlated at least to one of the regressors and determines the medical care use. As a result in the estimation of need-expected values the coefficients of need variables pick up the effect of the omitted variable. This in turn has an influence on the estimate of horizontal index.

The problem is solved by including non-need variables in the regression as in equation (2) above. Then the need for medical care for each individual is the predicted value from this regression when non-need variables are replaced by their mean values. Setting the non-need variables to their mean values in the prediction of need neutralize their impact (Van Doorslaer et al., 2004). Thus need is the predicted value of m_i given the determinant factors obtained by storing the predicted values.

(3) $$m_i^* = \hat{\alpha} + \sum_j \hat{\beta}_j x_{ji} + \sum_k \hat{\gamma}_k \bar{z}_{ki}$$

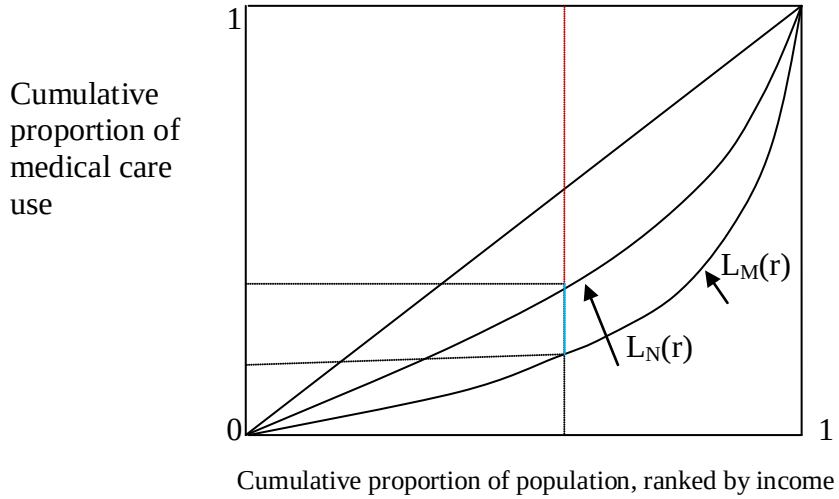
Thus m_i^* measures the expected amount of medical care that individuals with the same need characteristics would have received if the system had treated them equally, on average. In other words it is the amount of medical care an individual, on average, expected to receive given his/her need characteristics (Wagstaff and Van Doorslaer, 2000). The concentration curve corresponding to need can be expressed by $L_N(r)$, and the associated concentration index C_N is computed by:

(4) $$C_N = 1 - 2\int_0^1 L_N(r)\, dr$$

Geometrically, horizontal inequity can be computed by comparing the position of concentration curve of actual medical care use $L_M(r)$ and need concentration curve $L_N(r)$. HI is then defined as twice the area between the actual medical care uses and need concentration curves or the difference between the corresponding concentration indices:

(5) $$HI = 2\int_0^1 [\, L_N\,(r) - L_M(r)]d(r) = C_M - C_N$$

Figure 3.1.2 Concentration curves for actual and expected medical care utilization



By investigating the share of need and the share of actual use by each income group, we can measure the extent of horizontal inequity. We start with the case when the need concentration curve $L_N(r)$ coincides with the actual use concentration curve $L_M(r)$. In this case the share of medical care use of each group equals the share of its need and there is no horizontal inequity. For example, the share of need and the share of actual use of the poorest k%of the population are equal. And the share of need and the share of actual use of the remaining richer 100% - k% of the population are also equal.

If $L_N(r)$ lies above $L_M(r)$, the higher income groups obtain a higher share of medical care than their share of need (Van Doorslaer et al., 2000). At the same time the lower income groups obtain lower share of actual medical care than their share of need, and we say that there is horizontal inequity favoring the better-off. In terms of concentration index from corresponding curves, the difference between C_M and C_N, i.e. HI is positive. That is why we say that positive HI index indicates pro-rich distribution of medical care. Conversely, when $L_N(r)$ lies below $L_M(r)$, with similar analysis and computation we arrive at a negative HI that indicate the existence of horizontal inequity that favors the lower income groups.

Van Doorslaer, et al. (2000, p. 557) emphasize also that coinciding curves for need and actual use that asserts zero HI provide a sufficient but not a necessary condition for no horizontal inequity. They give an example that HI can also be zero if “inequity favoring the poor in one part of the distribution exactly offsets inequity favoring the rich in another”.

3.2 Covariance approach

The concentration indices that measure health care inequalities discussed above are generally estimated from sample observations. Kakwani et al. (1997) observed that it is important to test whether the value of the estimated indices are statistically significant. They developed "convenient regression" method, to estimate concentration indices, related to the concept of the relationship between the Gini index and standard regression coefficient in Lerman and Yitzihaki (1984).[3] With the convenient regression approach it is possible to measure indices and their standard errors at the same time so that one can undertake statistical inferences.

For individual-level data where m_i is medical consumption of the i^{th} individual, concentration index can be computed using empirical "convenient covariance" formula (Kakwani et al., 1997) which is analogous to the convenient way of calculating the Gini coefficient in Lerman and Yitzihaki (1984) :[4]

$$C_M = \frac{2}{n\bar{m}}\sum_{i=1}^{n}(m_i - \bar{m})(R_i - 1/2) \quad (6)$$

$$= \frac{2}{n\bar{m}}\sum_{i=1}^{n} m_i \; R_i - 1$$

where n is sample size, $\bar{m}$ is the sample mean of m_i and R_i is the fractional rank of i^{th} individual in income distribution. Based on the relationship between the concentration index, and the covariance of medical care and fractional rank in equation (6), the "convenient regression" model can be written as:

$$2\sigma_R^2\left[\frac{m_i}{\bar{m}}\right] = \alpha_1 + \beta_1 R_i + u_i \quad (7)$$

where σ_R^2 is the variance of fractional rank and considered to be constant. The OLS estimator of β_1 is

$$\hat{\beta}_1 = \frac{\frac{2\hat{\sigma}_R^2}{\bar{m}}\frac{1}{n}\sum(m_i - \bar{m})(R_i - 1/2)}{\frac{1}{n}\sum(R_i - 1/2)^2} = \frac{2}{n\bar{m}}\sum_{i=1}^{n} m_i \; R_i - 1$$

[3] Running regressing m_i on R_i, $m_i = \alpha + \beta R_i + v_i$, yields a slope coefficient $\beta = cov(m_i, R_i)/var(R_i)$, together with equation (6) this is used to formulate convenient regression.

[4] The fractional rank R_i is computed by $R_i = i/n$, where i= 1, 2 . . . n (ranking individuals by their income from lowest to highest; 1to n). Thus the highest value of R_i is 1. For the uniformly distributed R_i between 0 and 1 the mean of R_i is 1/2.

which is the same as the concentration index in equation (4); where the sample variance is $\hat{\sigma}_R^2 = \frac{1}{n}\sum(R_i - 1/2)^2$. The standard error of $\hat{\beta}_1$ is then the standard error of the concentration index C_M and can be used to conduct t-test to determine the statistical significance of the index.

Similarly, concentration index of need and its standard error can be computed using:

$$2\sigma_R^2 \left[\frac{m_i{}^*}{\bar{m}^*}\right] = \alpha_2 + \beta_2 R_i + \varepsilon_i \quad (8)$$

where $m_i{}^*$ is predicted medical care (need) $\bar{m}^*$ is its sample mean and ε_i is an error term. Then the estimator of β_2 measures need concentration index C_N.

Unlike the horizontal inequity index that can be computed from the difference between C_M and C_N, its standard error cannot be easily obtained in the same manner. The reason is that sample estimates of C_M and C_N are not independently distributed (Kakwani et al., 1997). The standard error of HI can rather be computed from a convenient regression:

$$2\sigma_R^2 \left[\frac{m_i}{\bar{m}} - \frac{m_i{}^*}{\bar{m}^*}\right] = \alpha_3 + \beta_3 R_i + \epsilon_i \quad (9)$$

The OLS estimator of β_3 and its standard error represent the estimate of HI index and standard error of HI index respectively.

Based on the definition and explanations of inequality and inequity given in section 2.2, in the preceding paragraphs we have seen the methods how to quantify and analyze inequalities and inequities in the health care utilization. Accordingly the inequality is measured by C_M and the inequity is measured by HI using equations (7) and (9), respectively.

3.3 Decomposing concentration index

Concentration index measures the overall income-related inequality in health care utilization. It is possible to decompose the concentration index in order to assess the contribution of each need and non-need determinant factor to overall inequality. Wagstaff et al. (2003) propose the decomposition of concentration index of health as the sum of the degree of income-related inequality in each determinant factor weighted by the elasticity of the health with respect to that factor. The decomposition presupposes a linearly additive explanatory model such as, in our case, linear regression model of health care utilization m_i given by

(10) $$m_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i$$

where x_k is a set of all need and non-need related determinant factors of health care utilization, β_k are parameters and ε_i is an error term. Plugging this expression into equation (6) one can get the overall concentration index which is written as:[5]

(11) $$C_M = \sum_k \frac{\beta_k \bar{x}_k}{\bar{m}} C_k + \frac{GC_\varepsilon}{\bar{m}}$$

where $\bar{m}$ is the mean of m_i, $\bar{x}_k$ is the mean of x_{ki} and C_k is the concentration index of factor k obtained analogously to C_M in equation (6). From the expression it can clearly be seen that the degree of the over all income-related inequality in health care use is the weighted sum of the concentration indices C_k of each factor with respect to income and a residual inequality $\frac{GC_\varepsilon}{\bar{m}}$ due to the error term. The weights are the elasticity of health care use with respect to each factor evaluated at sample means which are expressed by $\frac{\beta_k \bar{x}_k}{\bar{m}}$. The last term in (9) is a residual component of inequality that cannot be explained by variations in x_k related to income. In the residual component $\frac{GC_\varepsilon}{\bar{m}}$, GC_ε is a generalized concentration index for ε (Wagstaff et al., 2003) and defined as

(12) $$GC_\varepsilon = \frac{2}{n} \sum_{i=1}^{n} \varepsilon_i R_i$$

One can also deduce that a determinant factor contributes substantially to overall inequality if the determinant itself is unequally distributed by income, i.e. C_k is different from zero and if it substantially determines health care use ($\beta_k \neq 0$) (Van Doorslaer, 2008). However, if one of the two components is zero, the variable contributes nothing to the overall income-related inequality index.

The decomposition quantifies the inequalities attributed to each determinant factor. Thus it can be used as a tool to identify which factors are important for a prevailing health care policy. It also helps to measure the extent of inequalities attributable to policy relevant and policy irrelevant factors. As it is mentioned in section (2.2), variables are distinguished as need variables if their effects on health care are unavoidable or if they reflect individual responsibility. In some cases categorizing the determinants into policy relevant and irrelevant

[5] The detail proof is given in wagstaff et al (2003). Expression $\frac{\beta_k \bar{x}_k}{\bar{m}}$ represents the elasticity of medical care utilization with respect to each variable evaluated at their mean, where $\beta_k = \frac{dm}{dx}$, for linear regression.

factors depends on the policy circumstances. Some factors can be policy relevant in some circumstances and non-relevant in other circumstances. For example as it is stated in Gravelle (2003) even age can be a policy relevant variable even though it is impossible to alter the age distribution of the population. Suppose age and income are denoted by x and y respectively. It is possible to change the effect of age on the use of medical care (β_x) by targeting the health of elderly or altering the joint distribution of age and income (C_{xy}) by taxation policy.

If we could clearly identify need (policy irrelevant) variables say as x_k^N and non-need (policy relevant) variables as x_k^{NN}, we can compute a policy relevant partial concentration index using decomposition equation in (13). This is usually known as horizontal inequity index which is obtained by removing inequalities due to need variables from the overall concentration index.

(13) $$HI = C_M - \sum_k \frac{\beta_k \bar{x}_{ki}^N}{\bar{m}} C_{x_K^N}$$

The horizontal inequity measure HI obtained in this way is exactly the same as HI obtained in the convenient regression method when "need" is estimated using linear regression models in indirect standardization.

The advantage of linearity of the regression model is that its additivity facilitates the decomposition and makes the interpretation easier. However, medical care utilization data are better estimated by nonlinear models which make decomposition impossible.

To restore the mechanism of decomposition Van Doorslaer et al. (2004) propose decomposition based on a re-linearization of the nonlinear models by applying approximation technique. The results from this method are only approximates. It is reported that the HI derived from this method is not identical to the one derived from the concentration indices. However several studies of inequality in health care witness that model specification is not so strict. Studies for many OECD countries and other countries show that decomposition results differ little and that HI is not sensitive to the choice between least squares and non-linear estimators (Van Doorslaer et al., 2000; Van Doorslaer and Masseria et al., 2004; Allin and Hurley, 2009; Lu et al., 2007). Given the evidence I resort to use ordinary least squares estimators in decomposition for simplicity and convenience.

4 Overview of Norwegian health care system

The Norwegian health care system has universal health care coverage, and it is financed mainly through general tax system. Thus every resident has access to medical care based on his/her need irrespective of his/her income, social status, and place of residence. As it is mentioned in section 2.3, empirical studies show that the equity principle is achieved in the primary health care and public provision of specialist services. The health care system has accomplished remarkable improvements in health status of the population over time. According to the Norwegian central statistics office life expectancy in Norway is among the highest in the world. As of 2007 the life expectancy of Norwegian men reached 78.2 years, compared to 71 in 1970 and that of women reached 82.7 years, compared to 77 for the same years. Infant mortality rate (per 1000) has fallen dramatically from 8 in 1980s to 3.2 in 2006-2007 (www.ssb.no). Despite these achievements, there are areas that need further improvements. Report no.20 (2006-2007) to the Storing indicates that there exists socioeconomic variation in health. This can be attributed to that people are living in different social strata where people with higher income have best health. This can also be reflected in the consumption of health care that people with high income and education have higher probability to use private specialist services than lower-socioeconomic groups (Iverson and Kopperud, 2005).

In Norway the health care system has reached to this level through several health care reforms. One important institution is the National Insurance Scheme (NIS), which was established in 1967. Among major reforms recently undertaken are the 2001 reform of Regular General Practitioner scheme and the 2002 hospital reform. The reforms were undertaken with the aim of improving equity and efficiency in the delivery of health care and efficient allocation of resources in the health sector in general.

In reference to the reforms, current health care provision can be classified into three categories. The first is that where most of the specialized medical care services are provided by the central government through the five regionally organized state health enterprises. The second is the primary health care provision by municipalities through contracts signed with predominantly privately owned general practitioners (GP) practices in the framework of NIS.

As a third category there are also few privately owned specialist and GP health care service providers without the contract with municipalities whose financial sources are totally from revenue collected from the services provided.

The 2001reform of the patient list system requires inhabitants to be listed to a GP with vacant list and the GPs to have a contract with municipalities in order to benefit from the NIS. Under the patient list scheme the GPs are required to provide primary health services to the patient listed in his practice or as a 'gatekeepers' to refer to specialists. The private practice GPs receive income from the services they provide in three forms and each form of income believed to constitute one third of the total annual income of a practice on average (Iversen and Kopperud, 2005). The first is the fee-for-service payments where a GP is paid fees from the national insurance for the various services provided to patients. Second the GP gets a capitation fee from the municipalities he/she signed a contract, i.e. a fixed amount of money per patient listed to his/her practice irrespective of the type of patient. The third is a reasonable standard copayment the patient pays per visit. However the income of the few GPs that provide services without having contracts with a municipality is totally from the fee they charge the patients they treat.

Most of specialized medical services are provided in the public hospitals. There are also private specialist's practices engaged in providing specialized medical services. In the history of health sector reforms most of the reforms undertaken were to the specialized service provision. The specialist health services provision encountered problems such as long waiting list and time for some specialist treatment. In addition, inequality in the supply of hospital services and the over time increasing cost concerns can be mentioned (Van Noord et al., 1998).

Before 1974 hospitals and other specialized medical services were administered by the 19 counties. Since 1974 the 19 counties were grouped into five health regions, maintaining the ownership of the respective counties, headed by regional health committees formed from the representatives of respective counties. These institutional setups had been operative until the 2002 when the government overtook the ownership of hospitals by establishing five regional health enterprises which are independent of counties but each reporting to the ministry of health and social affairs.

Concerning hospital financing; before 1997 block budgets were allocated by the government to the counties. The counties, in turn, allocate the budget to the hospitals. Since 1997 the block budget grant to the counties was replaced by a grant based on the number and composition of treatment in the hospital which is known to be Diagnosis Related Group (DRG) approach. The introduction of this activity based budget was to alleviate the increase in the hospital expenditures following the legislation of the waiting-time guarantee in 1990. The legislation required that the county councils supposed to ensure treatments within six months for patients who have been given a waiting-time guarantee. This has created a pressure on the budget of the hospitals (Hagen and Kaarbøe, 2006).

It is in this post reform period of health care system and historical background that we are going to investigate the prevalence and extent of inequity in physician services.

5 Data and variable specifications

To test and measure the degree of income-related inequality and inequity in the utilization of health care in Norway I use Norwegian level of living conditions survey data of the year 2005. The survey data is collected and compiled by the Norwegian central statistics office (SSB) and provided by Norwegian Social Science Data Services (NSD). The survey was based on 10,000 randomly selected observations on individuals aged 16 and older. It was conducted through interview and postal questionnaires (Hougen, 2006). The survey contains data on medical care utilization measured by physician visits, health status, lifestyle, demographic (age and gender), and socioeconomic (income, education, employment, marital status, birth place and residence area) of the groups. Data on income, education and employment conditions of the groups in the sample are added to the dataset from administrative records by the central statistics office.

The response rate in the sample is about 70% resulting in 6766 net observations. The remaining 30% of the sample population are non-respondents. Among other things the main reason for not to respond is unwillingness to participate in the survey (Hougen, 2006). In the data-set, population density and cigarette smoking variables have significant number of missing values. To keep the number of observations as large as possible the missing values of these variables are replaced by the average of the observed values on subcategories of the respective variables. After correcting for missing values and outliers, the sample is reduced to 6699 observations. A statistical summary of the variables used in this paper is shown in table 5.1.

5.1 Medical care utilization

Medical care utilization is measured by the probability of GP and medical specialist visits. Specialist visit is divided into specialist visit outside hospitals which is considered to be private specialist services and policlinic specialist visit in public hospitals. In the survey each individual is asked whether he/she has contacted GP and specialists, and the number of times he/she contacted in the past 12 months in 2005. The empirical analysis has three binary dependent variables: the probability of GP, of private specialist and of hospital specialist outpatient visits.

Table 5.1 Statistical summary and variable description, N=6699

Variable	description	Mean	Std. Dev.	Min	Max
Dependent v.					
proGP_vst	Probability of GP visit	.7021944	.4573277	0	1
prpvtsp_vst	Probability of private specialist visit	.170921	.376468	0	1
prhos_sp_vst	Probability of hospital specialist visit	.2200328	.4142994	0	1
Need variables					
morbidity					
sah_good	Self assessed health- good or v. good	.813405	.3896152	0	1
sah_fair	Self assessed health- fair	.1280788	.3342025	0	1
sah_poor	Self assessed health- poor or v. poor	.0585162	.2347345	0	1
num_cron	Number of chronic diseases	1.35677	1.871161	0	17
no_cron	Has no chronic disease	.4228989	.4940565	0	1
cron_sever	Chronic affects daily activ. severely	.1079266	.3103108	0	1
cron_somlit	Chronic affects daily activ. Some/little	.37319	.4836881	0	1
cron_noefct	Chronic does not affect	.0959845	.2945919	0	1
Lifestyle var.					
nonsmok	Non-cigarette smoker	.6592029	.4740126	0	1
daily_sm	Daily cigarette-smoker	.2434692	.4292079	0	1
smt_sm	rarely cigarette smoker	.097328	.296426	0	1
notrain	Never do physical exercise	.1564413	.3633003	0	1
rare_trai	physical exer. less than once a week	.1347962	.3415313	0	1
often_trai	physical exer. Once or more a week	.7087625	.4543666	0	1
drink_mis	Missing data on alcohol	.2861621	.4519998	0	1
nodrink	Do not drink alcohol	.0798627	.2711007	0	1
som_drink	Drink alcohol 1-3 times per month	.3770712	.4846892	0	1
more_drink	Drink alcohol 1-7 times per week	.256904	.4369586	0	1
Age-sex dum.					
m16_29	Male, age 16-29	.1137483	.317529	0	1
m30_45	Male, age 30-45	.1495746	.3566805	0	1
m46_59	Male, age 46-59	.1256904	.3315249	0	1
m60_	Male, age above 60	.1158382	.3200547	0	1
f16_29	Female, age 16-29	.1055381	.3072685	0	1
f30_45	Female, age 30-45	.1533065	.3603095	0	1
f46_59	Female, age 46-59	.1177788	.32237	0	1
f60_	Female, age above 60	.1185252	.3232531	0	1
Non-need var.					
lninc	Log of equivalent income	12.41092	.5965698	.69	17.46
popd_mis	Missing data on population density	.2098821	.4072546	0	1
pdens1	Residence area, population < 2000	.087625	.2827699	0	1
pdens2	Residence area, population 2000-20000	.2695925	.4437812	0	1
pdens3	Residence area, pop. 20000-100000	.1946559	.3959651	0	1
pdens4	Residence area, pop. Above 100000	.2382445	.4260413	0	1
reg1	Region1- Oslo and Akerhus	.2177937	.4127772	0	1
reg2	Region2- Hedmark and Oppland	.0841917	.2776958	0	1
reg3	Region3- East	.1846544	.3880459	0	1
reg4	Region4- Agder and Rogaland	.1347962	.3415313	0	1
reg5	Region5- West	.1798776	.3841141	0	1
reg6	Region6- Trondelag	.0918047	.2887717	0	1
reg7	Region7- North	.1068816	.3089858	0	1
unmaried	single	.3700552	.4828552	0	1
maried	Married or registered partner	.4836543	.49977	0	1
w_d_s	Widow or separated	.1462905	.3534236	0	1
empl	Employed	.6741305	.4687338	0	1
mil_stu	Student or on military service	.0738916	.261614	0	1
pensj	retired	.1298701	.3361856	0	1
unempl	unemployed	.1221078	.3274347	0	1
no_edu	Non-educated	.0008957	.0299163	0	1
joun_edu	Have 1-7 or 8-10 years education	.2760113	.4470558	0	1
high_edu	Have 11-14 years education	.4334975	.4955947	0	1
coll_edu	College and above. 14 + years edu.	.2739215	.4460025	0	1
bNorway	Born in Norway	.9281982	.2581787	0	1
bEuro	Born in Europe	.0370205	.188826	0	1
bUtEur	Born outside Europe	.0347813	.1832391	0	1

From the statistical summary table we can see that in Norway about 70% of the population visits general practitioners at least once a year.[6] The table also shows that specialists are visited less frequently than GPs. This can be due to the fact that the GPs serve as the "door keeper" to the specialists. A patient has to contact his doctor first to be referred to specialists. Only 22% of the population visits specialists in public hospitals while only 17% of the population visits private medical specialists.

5.2 Determinant factors

As Norway has a universal health care system, medical care is expected to be distributed according to need. In assessing the income-related inequity of medical care, the determinant factors of medical care use are categorized into two parts based on the analysis given in the theoretical part, section 2.2.

Those factors that reflect characteristics internal to the individual behavior and unavoidable conditions are taken as need variables. Those that are external to the individual and ought not to determine the medical care use according to the equity principle are categorized as non-need variables. This categorization is shown in the statistical summary table.

In the empirical analysis need is proxied by morbidity, age-gender, and lifestyle variables. Morbidity is represented by three categories of self-assessed health status (SAH), the existence of chronic (long standing) diseases and the level of effects of the chronic disease on the daily activities of the groups. In the survey each individual was asked to rate his/her health status as very good, good, fair, poor and very poor. The groups were also asked how many chronic diseases they had (from some list of diseases categorized as chronic) and to rate the effects these sicknesses have on their daily activities (severe, some, little and no effects). From table 5.1 we can see that about 81% of the population in the sample reported good or very good health in year 2005. About 42% of the population did not have a chronic disease. But an individual had 1.35 chronic diseases on average. Age-gender dummies are created from the reaction of age and gender dummies to clearly identify the influence of age groups by sex on medical care utilizations. Each age-sex group is distributed in the sample representing 11-15% of the population. Lifestyle variables are represented by dummies of smoking, alcohol consumption and physical exercises. The survey indicates that about 70% of

[6] In the survey questionnaire the GP visit includes regular individual doctor, doctor at emergency center, school doctors and firm doctors.

the population is non-smokers and equally many undertake physical exercises. Only 8% do not drink alcohol; the rest takes alcohol at least once a month.

In this study the non-need variables are household income after tax, region, population density, education, marital status, occupation and birth place of the groups in the sample.

For the income variable, household income after tax is chosen because income after tax is expected to be more equally distributed than gross income because taxation of income considers family size and other economic conditions of a household. In this paper, income after tax is again readjusted to equivalent income for the household size. It is obvious that the higher the size of a household, the bigger resources are required to maintain a living standard. On the other hand there is an advantage of 'economies of scale' or cost advantage in consumption for the household as they live together. That is, a household expend less, for example, for electricity and housing by living together than they as a group would have done if each live alone. In the computation of income-related inequity household income is adjusted using "equivalence scale" method. There are different types of equivalence scales[7]. Here I use square root scale which divides the household income by the square root of the household size (www.oecd.org). Region and the population density of the residence area of the individual included to examine the effects of regional variation, in terms of population size and settlement pattern, on medical care utilization. Most health care facilities are concentrated in the densely populated and urban areas. As a result people in these areas have better access to medical services. In addition, regional variation may reflect socioeconomic differences. People living in urban areas usually tend to be wealthier and have better access to secondary care services. Education affects medical care use in several ways. The higher educated a person is, the better she/he to produce health, and all other thing equal, the less frequent to use medical care. On the other hand, a highly educated person can make higher income and can use private specialist services to bypass waiting lists in public hospitals specialist services whenever necessary. Moreover an educated person can understand and explain better her health status, and can benefit more from the system. Occupation, marital status and country of origin are expected to affect efficiency of health production and thus the utilization of medical care.

[7] Other equivalence scales such as 'OECD equivalence scale' assigns a value of 1 to the first household member, 0.7 to each additional adult and 0.5 to each child. The 'OECD modified scale' assigns a value of 1 to the first household member, 0.5 to each additional adult and 0.3 to each child.

6 Estimation results

6.1 Inequality and inequity

The results of convenient regressions based on equation (7) - (9) are presented in table 6.1 below for the three types of medical care utilizations. For each type of medical care the degree of inequality in actual medical care use and need, and the degree of horizontal inequity are shown. The signs of the values of these indices and their interpretations are clearly stated in section (3.1). Based on this theoretical background the empirical results shown in table 6.1 will be discussed separately for each types of medical care. In addition, graphical representation of inequalities and inequities are presented to make the discussion more clear.

Table 6.1 presents the estimated indices from two regression model specifications. The first is when the need for the medical care is estimated using logit and the second is when linear regression model is used for comparison. As it can be seen from the table the two model specifications provide similar results for the horizontal inequity indices (HI). More importantly the statistical significances of the indices do not change with the change of model specification. This will allow us to use the linear regression model to make decomposition of the overall income-related concentration indices possible in the next subsection.

It is important to point out some general features of the results in the table. For all three types of medical care the indices are very small though some are statistically significant. All are below 0.1 in absolute value. The figures are small in reference to that the indices should fall within the range of [-1, 1] and the more the indices closer to -1 or 1, the more inequality is observed. This may indicate that medical care use differences and distribution in Norway do not show considerable inequalities or inequities. From the table it can also be seen that in all types of medical care the need concentration index is negative. In general, it is the lower income population that more likely to need medical care at all levels of services, i.e. the primary and secondary services.

Table 6.1 Concentration indices for GP, private specialist and hospital specialist services when need is estimated using logit and linear regression models

Medical care	Index when need is estimated using logit model			Index when need is estimated using linear regression model		
	C_M	C_N	HI	C_M	C_N	HI
General practitioner services	**-.0133** (-2.89)	**-.0185** (-12.84)	.0053 (1.21)	**-.0133** (-2.89)	**-.0175** (-12.31)	.0043 (.97)
Private medical specialist services	.0120 (0.77)	**-.0216** (-6.55)	**.0336** (2.21)	.0120 (0.77)	**-.0235** (-7.32)	**.0355** (2.32)
Hospital specialist outpatient services	**-.0351** (-2.64)	**-.0488** (-13.02)	.0137 (1.08)	**-.0351** (-2.64)	**-0494** (-13.48)	.0143 (1.13)

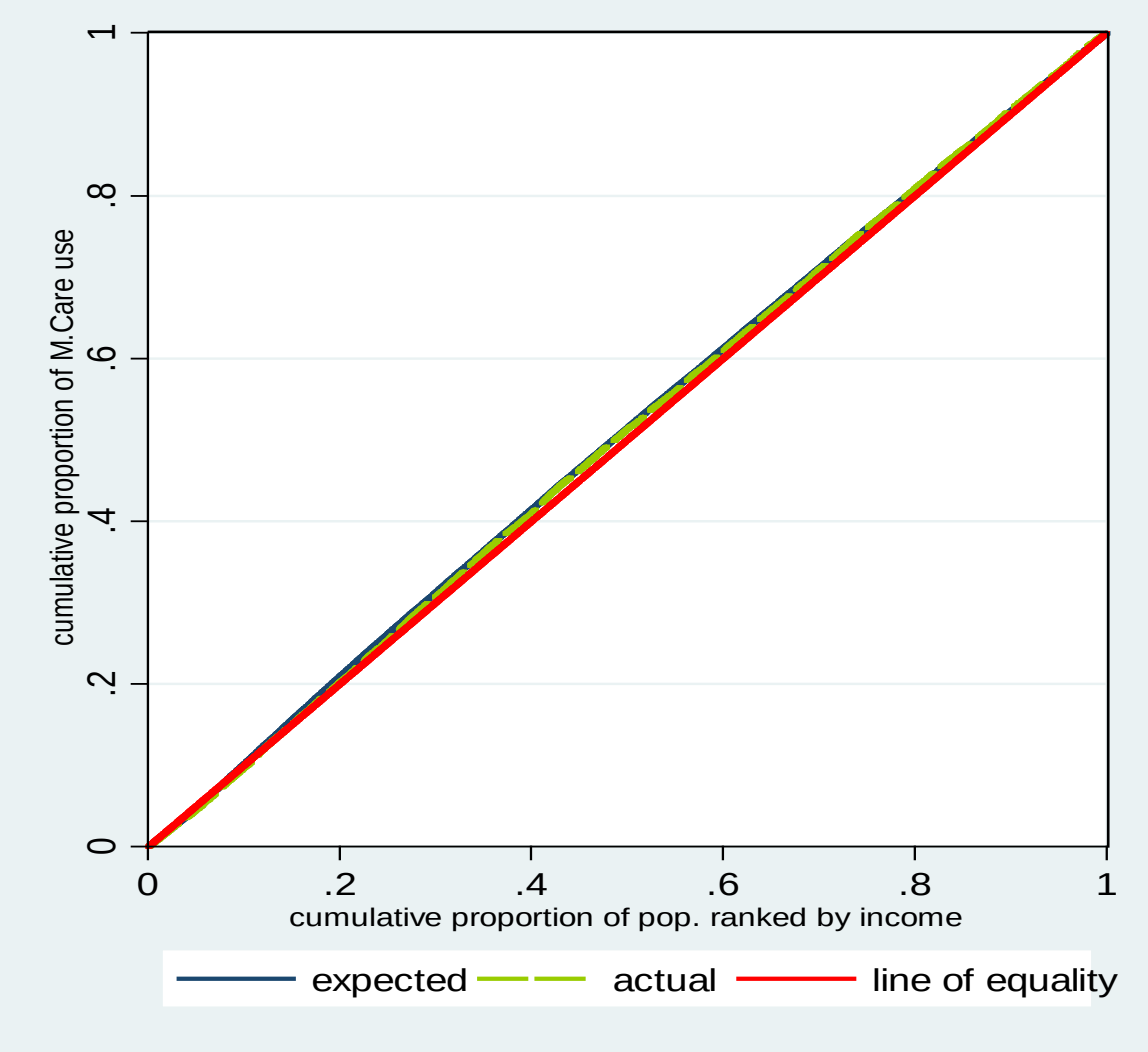
Note: Numbers in bold show the indices that are significant at least at 5% significant level. Numbers in bracket are t-statistics. C_M, C_N and HI represent concentration index of actual use, need and horizontal inequity respectively.

6.1.1 General practitioner services

The overall concentration index C_M of the probability of GP service utilization is negative, and significantly different from zero at 5% significance level. It indicates that the distribution of the actual GP service utilization is pro-poor. In other words the lower income groups are more likely to visit GP than the higher income groups. The index of the need for the GP services is also negative and statistically significant even at more conservative level of significance. The implication is that lower income groups are more likely to need medical treatment than higher income groups. This is in line with the prediction that the lower income groups require more medical care than the higher income groups as they have relatively lower health status. After taking the need differences across groups into account in the GP service utilization, the pro-poor inequality changes. Horizontal inequity index HI measures the inequity that caused by income-related differences assuming that differences in medical care use caused by differences in need are fair. The horizontal inequity index of the probability of GP service use is positive and has an implication that GP service use is distributed pro-rich but it is not statistically different from zero. This can be interpreted as the utilization of GP services are fairly equally distributed across income groups.

At this point it is important to recall that in Norway most of the GP practices have contract with the municipalities in which they provide their services in order to benefit from the National Insurance Scheme (NIS). The patients are also required to be registered with one of the GPs that have signed a contract with the municipality to have the expenses of medical care to be covered by the NIS. As the social health insurance scheme serves all residents equally, this equal right contributes to the fair and equitable distribution of GP services across income groups. The level of equity in the distribution of GP services can be interpreted more intuitively in the following graph.

Figure 6.1.1 Actual and need concentration curves of the probability of GP visit, 2005



The graph shows an impressive picture of the distribution of the probability of GP service utilization. At first glimpse one can see that both the actual use and need concentration curves lie above the equality line. This can be interpreted as the actual use of GP services is concentrated among the lower income groups. The poor are more likely to user GP services

intensively than the rich. The fact that the need concentration curve lies above the equality line shows that the lower-income groups obviously are more likely to need more GP services than the high-income groups. As the two curves lie close to the equality line, the income-related inequalities in the actual use and expected need can be considered relatively low. However, the degrees of the inequalities are statistically significant (see table 6.1). Since the actual use and need concentration curves coincide, horizontal inequity is zero indicating that there is no income-related inequity in the distribution of the probability GP visit across income groups.

The main finding concerning probability of GP services use is that both need and actual use are more concentrated among the lower income groups. Particularly, the significantly pro-poor distribution of actual use of GP services is different from the findings of earlier studies by Van Doorslaer and Masseria et al. (2004) and Grasdal and Monstad (2008). In these studies they find that actual use (unstandardized) concentration index for the probability of GP visit is statistically insignificant though it is negative. This shows that the low income and higher income groups have the same probability in the use of GP services. However concerning horizontal equity, the finding in this paper is consistent with that of earlier studies. Horizontal inequality indices are positive but statistically insignificant. That is, as it is stated earlier the low and higher income groups face very similar probabilities of contacting a GP after need differences are adjusted for.

6.1.2 Private medical specialist services

The concentration index for the probability of actual utilization of private medical specialist services is positive, which signals pro-rich inequality distribution. That is, higher income groups are more likely to report visits to private specialists than the lower income groups. However, the index is not significantly different from zero indicating that actual use of private specialist services are fairly distributed at best. It can be seen from the need index C_N that the need for specialist service is higher among the poor. When the need differences are taken into account, the distribution of the probability of private specialist service favors the higher income groups. The horizontal inequity index is positive, and statistically significant. This result is consistent with previous inequity findings in the distribution of private specialist services (Van Doorslaer, Masseria et al. 2004; Grasdal and Monstad 2008; Iversen and Kopperud, 2005) as it is discussed in section 2.3.

Figure 6.1.2 Actual and need concentration curves of the probability of private specialist visit, 2005

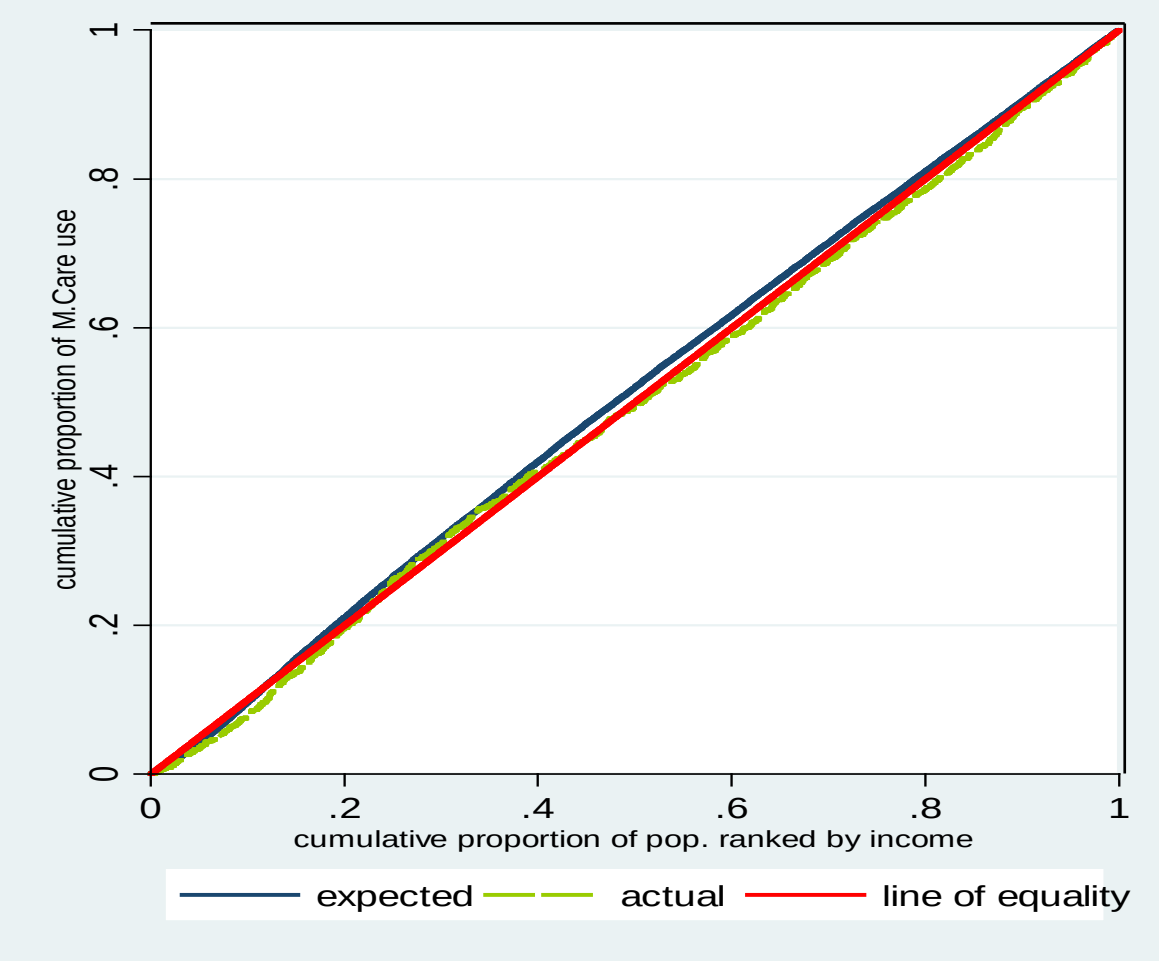


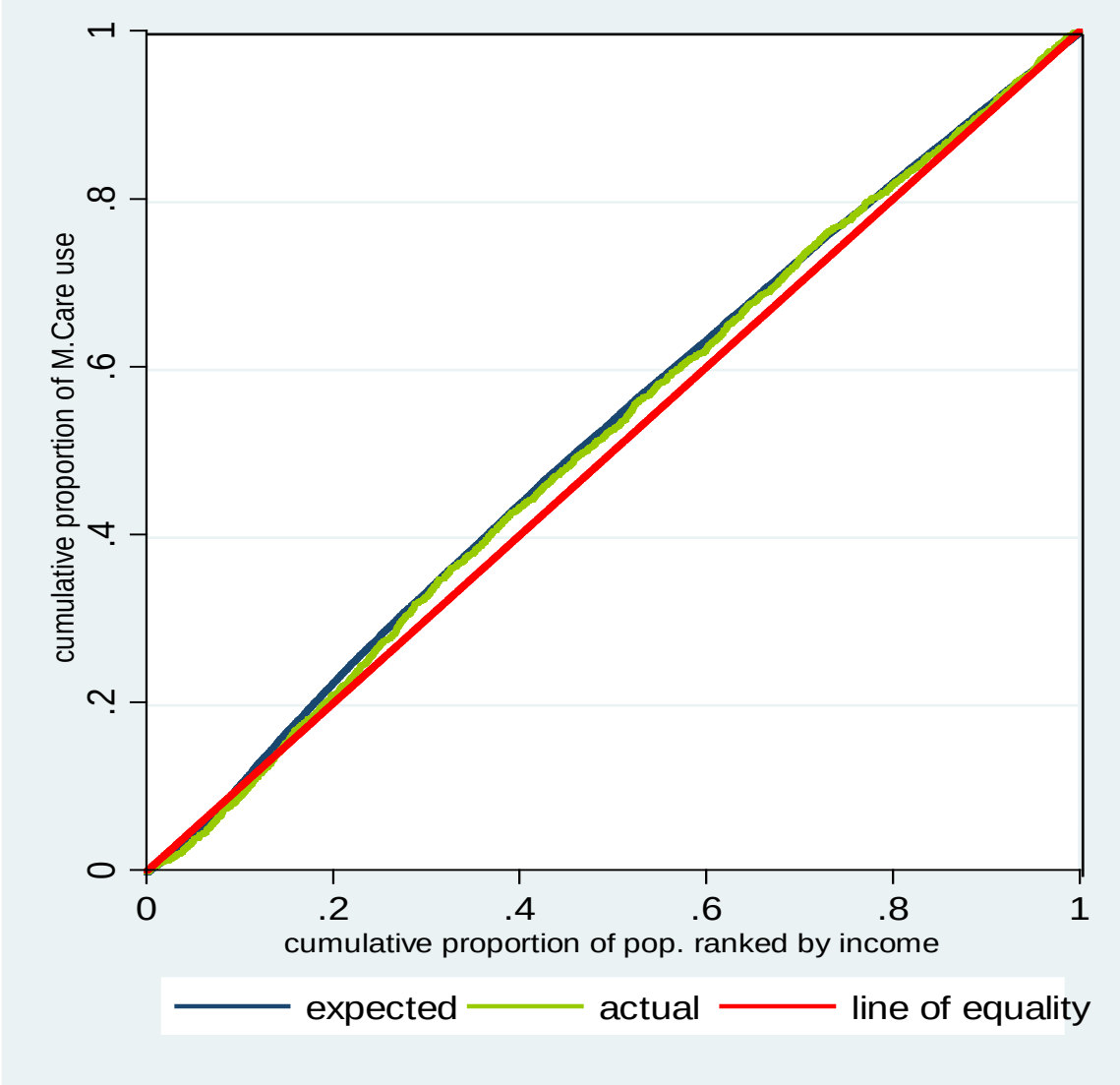
Figure 6.1.2 shows that the actual use concentration curve of the probability of private specialist services crosses the equality line. This creates a difficulty to determine, graphically, whether the actual use of private specialist service is concentrated in lower or higher income groups. The concentration curve of the need for the private specialist service lies above the equality line in most parts. It indicates that the lower income groups are more likely to need private specialist service than the higher income groups. As it is mentioned in section 3.1, when the need concentration curve lies above the actual use concentration curve, the higher income groups receive a higher share of medical care than the share they need. As a result the poor is left with less use of actual care than the share they need. Thus, in this situation the distribution favors the rich. The fact that, need concentration curve lies above actual use concentration curve in figure 6.1.2 indicates that there is horizontal inequity favoring the rich. The area between the two curves represent horizontal inequity index which is the measure of

inequity. According to equation (3) the area between the two curves provides positive horizontal inequity index. This is consistent with the positive value of HI.

6.1.3 Hospital specialist outpatient services

In Norway almost all hospitals are owned by the state and the services provided are free of charge for inpatient services and very small copayment for outpatient services. The concentration index for actual hospital specialist outpatient services use indicates pro-poor distribution. Unlike for private medical specialist services, the low-income groups are more likely to visit specialists in public hospitals than the higher income groups. The need concentration index C_N also indicates that the need for specialist services in the public hospitals is higher among lower income groups. When the need differences are controlled for, the resulting horizontal index indicates a pro-rich distribution of the specialist services. However, the index is not statistically different from zero. This shows, like in the case of GP services that of specialist services in the public hospitals are distributed fairly across income groups.

Figure 6.1.3 Actual and need concentration curves of the probability of hospital specialist outpatient visit, 2005



The concentration curves of actual use of hospital specialist outpatient and need for the hospital specialist outpatient services are easier to interpret than that of private specialist services. The actual concentration curve lies above the equality line implying that the actual use of specialist services in public hospitals are more concentrated among the lower income groups. The need concentration curve shows that the need for the specialist services in the public hospitals is also concentrated among the lower income groups. As the two curves coincide it can easily be seen that the medical services in this sector appear to be distributed fairly equitably across the income groups.

6.2 Decomposing concentration index

The previous section showed the overall estimated gradient of distribution in the three types of medical care, with respect to income distribution, using the concentration indices. The indices are only general indications. It is possible to identify the major sources of inequalities in the utilization of the medical care using the decomposition method expressed in (11). It is mentioned earlier that the decomposition presupposes a linear regression model. It is known that medical care utilization data are better estimated using nonlinear regression models. Since the estimated horizontal inequity indices are similar in the two model specifications, the decomposition here is conducted using linear regression model (see table 6.1). The empirical results of the decomposition based on OLS regression are presented in tables 6.2.1-3.

It is worth to present the common features of the detailed decomposition tables. In the decomposition tables the components that make up the overall concentration index (measure of inequality) are indicated in the columns in a way that they can express equation (11). The inequality due to the residual can be obtained by subtracting the sum of the contributions of all factors listed in each table from the total inequality or using equation (12) divided by the mean of medical care use.

According to the tables the means show the proportion that the factors have in the sample population except income and number of chronic diseases. For these factors the means just show their average figures. The third column presents the coefficients from the linear regression of medical care on the determinant factors. They measure marginal effects of a small change in the determinant factors on the probability of respective medical care use for continuous explanatory variables (income and number of chronic diseases). For the dummy explanatory variables the coefficients represent the effects of the dummies, with reference to omitted dummy, on the probability of medical care use. Positive signs of coefficients on continuous variables indicate that increase in the factors increase the probability of utilization of the medical care while the negative sign shows the opposite. The positive sign of the coefficients on the dummy variables indicate the effect is higher than that of the omitted reference dummy while the negative sign indicates the effect is lower than that of the reference dummy all other things being equal. The partial elasticity in the fifth column shows a percentage change of medical care utilization due to a percentage change in each determinant factor. The partial concentration indices of the factors in the sixth column

indicate how a particular factor or dummy is distributed across income. The sign of the partial concentration index indicates whether that particular factor (dummy) is concentrated among higher or lower income groups. For instance the partial concentration index of the variable measuring number of chronic disease is negative and implies that individuals with chronic diseases are concentrated in the lower income groups. As it is expressed in equation (11) the product of the partial elasticity and the partial concentration index of a factor produce the partial inequality contribution to overall income-related inequality shown in seventh column. The negative sign of the contribution indicates that the contribution is to increase the pro-poor income-related inequality or to decrease the pro-rich inequality in the utilization of medical care.

From the tables of decomposition we can see that the inequality index of each type of medical care has different major factor contributors. In the following sections the contributing factors to the overall inequality are discussed separately by type of medical care. To understand how the decomposition works and the role of each factor's contribution to the overall inequality, decomposition in the GP visit concentration index is discussed in detail. Only major results unique to the other types of medical care are discussed to avoid redundancy.

6.2.1 General practitioner services

In section 6.1.1 it is shown that the concentration index for actual GP service utilization is negative and it indicates pro-poor inequality. When the index is decomposed into the contributing factors, as shown in table 6.2.1, it appears that most pro-poor inequalities are caused by the need variables.

Among the need variables, dummies of self assessed health (SAH) and chronic disease, and number of chronic diseases are major causes of the pro-poor inequality. The positive coefficients on the SAH variables show that those individuals who report poor or very poor health are more likely to visit GP than individuals who report fair and good or very good health (omitted dummy). Similarly, those individuals who report severe effect of chronic diseases on their daily activities are more likely to visit GP than those report some or little, no effect and with no chronic diseases (omitted dummy). The negative partial concentration indices of these dummies indicate that health status lower than good or very good and the prevalence of chronic disease effects are concentrated among the lower income groups. These factors contribute negatively, and increase the pro-poor inequality in the GP visit.

Table 6.2.1 decomposition of inequality in GP visit, 2005 (based on linear model)

variable	**Mean, $\bar{x}_k$**	**Marginal effect, β_k**	t-value	**Elasticity $\frac{\beta_k \bar{x}_k}{\bar{m}}$**	**Partial Conc. Index, C_k**	**Contribution $\frac{\beta_k \bar{x}_k}{\bar{m}} C_k$**	**% contr.**
Log of equivalent income	12.41	0.000	-0.05	-0.008	0.02	-0.0002	0.01
Self assessed health- fair	0.13	**0.085**	4.78	0.015	-0.13	-0.0020	0.15
Self assessed health- poor or v. poor	0.06	**0.107**	3.82	0.009	-0.25	-0.0023	0.17
Chronic affects daily activ. severely	0.11	**0.197**	7.96	0.030	-0.17	-0.0052	0.39
Chronic affects daily activ. Some or little	0.37	**0.168**	11.33	0.090	-0.04	-0.0033	0.25
Chronic does not affect	0.10	**0.132**	6.58	0.018	0.07	0.0012	-0.09
Number of chronic diseases	1.36	**0.019**	4.64	0.037	-0.11	-0.0042	0.31
Daily cigarette-smoker	0.24	0.016	1.19	0.006	-0.09	-0.0005	0.04
rarely cigarette smoker	0.10	0.010	0.52	0.001	0.00	0.0000	0.00
Never do physical exercise	0.16	-0.015	-0.93	-0.003	-0.15	0.0005	-0.04
physical exer. less than once a week	0.13	-0.021	-1.30	-0.004	-0.04	0.0001	-0.01
Missing data on alcohol	0.29	0.002	0.11	0.001	-0.15	-0.0001	0.01
Drink alcohol 1-3 times per month	0.38	0.010	0.48	0.005	0.00	0.0000	0.00
Drink alcohol 1-7 times per week	0.26	0.017	0.76	0.006	0.22	0.0014	-0.10
Male, age between 30-45	0.15	0.005	0.20	0.001	0.05	0.0001	0.00
Male, age between 46-59	0.13	0.005	0.18	0.001	0.26	0.0002	-0.02
Male, age above 60	0.12	0.055	1.80	0.009	-0.03	-0.0003	0.02
Female, age between 16-29	0.11	**0.132**	5.71	0.020	-0.21	-0.0042	0.32
Female, age between 30-45	0.15	**0.054**	2.26	0.012	-0.01	-0.0001	0.01
Female, age between 46-59	0.12	**0.099**	3.68	0.017	0.24	0.0040	-0.30
Female, age above 60	0.12	**0.078**	2.51	0.013	-0.22	-0.0029	0.22
Missing data on population density	0.21	0.001	0.04	0.000	-0.06	0.0000	0.00
Residence area, population 2000-20000	0.27	0.005	0.25	0.002	0.03	0.0001	0.00
Residence area, pop. 20000-100000	0.19	0.011	0.48	0.003	0.04	0.0001	-0.01
Residence area, pop. Above 100000	0.24	0.027	1.19	0.009	0.02	0.0001	-0.01
Region2- Hedmark and Oppland	0.08	0.028	1.18	0.003	-0.05	-0.0002	0.01
Region3- East	0.18	-0.013	-0.67	-0.003	-0.02	0.0001	0.00
Region4- Agder and Rogaland	0.13	-0.029	-1.46	-0.005	0.06	-0.0003	0.02
Region5- West	0.18	-0.032	-1.80	-0.008	-0.03	0.0003	-0.02
Region6- Trondelag	0.09	-0.023	-1.08	-0.003	-0.09	0.0003	-0.02
Region7- North	0.11	-0.018	-0.81	-0.003	-0.08	0.0002	-0.02
Married or registered partner	0.48	0.016	1.06	0.011	0.16	0.0019	-0.14
Widow or separated	0.15	0.026	1.29	0.005	-0.26	-0.0014	0.10
Student or on military service	0.07	-0.021	-0.92	-0.002	-0.29	0.0006	-0.05
retired	0.13	-0.013	-0.52	-0.002	-0.33	0.0008	-0.06
unemployed	0.12	-0.011	-0.60	-0.002	-0.21	0.0004	-0.03
Have 1-7 or 8-10 years education	0.28	-0.017	-0.37	-0.007	-0.19	0.0013	-0.10
Have 11-14 years education	0.43	0.001	0.03	0.001	0.00	0.0000	0.00
College and above, 14 + years edu.	0.27	-0.023	-0.49	-0.009	0.22	-0.0019	0.15
Born in Europe	0.04	0.027	0.92	0.001	-0.02	0.0000	0.00
Born outside Europe	0.03	**-0.062**	**-1.96**	-0.003	-0.26	0.0008	-0.06

Note: numbers in bold show the coefficient is significant at least at 5% level of significance while numbers in shadow show considerable contributions to the overall inequality. But one does not necessarily follow the other.

Inequality due to need factors, C_N = -.0175

Inequality due to non-need factors = .0028

Horizontal inequality index, HI = .0043

Inequality due to residual, GCε/ $\bar{m}$ = .0014

Lifestyle variables have no uniform contributions to the overall inequalities since they have different patterns of elasticity and partial concentration indices. Smoking dummies have positive elasticity and negative partial concentration indices resulting in negative contribution which increase pro-poor GP visit. Physical training dummies have negative elasticity and negative partial inequality contributions resulting in positive contributions which decrease pro-poor inequality in GP visit. Alcohol drinking is concentrated in higher income groups in most cases showing positive contributions to decrease the pro-poor overall inequality index. Generally, the contributions of lifestyle variables to the overall inequality are very low. Most of the contributions are below 5% except the dummy that represents drinking alcohol 1-7 times a week (more_ drink).

Among the age-sex dummies, the partial concentration indices of being female aged 16-29 and female aged above 60 are negative. Individuals in these groups are represented among the lower income groups. These dummies contribute considerably to the overall pro-poor inequalities in the probability of GP visit. On the other hand the dummy for being female aged 46-59 contributes considerably to decreases pro-poor inequality in the probability of GP visit.

The partial concentration indices of population density dummies indicate that relatively densely populated areas are represented by higher income groups. As a result the contribution indices are positive and reduce the pro-poor inequality. However, the total contribution of population density variables to the overall inequality is very low. Like population density variables, regional variation variables contribute very little to the overall inequality. This implies that there is no significant regional variation as far as GP service utilization is concerned.

The contribution of income itself to the overall income-related inequality in the probability of GP visit is very low. Education also shows the same pattern as income concerning the probability of GP visit; the total percentage contribution of education dummies to the overall inequality is also very low. Income and education shows the opposite patterns in the private specialist visit discussed in the next subsection.

Other non-need variables such as marital status, occupation and place of birth also contribute little to overall inequality. However a dummy for being married contribute considerable positive inequality that decrease the overall pro-rich inequality while a dummy for being

widowed/separated does the opposite. Married individuals are represented among higher income groups while widowed/separated groups are represented among lower income groups i.e. the partial concentration index is positive for married and negative for widowed/separated.

6.2.2 Private medical specialist services

The overall income-related inequality measure of the probability of private specialist visit shows a pro-rich inequality though it is not statistically significant, see table 6.1. The pro-rich tendency is witnessed by the fact that the largest contribution to pro-rich inequality comes from income (table 6.2.2). Following income, a dummy for education level college and above (coll_ edu) contributes a considerable amount to the pro-rich inequality. Higher level education has a close relationship with income that highly educated people have higher income and have higher probability to use private specialist services. The substantial influence of education and income on the probability of private specialist visit cause horizontal inequity. Dummies for being a woman aged 46-59 and being a married or registered partner are also major contributors to the pro-rich inequality. The partial concentration indices of these variables indicate these individuals in these groups are represented among the better-off.

On the other hand, explanatory variables that measure the number of chronic diseases, and dummies for self assessed health, effect of chronic disease on daily activities, being a woman aged above 60, being retired and having education level below 10 years of education contribute considerably large negative inequities. The negative contribution of these variables reduces the pro-rich inequalities in the probability of private specialist visit.

Table 6.2.2 decomposition of inequality in private specialist visit, 2005 (based on linear model)

variable	Mean, $\bar{x}_k$	Marginal effect, β_k	t-value	Elasticity $\frac{\beta_k \bar{x}_k}{\bar{m}}$	Partial Conc. Index, C_k	Contribution $\frac{\beta_k \bar{x}_k}{\bar{m}} C_k$	% contribution
Log of equivalent income	12.41	0.014	1.69	1.030	0.02	0.0234	1.95
Self assessed health- fair	0.13	**0.068**	4.55	0.051	-0.13	-0.0068	-0.56
Self assessed health- poor or v. poor	0.06	**0.056**	2.36	0.019	-0.25	-0.0048	-0.40
Chronic affects daily activ. severely	0.11	**0.055**	2.61	0.034	-0.17	-0.0059	-0.49
Chronic affects daily activ. some or little	0.37	**0.048**	3.85	0.106	-0.04	-0.0039	-0.33
Chronic does not affect	0.10	0.020	1.16	0.011	0.07	0.0007	0.06
Number of chronic diseases	1.36	**0.019**	5.52	0.152	-0.11	-0.0172	-1.43
Daily cigarette-smoker	0.24	-0.007	-0.63	-0.010	-0.09	0.0009	0.08
rarely cigarette smoker	0.10	0.020	1.25	0.011	0.00	0.0000	0.00
Never do physical exercise	0.16	-0.015	-1.16	-0.014	-0.15	0.0021	0.17
physical exer. less than once a week	0.13	-0.020	-1.48	-0.016	-0.04	0.0006	0.05
Missing data on alcohol	0.29	**-0.047**	-2.58	-0.079	-0.15	0.0123	1.02
Drink alcohol 1-3 times per month	0.38	-0.017	-0.97	-0.039	0.00	-0.0001	-0.01
Drink alcohol 1-7 times per week	0.26	0.003	0.14	0.004	0.22	0.0009	0.08
Male, age between 30-45	0.15	0.011	0.55	0.009	0.05	0.0005	0.04
Male, age between 46-59	0.13	0.001	0.03	0.001	0.26	0.0001	0.01
Male, age above 60	0.12	0.029	1.12	0.020	-0.03	-0.0006	-0.05
Female, age between 16-29	0.11	0.015	0.76	0.009	-0.21	-0.0019	-0.16
Female, age between 30-45	0.15	0.036	1.78	0.032	-0.01	-0.0002	-0.02
Female, age between 46-59	0.12	0.044	1.95	0.031	0.24	0.0073	0.61
Female, age above 60	0.12	0.050	1.90	0.035	-0.22	-0.0076	-0.63
Missing data on population of the area	0.21	**-0.036**	-1.96	-0.044	-0.06	0.0028	0.23
Residence area, population 2000-20000	0.27	-0.008	-0.47	-0.013	0.03	-0.0004	-0.03
Residence area, pop. 20000-100000	0.19	-0.017	-0.91	-0.020	0.04	-0.0007	-0.06
Residence area, pop. Above 100000	0.24	-0.001	-0.03	-0.001	0.02	0.0000	0.00
Region2- Hedmark and Oppland	0.08	0.009	0.43	0.004	-0.05	-0.0002	-0.02
Region3- East	0.18	-0.013	-0.80	-0.014	-0.02	0.0002	0.02
Region4- Agder and Rogaland	0.13	**-0.048**	-2.89	-0.038	0.06	-0.0021	-0.18
Region5- West	0.18	-0.009	-0.60	-0.010	-0.03	0.0003	0.02
Region6- Trondelag	0.09	**-0.067**	-3.69	-0.036	-0.09	0.0031	0.26
Region7- North	0.11	**-0.074**	-4.03	-0.046	-0.08	0.0039	0.33
Married or registered partner	0.48	0.008	0.58	0.022	0.16	0.0035	0.30
Widow or separated	0.15	0.013	0.75	0.011	-0.26	-0.0028	-0.23
Student or on military service	0.07	0.014	0.74	0.006	-0.29	-0.0018	-0.15
retired	0.13	0.013	0.64	0.010	-0.33	-0.0034	-0.28
unemployed	0.12	0.006	0.39	0.004	-0.21	-0.0009	-0.08
Have 1-7 or 8-10 years education	0.28	0.038	0.96	0.061	-0.19	-0.0116	-0.97
Have 11-14 years education	0.43	0.048	1.23	0.121	0.00	-0.0003	-0.03
College and above, 14 + years edu.	0.27	0.050	1.28	0.081	0.22	0.0175	1.46
Born in Europe	0.04	-0.010	-0.39	-0.002	-0.02	0.0000	0.00
Born outside Europe	0.03	-0.016	-0.59	-0.003	-0.26	0.0008	0.07

Note: numbers in bold show the coefficient is significant at least at 5% level of significance while numbers in shadow show considerable contributions to the overall inequality. But one does not necessarily follow the other.

Inequality due to need factors, C_N = -.0235

Inequality due to non-need factors = .0312

Horizontal inequality index, HI = .0355

Inequality due to residual, $GC\varepsilon/\bar{m}$ = .0043

In Van Doorslaer and Masseria et al. (2004) it is indicated that in Norway there prevailed regional variations in the use of specialist services for year 2000 data. There is still regional variations in the private specialist service use as it can be seen in table 6.2.2 in the current study. The coefficients on the regional variation dummies indicate most of the regions have lower probabilities in the private specialist visit compared to relatively densely populated region, Oslo and the surroundings (omitted dummy). Individuals living in urban areas are more likely to have higher income and education than the individuals in rural areas and more likely to visit private specialists. In addition private specialist services are concentrated in urban areas. This also contributes to the regional variation in the private specialist service use. The total contribution of regional variation to overall inequality indicates a substantial pro-rich inequality as there may be variation in income between the regions. It can also be seen that regional variation dummies contribute larger inequalities in private specialist use compared to the other types of medical care use.

6.2.3 Hospital specialist outpatient services

Table 6.2.3 shows that the inequality contributions of the determinant factors in the overall income-related inequality of the probability of hospital specialist visit have similar pattern as that of the probability of GP visit. The largest percentage of the pro-poor inequality in the probability of hospital specialist visit is caused by need factors. The percentage inequality contributed by income itself to the total income-related inequality is very small compared to the percentage contribution of inequality in income in the probability of private specialist visit. The total contribution of education is also relatively low but a dummy having higher education level (coll_ edu) contributes relatively larger percentage to pro-rich inequality. Some explanatory variables like dummies for being married, and being female aged 46-59 have positive partial contribution indices that reduce the pro-poor overall inequality. Like in the probability of GP visit the contribution of regional variation dummies are low.

Table 6.2.3 decomposition of inequality in hospital specialist outpatient visit, 2005 (based on linear model)

variable	Mean, $\bar{x}_k$	Marginal effect, β_k	t-value	Elasticity $\frac{\beta_k \bar{x}_k}{\bar{m}}$	Partial Conc. Index, C_k	Contribution $\frac{\beta_k \bar{x}_k}{\bar{m}} C_k$	% Contribution
Log of equivalent income	12.41	0.002	0.18	0.093	0.02	0.0021	-0.06
Self assessed health- fair	0.13	**0.107**	6.59	0.062	-0.13	-0.0082	0.23
Self assessed health- poor or v. poor	0.06	**0.188**	7.32	0.050	-0.25	-0.0126	0.36
Chronic affects daily activ. severely	0.11	**0.151**	6.71	0.074	-0.17	-0.0127	0.36
Chronic affects daily activ. some or little	0.37	**0.080**	5.91	0.136	-0.04	-0.0050	0.14
Chronic does not affect	0.10	0.030	1.64	0.013	0.07	0.0009	-0.02
Number of chronic diseases	1.36	**0.015**	3.98	0.092	-0.11	-0.0104	0.30
Daily cigarette-smoker	0.24	0.012	0.95	0.013	-0.09	-0.0011	0.03
rarely cigarette smoker	0.10	0.006	0.34	0.003	0.00	0.0000	0.00
Never do physical exercise	0.16	-0.026	-1.84	-0.019	-0.15	0.0028	-0.08
physical exer. less than once a week	0.13	**-0.036**	-2.48	-0.022	-0.04	0.0008	-0.02
Missing data on alcohol	0.29	0.015	0.77	0.020	-0.15	-0.0031	0.09
Drink alcohol 1-3 times per month	0.38	0.011	0.54	0.018	0.00	0.0000	0.00
Drink alcohol 1-7 times per week	0.26	0.015	0.71	0.017	0.22	0.0037	-0.11
Male. age between 30-45	0.15	0.004	0.17	0.002	0.05	0.0001	0.00
Male, age between 46-59	0.13	0.005	0.20	0.003	0.26	0.0007	-0.02
Male, age above 60	0.12	0.013	0.47	0.007	-0.03	-0.0002	0.01
Female, age between 16-29	0.11	0.027	1.26	0.013	-0.21	-0.0027	0.08
Female, age between 30-45	0.15	0.035	1.61	0.025	-0.01	-0.0001	0.00
Female, age between 46-59	0.12	0.037	1.50	0.020	0.24	0.0047	-0.13
Female, age above 60	0.12	**0.060**	2.12	0.032	-0.22	-0.0071	0.20
Missing data on population of the area	0.21	0.011	0.55	0.010	-0.06	-0.0006	0.02
Residence area, population 2000-20000	0.27	0.006	0.34	0.008	0.03	0.0002	-0.01
Residence area, pop. 20000-100000	0.19	-0.005	-0.26	-0.005	0.04	-0.0002	0.00
Residence area, pop. Above 100000	0.24	-0.010	-0.48	-0.011	0.02	-0.0002	0.00
Region2- Hedmark and Oppland	0.08	**0.082**	3.85	0.032	-0.05	-0.0016	0.05
Region3- East	0.18	0.019	1.07	0.016	-0.02	-0.0003	0.01
Region4- Agder and Rogaland	0.13	-0.013	-0.73	-0.008	0.06	-0.0004	0.01
Region5- West	0.18	**0.043**	2.61	0.035	-0.03	-0.0011	0.03
Region6- Trondelag	0.09	0.028	1.43	0.012	-0.09	-0.0010	0.03
Region7- North	0.11	0.036	1.80	0.017	-0.08	-0.0015	0.04
Married or registered partner	0.48	0.026	1.85	0.057	0.16	0.0094	-0.27
Widow or separated	0.15	0.024	1.29	0.016	-0.26	-0.0040	0.11
Student or on military service	0.07	-0.016	-0.76	-0.005	-0.29	0.0015	-0.04
retired	0.13	0.004	0.20	0.003	-0.33	-0.0009	0.02
unemployed	0.12	0.018	1.05	0.010	-0.21	-0.0021	0.06
Have 1-7 or 8-10 years education	0.28	0.008	0.19	0.010	-0.19	-0.0020	0.06
Have 11-14 years education	0.43	0.034	0.82	0.068	0.00	-0.0002	0.01
College and above, 14 + years edu.	0.27	0.038	0.90	0.047	0.22	0.0102	-0.29
Born in Europe	0.04	**0.067**	2.48	0.011	-0.02	-0.0002	0.01
Born outside Europe	0.03	0.041	1.43	0.006	-0.26	-0.0017	0.05

Note: numbers in bold show the coefficient is significant at least at 5% level of significance while numbers in shadow show considerable contributions to the overall inequality. But one does not necessarily follow the other.

Inequality due to need factors, C_N = -.0494

Inequality due to non-need factors = .0057

Horizontal inequality index, HI = .0143

Inequality due to residual, $GC\varepsilon/\bar{m}$ = .0086

6.2.4 Summary of concentration indices decomposition

Table 6.2.4 presents a summary of the patterns in the major contributions of inequalities in the three medical care uses. The factors are selected on the bases of the major or the least contributors to overall inequality in the three types of medical care use. For instance income and education are the major contributors to pro-rich inequality in the private specialist service while they are the minor contributors to inequality in the GP service utilization. Inequality due to need variables is the summation of the contributions of each need-related dummies of SAH, effect of chronic disease, lifestyle and number of chronic disease. Inequality due to other non-need factors includes the contributions of all non-need factors other than income and education namely population density, regional variation, occupation and place of origin. Inequality due to the residual is the inequality that is not explained by the determinant factors. It is computed using equation (12).

Table 6.2.4 Contributions of factors to inequality in the use of GP, private specialist and hospital specialist outpatient services (based on linear model)

Indices	General practitioner	%	Private specialist	%	Hospital specialist	%
Need, C_N	-.0175	132	-.0235	-195.8	-.0494	141
Income	-.0002	1.4	.0234	194.7	.0021	-6
education	-.0007	4.9	.0055	46	.0081	-23
other non-need	.0037	-27.6	.0024	19.5	-.0045	12.7
residual	.0014	-10.7	.0043	35.6	.0086	-24.7
Total, C_M	-.0133	100	.0120	100	-.0351	100
Horizontal ineq., HI	.0043		.0355		.0143	

Source: extracted from decomposition tables 6.2.1 – 3

Note: HI here is not the same to the HI from "convenient regression" in the case when need is estimated using logit model in table 5.1. However, HI here and that from "convenient regression" when need is estimated using linear regression model are equal since decomposition used the same linear model.

Table 6.2.4 provides a good overview of the findings in table 6.1, which asserted that there is no horizontal inequity in the GP and hospital specialist outpatient services utilization, and that there exists horizontal inequity in the use of private specialist services. In table 6.1 it is indicated that there is a significant overall pro-poor inequality in actual use of GP and hospital specialist outpatient services. But after need differences are controlled, the resulting horizontal inequality indices show no more significant differences in the distributions across income groups. The decomposition reveals that the effects of non-need factors (including income and education) on medical care use are insignificant and their contributions to total inequality are also low. This can be seen in table 6.2.4 looking at the percentage contribution of each summarized factors to the total inequality. The major pro-poor contributors are the need factors. Inequality due to the residual shows that there are other omitted factors that contribute positively to total inequality. These factors cause a decrease in the total degree of inequality in the use of GP and hospital specialist outpatient services by 10.7% and 24.7% respectively.

The aggregated decomposition results for the probability of private specialist visit shows the opposite compared to that of the other types of medical care services. It is rather income and education that contribute the largest share to pro-rich total inequality. The contribution of need is negative in private specialist case too and decreases the pro-rich inequality.

Table 6.2.4 helps to identify the difference between income-related inequity (HI) and the contribution of income itself to the inequity. HI is computed taking needs into account, i.e. keeping only need constant. The effect of non-need factors (including income) remain in the computation, see (13). On the other hand, the inequality contribution of income itself to the overall income-related inequity is computed based on the marginal effect that assumes all other things equal. That is, it shows only the partial contribution of income. For example, in private specialist use income-related inequity (HI) is 0.035 and the contribution of income is 0.023. The difference is thus due to the contributions of other non-need variables and the residual.

One of the impressive results of the decomposition method is that need factors contribute to increase pro-poor inequality and to decrease pro-rich inequality. As it is seen in table 6.2.4 the largest share of pro-poor inequality in the probability of GP visit is contributed by need factors. In the aggregation of inequalities the contribution of need factors is balanced by the

pro-rich inequalities (positive indices) of other non-need factors and residual. On balance, the overall inequality remains significantly pro-poor in the actual use of GP services.

The overall inequality in the probability of private specialist visit is pro-rich but statistically insignificant. As one can see from table 6.2.4, the largest share of inequality is caused by non-need factors; particularly income and education. The table also indicates that there are some considerable pro-rich inequalities that are not explained by the determinant factors and appear in the residual. The negative inequality index due to need-related factors reduces the pro-rich inequality in the probability of private specialist service distribution. The negative contribution of need factors could cancel the positive contribution of income itself to the inequality. However due to considerably large contribution of other non-need and education, the HI remains statistically significant (referring table 6.1).

7 Conclusion

The aim of this paper has been to examine the degree of income-related inequality and inequity in the utilization of medical care services, measured by physician visit, in Norway. I have estimated the degree of inequalities (concentration indices) in the probability of general practitioners, of private specialists and of hospital specialist outpatient visit. Further, I decomposed the degree of inequalities to identify the major factors that contribute to the inequality. To conduct the study, Norwegian living conditions survey data for the year 2005 is used.

To measure inequality in the distribution of medical care utilization Concentration index is chosen as an appropriate tool because it is convenient to compute inequality and easy to interpret intuitively. By using the indirect standardization method need for medical care is estimated to measure need concentration index. A measure of the degree of horizontal inequity is then obtained by comparing the distribution of actual medical care use and need distribution.

This paper finds that the low-income groups are more likely to use primary and public hospital specialist services intensively than the higher income groups. The need for these medical services is also higher among the lower income groups. After need differences are controlled for, the probability of GP and hospital specialist services appear to be distributed fairly across the income groups. No evidence of horizontal inequity is found in distribution of these services. This result is consistent with those previously found by Van Doorslaer and Masseria et al. (2004) and Grasdal and Monstad (2008). That is, need is the driving force for utilization rather than income or other socioeconomic factors. However, the concentration indices for the probability of (actual) use in these services indicate significant pro-poor inequality contrary to the insignificant pro-poor inequalities in the previous studies.

When it comes to the utilization of private specialist services, results are different. The distribution in the probability of actual use shows pro-rich inequality, though it is not statistically significant. When need differences are taken into account, the distribution of the probability of private specialist services favors the rich significantly. This finding is in line with findings of previous studies. Van Doorslaer, Masseria et al. (2004), Grasdal and Monstad (2008); Iversen and Kopperud (2005) found inequity in private specialist services.

The results from the decomposition also reveal that the most important factors that contribute to pro-poor inequality in the GP and hospital specialist service are need factors. The contributions of non-need factors, including income, are very low. Conversely, the major factors that contribute to the pro-rich inequality in the probability of private specialist services are non-need factors mainly income and education. Concerning identification of the major factors contributing to the overall income inequality, the results in this paper are broadly consistent with those identified in previous studies mentioned above. Generally, the distribution of GP and public hospital services are more related to need factors while that of private specialist services are more related to income and education.

This study finds no evidence that the equity principle is violated in the hospital specialist and GP service utilization. However the distribution of private specialist services favors the well-off. The fact that the lower income groups have higher need for medical care, and are more intensive users of hospital specialist and GP services suggest inequity in health in the society.

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