STOCKHOLM SCHOOL
OF ECONOMICS
THE ECONOMIC RESEARCH INSTITUTE

Measuring Income-related Health Inequalities in Sweden

Ulf-G Gerdtham and Gun Sundberg

Working Paper No. 120
August 1996

***Working Paper Series
in Economics and Finance***

AUGUST 1996

MEASURING INCOME-RELATED HEALTH INEQUALITIES IN SWEDEN

Ulf-G Gerdtham[1] and Gun Sundberg[2]

[1] Centre for Health Economics, Stockholm School of Economics, Box 6501, S-11383 Stockholm, Sweden.

[2] Department of Economics, Box 513, S-75120 Uppsala, Sweden.

Abstract. In Sweden, health, measured as self-assessed health, is distributed fairly evenly in an international perspective. The purpose of this paper is to study whether specific disorders and diseases also are distributed fairly evenly. There are 44 diseases or disorders dealt with in this study, from a common cold or cough to serious diseases such as cancer and heart attack. All disorders and diseases are rated on a three-point scale. The data used are the Swedish Level of Living Survey from 1981 and 1991 (LNU81 and LNU91), where income data received from the National Tax Statistics have been linked to the LNU data. The method is the same as the one used by the EC-group on equity, where the different disorders and diseases are measured by concentration indices. All 44 illness conditions are age and sex standardized. The income measure is disposable household income per equivalent adult. The results show that even if there are no inequalities in health in Sweden, there are significant inequalities in diseases and disorders, as well as differences between the two periods 1980 and 1990. In general, the inequalities in the diseases and disorders were less obvious in 1980 than in 1990.

***Acknowledgements:** This work was financially supported by the National Corporation of Swedish Pharmacies. Comments from Per-Anders Edin, Bertil Holmlund, Bengt Jönsson and Mårten Palme are highly appreciated.

1. INTRODUCTION

Good health affects several aspects of life and personal well-being. A healthy population will have a high work productivity, and thereby contribute to the country's living standards. A healthy population may also require less health care, which implies lower health expenditures for both the individual and the public sector. Furthermore, good health for the entire population is an important goal for the public health policy in Sweden [The Swedish Health Care Act (1982)]. The Health Care Act (1982) states that people are to be treated equally, i.e., people with equal need are to be treated in the same way, and that limited health care resources are to be distributed as equitably as possible in the population. However, it has also been argued that it is difficult to rationalise a concern about the distribution of health care other than in terms of a distribution of health in itself [Culyer (1993)]. This explains why it is interesting to analyse the degree of inequality of health in the population.

Health is affected by medical and socio-economic circumstances, where income plays an important role[1]. If income is low, for example, people may be required to work more hours and/or forced to work in more risky businesses to receive higher incomes. In this sense, the health of people with low income is getting worse. On the other hand, poor health may make people unable to work full-time, and thus their income level is reduced. This means that income affects health but income is also affected by the individual's health. By means of a simultaneous model Sundberg (1996) found that the causility between health and wage may be bidirectional. Moreover, higher income implies increasing prosperity and standards of living, which has positively contributed to the decreasing mortality in the industrialised countries. However, although many countries have poor economic standards, they still have managed to increase their life expectancy of the individual. This suggests that income differentials within the country also matters [Lundberg and Fritzell (1994)].

Health is an aggregate measure that in empirical work is primarily measured by self-assessed responses to questions concerning general health conditions. In many industrialised countries, income inequality is a strong determinant of self-assessed health and income-related inequalities in health exist that favour the better-off [van Doorslaer and Wagstaff et al. (1996)]. However, the general health condition depends, to a large degree, on specific diseases and disorders. Although there are international studies, where Sweden is included, on income-related self-assessed health [i.e. van Doorslaer and Wagstaff et al. (1996)], there are no studies on income-related specific diseases for Sweden[2]. It is important to analyse whether there are income-related inequalities for different diseases and disorders in the sense that these inequalities may be related to occupation. Further, if diseases are income-related, it may have equity consequences, because people with higher incomes are able to pay more to remain healthy. Such a situation may be regarded as being unfair to the poor section of society.

---

[1] See for example Townsend and Davidson (1982), Le Grand (1986, 1987, 1989), Blaxter (1989), Lundberg (1990, 1991), Lundberg and Fritzell (1994), Vågerö and Illsley (1995).

[2] Lundberg and Fritzell (1994) have examined the impact of income on health in Sweden. However, the health indicators included in this study are physical illness and psychological distress computed as additive indices from different items and not as specific disorders and diseases.

The purpose of the current study is twofold: First, to investigate income-related health inequalities in both aggregate self-assessed health and in different disorders and diseases. The second purpose is to compare potential changes between 1980 and 1990 in the distribution of disorders and diseases. The paper is organised into six sections. Section 2 describes the methodological background of previous studies. Section 3 presents the present data and incidence assumptions. Section 4 describes the methods used in the present study to measure inequalities in health. Section 5 reports the results and Section 6 summarises the findings and presents our conclusions.

2. METHODOLOGICAL BACKGROUND

When measuring inequalities in health one approach is the class-based one used in the Black Report [Townsend and Davidson (1982)] and by Blaxter (1989), who focused on comparisons of mortality measures and morbidity patterns across socio-economic groups. However, there are problems with the class-based approach because it fails to reflect the relative size of the groups being compared and because the classification scheme of individuals in different groups is arbitrary. Most countries tend to change their classification schemes over time and different countries tend to define occupational groups differently.

Le Grand (1986, 1989) suggested an alternative to the class-based approach that involved Lorenz curves and Gini coefficients. In his empirical analyses, Le Grand used age-at-death as an indicator of health. The Lorenz curve for health plotted the cumulative proportions of the population (starting from the sickest, which is the one with the lowest age at death, to the healthiest individual, which is the one with the highest age at death) against the cumulative proportions of health, which is the cumulative proportion of age at death. If health is equally distributed in the population, the Lorenz curve would coincide with the diagonal and the corresponding Gini coefficient for health would equal zero.

However, Wilkinson (1986) argued that Le Grand's approach fails to address the issue that researchers are really interested in, namely if there are inequalities in health related to socio-economic status. Le Grand analyses inequalities in health *per se* by the argument that measures of inequalities in health should not implicitly incorporate any hypothesis of why they exist. However, Wilkinson's view is that what matters about inequalities in health is not that they exist, but that they may reflect inequalities in economic status.

Wagstaff et al. (1991a, 1991b) have suggested another approach, one that reduces the problems with the class-based approach and also meets Wilkinson's critique of Le Grand. In this approach, the individuals are ranked by their incomes from the poorest to the richest. The concentration curve for health plots the cumulative proportions of health against the cumulative proportions of the population ranked by income, and the estimated concentration index is a measure of inequality. The concentration index method has also been used by the EC-group on equity[3] [van Doorslaer et al. (1993), van Doorslaer and Wagstaff (1992), van Doorslaer and Wagstaff et al. (1996)]. The

---

[3]This group is called the ECuity-group. In this group there are people from Belgium, Denmark, England, Finland, France, Germany, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland,

study on inequalities in health by this group shows that in an international perspective, health is very evenly distributed in Sweden. Concentration indices have been calculated on grouped data for eight European countries[4] and the United States. In all countries the concentration indices are negative and significantly different from zero. Thus, in all these countries income-related inequalities in health exist favouring the better-off. Among those countries, the largest inequality was observed in the United States and smallest in Sweden.

3. DATA AND VARIABLE DEFINITIONS

The empirical analysis in the present study is based on data from probability samples of the Swedish population, the Level of Living Survey (LNU) from 1991 and 1981. The interviews were made during spring and summer, and the samples consist of about 7,000 individuals, in the ages 18-76 in 1991 (15-76 years in 1981). The response rate was about 80 % in both samples. After correcting for missing values the sample consists of 5,185 in 1991 (5,487 in 1981) individuals. The surveys contain data on health status, illness conditions, use of medical care, socio-economic variables and family composition. LNU samples have been linked to national income tax statistics. Hereby we also have data on income, wages and transfers, including non-taxable transfers. For further details, see Levnadsnivåundersökningen (1991) and Fritzell and Lundberg (1994). All figures about income, subsidies and transfers refer to the year before the interview, i.e. 1990 and 1980.

---

and United States with Adam Wagstaff (England) and Eddy van Doorslaer (the Netherlands) as project leaders.

In the survey from 1991 there is a question to the respondents concerning self-assessed health. People have been asked how they judge their own present health condition, whether the condition is good, bad or something between. In both the surveys from 1981 and 1991, we are supplied with answers to questions on headache, cough, problems to see or hear, chest pain, bronchitis, heart problems, gastric pain and other illness conditions. There are questions on 44 conditions, where the respondents have been asked whether they have been suffering severely, mildly or not at all on the relevant illness conditions during the last 12 months, that is mainly in 1980 or 1990, respectively if the interviews were made during the spring. This means that both health conditions and incomes refer to 1980 and 1990. Inequalities in health are also measured by the self-assessed health measure in the survey from 1991.

The income concept in this study is disposable household income per equivalent adult. The source of all income data is the National Income Tax Statistics, linked to the LNU data. The Swedish equivalence scale used is the one used by Jansson (1990): One adult equals 1, two adults equals 1.65, children younger or equal to 5 years equals 0.51, children 6 to 15 years equals 0.62 and children 16-18 years equals 0.65[5]. Another equivalent scale commonly used in studies of income distribution in Sweden is the one recommended by the National Board of Health and Welfare, and derivations from these recommendations. Some of those scales do not use different weights for children, and instead use only different weights for different number of persons in the

---

[4]The European countries are Finland, East Germany, West Germany, the Netherlands, Spain, Sweden, Switzerland and United Kingdom.

household. This means that a household with two adults receives the same equivalent weight as a single person with one child, irrespective of the age of the child[6]. We argue that it is better to describe the economic burden in the household by using the above mentioned equivalence scale. The samples have been separated into 10 equivalent disposable income deciles and four age groups in the ages 18 - 34, 35 - 44, 45 - 64 and 65 + years.

The distribution of the answers to the questions on health and different health conditions can be seen in Table 1. The general conclusion is that people on the whole are very healthy, and there are few people who experience severe suffering. However, for some of the diseases we see that there have been changes in the distribution between 1980 and 1990. For example, there is a lower proportion of individuals in 1990 who claim that they have not been suffering from disorders, such as lower back pain, painful shoulders and headache than the proportion of people in 1980.

---

[5]Jansson (1990) has equivalent weights for children 0 - 15 years only. We argue that children 16-18 years are the same burden in the family as the second adult.

[6]See for example Björklund et. al. (1995)

Table 1. Frequencies (in percent) of complaints for different illness conditions.						
DISORDERS AND DISEASES	**NO**		**MILD**		**SEVERE**	
	1980	1990	1980	1990	1980	1990
Anaemia, low blood value	96.8	97.9	2.5	1.7	0.7	0.4
Arthritis/painful joints	76.9	74.8	14.3	15.8	8.8	9.4
Cancer	99.1	99.2	0.4	0.3	0.5	0.6
Chest pain	90.9	91.8	6.5	5.8	2.6	2.5
Chronic bronchitis	93.3	95.4	4.7	3.3	2.0	1.4
Common cold	31.1	28.8	49.8	54.5	19.1	16.7
Constipation	94.2	94.9	4.2	3.8	1.6	1.3
Cough	75.4	75.6	20.0	20.3	4.6	4.1
Diabetes	97.2	97.6	2.0	1.7	0.9	0.7
Diarrhoea	90.2	88.6	8.0	9.2	1.7	2.2
Difficulties to breathe	93.2	93.4	4.7	4.6	2.2	2.0
Difficulties to hear	87.1	85.3	10.3	11.6	2.6	3.1
Difficulties to see	92.3	93.2	5.0	4.4	2.7	2.4
Difficulties to sleep	86.9	87.3	9.0	9.2	4.1	3.5
Dizziness, vertigo	89.3	90.0	8.5	8.3	2.2	1.8
Elevated blood pressure	89.7	90.8	8.2	7.6	2.1	1.7
Feeling of sickness	88.1	86.8	9.9	10.6	2.0	2.5
Gall bladder	96.6	97.6	2.2	1.7	1.1	0.7
Gastric pain	77.7	77.9	16.2	16.6	6.1	5.5
Gastric ulcer, duodenal ulcer, dyspepsia	98.1	97.9	1.1	1.3	0.8	0.8
Goitre	98.5	98.0	1.3	1.6	0.3	0.4
Haemorrhoids	93.4	94.5	5.2	4.2	1.4	1.3

Table 1 (cont.)

DISORDERS AND DISEASES	**NO**		**MILD**		**SEVERE**	
	1980	1990	1980	1990	1980	1990
Headache	54.6	46.7	35.3	41.9	10.1	11.5
Heart attack, myocardial infarction	99.3	99.2	0.5	0.4	0.3	0.4
Heart failure	95.7	97.6	3.2	1.7	1.1	0.7
Hernia	98.4	98.6	1.1	1.0	0.4	0.4
Kidney disease	97.9	98.1	1.1	1.0	1.0	0.9
Lower back pain	68.8	64.0	18.2	22.9	13.0	13.1
Mental depression	94.1	94.1	3.8	3.8	2.1	2.1
Nervous problems	87.6	89.4	9.0	8.1	3.4	2.5
Neurological disorder	98.7	99.3	0.4	0.4	0.9	0.3
Over weight	88.6	87.0	9.7	10.6	1.7	2.4
Painful shoulders	77.7	68.7	14.1	20.6	8.3	10.7
Perspiration problems	93.5	93.8	4.8	4.7	1.7	1.6
Psychiatric disease	98.4	99.2	0.9	0.5	0.7	0.3
Rash, eczema, psoriasis	88.0	86.5	9.5	11.1	2.5	2.4
Strain, unsolved problems, stressful situation	94.8	93.5	4.0	5.5	1.1	1.0
Swelling of the legs	91.4	92.0	6.5	6.3	2.1	1.7
Tiredness, exhaustion, weakness	80.3	76.9	15.3	18.4	4.4	4.7
Tuberculosis	99.7	99.7	0.2	0.2	0.1	0.1
Varicose veins, leg ulcers	92.8	93.9	5.5	4.9	1.8	1.2
Voiding difficulties, prostate, lower urinary tract infection	93.0	95.3	4.3	3.0	2.7	1.7
Vomiting	92.7	91.8	5.6	6.2	1.7	2.0
Weight loss	97.2	97.8	2.1	1.6	0.7	0.6
Ill health[7]		77.5		18.1		4.3

[7]The question to the respondent is: ”How do you value your own health conditions? Is it good, bad or something between?”There was no such question in 1980.

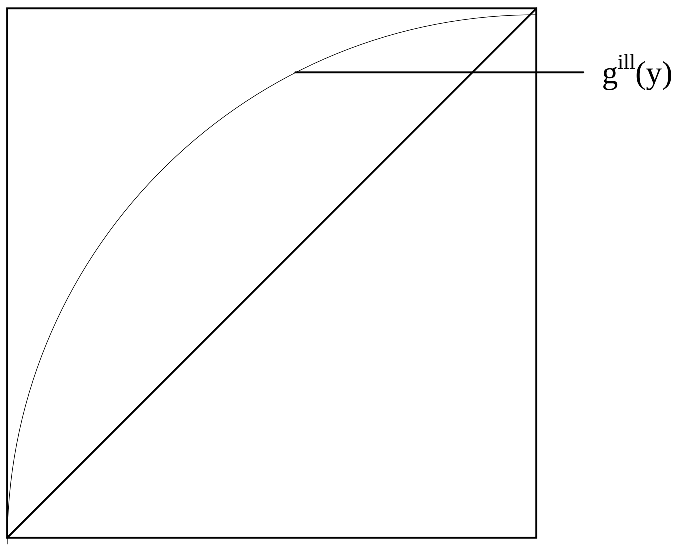
4. METHODS

An inequality measure of health should reflect socio-economic dimensions of inequalities in health for the entire population, and be sensitive to changes in the distribution of the population [Wagstaff et al. (1991a)]. According to Wagstaff et al. (1991a), the concentration index approach fulfils these requirements. Here the individuals are ranked according to their incomes from the lowest to the highest. The concentration curve for health plots the cumulative proportions of the population (starting with the poorest) against the cumulative proportions of their health[8]. By means of the concentration index, we are able to measure the relative inequality in health because this index does not change if, for example, health is doubled for the entire population. In this study, we use the concentration curve for morbidity or illness instead of health. This means that we have to define a measurable concept for illness. In most empirical studies, illness is measured by self-assessed responses to questions about illnesses, where the different alternatives are rated on a scale. However, people value their illnesses differently, depending on differences in occupations, incomes or other socio-economic conditions, or depending on the normal situation in their group. What we know from the self-evaluated responses is the individual ranking; that is, that the rating ”very bad” is worse than the rating ”bad” for each individual.

The concentration curve for morbidity, $g^{ill}(y)$ shown in Figure 1, plots the cumulative proportions of the population (ranked by income) against the cumulative proportions of illness in the population. If morbidity is equally distributed over income, then the concentration curve will coincide with the diagonal. If morbidity in the population is concentrated to those with lower incomes, then the concentration curve will be located above the diagonal, as is the case in Figure 1. The concentration index for illness is defined as one minus twice the area under the concentration curve[9]. This is a measure of the degree of income related inequality in health. The index will be negative when illness is concentrated to the poor section of the population. The lowest value that the concentration index can take is -1. This occurs when the population's morbidity is concentrated to the poorest individual. The highest value that the concentration index can be is +1, which describes a situation when the total illness of the population is concentrated to the richest.

Figure 1: Concentration curve of illness.

Percent of total illness



Percent of population

---

[8]We assume that we are supported with a continous measure of health. See later in this section for a discussion of this assumption.

[9]Note that the concentration index is negative if the concentration curve lies above the diagonal.

In our analysis of self-assessed ill health, diseases and disorders we first standardise for age and sex in order to make the study international comparable[10]. The standardised number of persons in each morbidity category j, and income group t have been calculated as

$$N^{*}_{jt} = \sum_{i=1}^{n} (f_i / f_{it}) N_{ijt},$$

where N^{*}_{jt} is the standardised number of persons in income group t falling into morbidity category j, f_i the fraction of the sample in demographic group i, f_{it} the fraction of the sample in demographic group i, income group t and N_{ijt} is the number of persons in demographic group i, category j, income group t[11].

In most health economic studies, health - or ill health - is measured as a categorical variable, for example good or bad health, rather than a continuous variable[12]. In this paper we will follow Wagstaff and van Doorslaer (1994) and assume that there is a continuous latent variable representing the individual's self-assessed ill health, disorder or disease that underlies the categorical variable. Thus, instead of using the

---

[10]The reason for standardization is that there are different age/sex distribution in the different income deciles. Thus, if we not standardize we will have inequalities which depend on different age/sex distribution in different deciles (See Wagstaff et al. (1991b), p.178-182). By means of standardization we obtain the same age/sex distribution in each decile.

[11]For example, if we standardise for the demographic groups age and sex, the standardised number of persons in morbidity group 1, income group 1 equals [(number of women 18-34/total number of women)/(number of women 18-34 in income group 1/total number of women in income group 1)]*number of women in morbidity group 1, income group 1, 18-34 summarized for all age groups for women and for men.

[12] When the morbidity indicators have more than two categories the indicators may be dichotomised. However, it has been shown [Wagstaff and van Doorslaer (1994)] that the estimated concentration indices are very sensitive to how the cut-off points are chosen and that the degree of inequality depends

ordinal self-assessed indicator we use the continuous latent variable in our analysis of inequalities. Suppose that the self-assessed ill health variable, *H*, has *J* categories, where 1 represents very bad health and *J* very good health. The latent ill health variable *H** is then related to *H* as follows:

$$H = 1 \text{ if } -\infty < H^* \leq \alpha_1$$
$$H = 2 \text{ if } \alpha_1 < H^* \leq \alpha_2$$
$$H = 3 \text{ if } \alpha_2 < H^* \leq \alpha_3$$
$$\vdots$$
$$H = J \text{ if } \alpha_{J-1} < H^* \leq +\infty,$$

where α_J are thresholds. Assume first that health status *(H*)* has a standard normal distribution. Then values of *H** can easily be computed for each individual. First, we estimate the *(J-1)* thresholds as

$$\hat{\alpha}_j = \Phi^{-1}\left(\sum_{i=1}^{j} N_j^* / N\right), \text{ j} = 1,2,\ldots\text{j-1},$$

where Φ^{-1} is the inverse standard normal cumulative density function, N_j^* the standardised number in category j and *N* the total number. In fact, the area under the standard normal distribution is divided into the proportion to the numbers in each category. The mean values in each interval are estimated as normal scores $(\hat{Z}_j)$ using the formula:

$$\hat{Z}_j = (N / N_j^*)\left[\phi(\hat{\alpha}_{j-1}) - \phi(\hat{\alpha}_j)\right],$$

---

on the choice of cut-off points. This is the reason why we assume that there is a continuous latent variable underlying the categorical variable.

where $\Phi(\cdot)$ is the standard normal density function. These scores are the scores that may be used when we calculate concentration indices. The most appropriate way to calculate the concentration index for ill health is by the covariance method proposed by Jenkins (1988). Here the concentration index is estimated by the formula $[(n^2 - 1)/6n](b/\bar{x})$, where $\bar{x}$ = mean for ill health, $b = cov(x,rx)/var(rx)$ and rx the rank variable for x. b is estimated by a regression of x on rx. This implies that $\bar{x}$ has to be non-zero. However, when we construct the latent variable we assume a standard normal distribution, that is, the mean value is zero. Moreover, most of the distributions concerning ill health are very skewed, in that there are few persons reporting severe illnesses while most report good health. Rather than assuming a standard normal distribution, we therefore assume a standard log-normal distribution. Hence, we assume that $\hat{Z}_j = - \ln H^*$, so that $H^* = exp(-\hat{Z}_j)$. We calculate the scores in the way described above, but we interpret them as the negative logarithm of the corresponding latent ill health variable and we obtain the latent ill health variable by exponentiating the negatives of the normal scores. This latent variable is always positive. Hence, it is possible to use this variable when we construct the usual illness concentration curve and calculate the illness concentration index. The self-assessed ill health variable is only available in the data from 1990. The distribution of ill health and the value of the latent ill health variable can be seen in Table 2. Category 1 refers to poor health, category 2 to something between and category 3 to good health. In Table 2 we also show the distribution of the unstandardised frequencies and latent health in the different categories.

Table 2. Calculation of latent ill health variable assuming a standard lognormal distribution.				
Category	Standardised for age and sex		Unstandardised for age and sex	
	Frequency (%)	Latent health	Frequency (%)	Latent health
1	4.2	8.4657	4.3	8.3417
2	18.2	3.1625	18.1	3.1432
3	77.6	0.6800	77.5	0.6794

To test whether the concentration indices are significantly different from zero, we have calculated standard errors for the concentration indices following Kakwani et al. (1996). The variance of the concentration index (C) has been calculated as

$$var(C) = 1/n[1/n \sum_{i=1}^{n} a_i^2 - (1+C)^2],$$

where $a_i = (x_i/\mu)((2R_i - 1 - C) + 2 - q_{i-1} - q_i)$, x_i is the value of the latent variable for individual i, μ = mean value for the relevant latent variable, R_i the relative rank of individual i, and $q_i = (1/\mu)\sum_{r=1}^{i} x_r / n$. We also test for differences by pairwise comparisons of 1980 and 1990 by using the conventional t-test for groups.

5. RESULTS

The results from the estimations of disorders and diseases in 1980 and 1990 are shown in Table 3. The concentration indices are ranked in increasing order for 1990; that is, the first condition or disease is the one where we have the most income-related inequality in favour of the more wealthy. For 1980, we have also ranked the disorders and diseases in the same order and have put a ranking number on the condition. We are thus able to study differences between the two periods. At the bottom of the table, we present the aggregate measure for 1990, which shows an almost even distribution of reported health status. We have also calculated a concentration index for self-assessed health that is not standardised for age and sex; the index changes only marginally to 0.00694.

From an international perspective, Sweden has small inequalities in health. In an earlier study [van Doorslaer and Wagstaff et al (1996)], in which concentration indices have been calculated on grouped data for eight European countries and the United States, Sweden had the smallest inequality, although the concentration index was negative and significantly different from zero. Our study shows that the concentration index for the aggregate measure self-assessed health was close to zero, indicating that there were no income-related health inequalities in Sweden. However, when we disaggregate by looking at the different self-assessed diseases or disorders, the general pattern for 1990 was that several of the disorders or diseases had a distribution that is unfavourable to the poor section of the population; people with lower incomes report more diseases. Of the 44 conditions, 28 had a negative sign, of which 17 were significantly different from zero, indicating inequalities unfavourable to the poor. The conditions where the concentration indices were positive in 1990 are close to zero, and only five conditions had concentration indices that were significantly different from zero. These disorders, which were reported more frequently by higher income groups, are cancer, overweight, elevated blood pressure, difficulties to hear and perspiration problems. These conditions also had positive signs in 1980, although significant only for overweight, elevated blood pressure and perspiration problems.

In 1980, 27 conditions had negative signs, of which 12 were significantly different from zero. Thus, there were more conditions that were unfavourable to the poor section in 1990 than in 1980. Feeling of sickness, gastric pain, vomiting, headache, tiredness, common cold, cough and chronic bronchitis are conditions that were distributed towards the poor both in 1980 and 1990. Nervous problems, rash, mental depression, difficulties to breath, psychiatric disease, tuberculosis and weight loss are diseases that were more commonly reported by the poor, although significant only in 1990. For gastric ulcer and diarrhoea there was a positive, though nonsignificant, index in 1980, and negative and significant index in 1990.

There are also interesting differences in the signs for heart failure, neurological disorder and hernia. In 1980, there were significant inequalities that adversely affected the poor, but, in 1990, there were no significant inequalities, although the concentration indices were positive. Overall, the indices were closer to zero in 1980 than in 1990; there were 22 diseases where the concentration indices were significantly different from zero in 1990 (17 negative and 5 positive), but only 16 were significant different from zero in 1980 (12 negative and 4 positive). Moreover, the variation in the concentration index was greater in 1990 than in 1980; between -0.03748 (cough) and 0.03247 (elevated blood pressure) in 1980 and between -0.06495 (feeling of sickness) and 0.04645 (perspiration problems) in 1990. Thus, the diseases were in general more evenly distributed in 1980 than in 1990.

To test whether the differences in concentration indices between the two periods for different disorders and diseases were statistically significant we have performed t-tests of the differences in all conditions. We found significant differences for 8 of the 44 diseases, of which four were positive. A positive significant difference between the two periods indicates either that the poor section of the population has been worse-off concerning that specific condition (the concentration indices were negative both in 1980 and 1990, but the absolute value was higher in 1990), or that the rich section is worse-off both in 1980 and 1990, but the absolute value of the concentration index is lower in 1990. A positive difference may also indicate that the rich section is worse-off in 1980 and the poor section in 1990. The conditions with a significant positive difference in concentration indices include feeling of sickness, gastric pain, nervous problems and gastric ulcer. The distribution is unfavourable for the poor for both periods concerning feeling of sickness, gastric pain and nervous problems, thus indicating that the poor section of the population has been worse-off with respect to those diseases. Concerning gastric ulcer the distribution was unfavourable regarding the rich section of the population in 1980, but the poor section in 1990, and thus making the poor section worse-off.

A negative sign on the difference between the concentration indices indicates either that the rich section was worse-off, that the poor section was still worse-off, but to a lesser degree, or that the poor section was worse-off in 1980 and the rich section in 1990. The four conditions for which the difference is negatively significantly different from zero include heart failure, neurological disorder, hernia and difficulties to hear. In our study, the poor section was worse-off in 1980 and the rich section in 1990 concerning heart failure, neurological disorder and hernia, whereas the rich section was worse-off regarding difficulties to hear.

Table 3. Concentration indices for illness conditions. Standard errors are given in parentheses.					
DISORDERS AND DISEASES	**CONCEN-TRATION INDEX 1990**	**RANK 1980**	**CONCEN-TRATION INDEX 1980**	**INDEX 1980-INDEX 1990 (T-VALUE)**	**RANK (1980-1990)**
1. Feeling of sickness	-0.06495** (0.01003)	2	-0.03294*** (0.00954)	0.03201 (2.31)	2
2. Gastric pain	-0.04843*** (0.00910)	6	-0.02239*** (0.00876)	0.02604 (2.06)	3
3. Vomiting	-0.04535*** (0.01050)	3	-0.02854*** (0.01001)	0.01681 (1.16)	9
4. Headache	-0.03757*** (0.00786	4	-0.02834*** (0.00778)	0.00923 (0.83)	17
5. Nervous problems	-0.03250*** (0.00911)	21	-0.00799 (0.00894)	0.02451 (1.92)	4

Table 3. (cont.)

DISORDERS AND DISEASES	CONCEN-TRATION INDEX 1990	RANK 1980	CONCEN-TRATION INDEX 1980	INDEX 1980-INDEX 1990 (T-VALUE)	RANK (1980-1990)
6. Rash, eczema, psoriasis	-0.02869*** (0.01008)	18	-0.00890 (0.01017)	0.01979 (1.38)	6
7. Gastric ulcer, duodenal ulcer, dyspepsia	-0.02700*** (0.01026)	36	0.00894 (0.00880)	0.03594 (2.66)	1
8. Tiredness, exhaustion, weakness	-0.02699*** (0.00899)	11	-0.01567* (0.00873)	0.01132 (0.90)	15
9. Common cold	-0.02599*** (0.00750)	5	-0.02325*** (0.00707)	0.00274 (0.26)	29
10. Mental depression	-0.02282*** (0.00959)	17	-0.00925 (0.00928)	0.01357 (1.02)	10
11. Cough	-0.02223** (0.00962)	1	-0.03748*** (0.00889)	-0.01525 (-1.16)	39
12. Difficulties to breathe	-0.02105** (0.01002)	15	-0.01185 (0.00862)	0.00920 (0.70)	18
13. Psychiatric disease	-0.02004*** (0.00768)	20	-0.00860 (0.00819)	0.01144 (1.02)	14
14. Chronic bronchitis	-0.01909* (0.01002)	8	-0.01801* (0.00953)	0.00108 (0.08)	30
15. Diarrhoea	-0.01889* (0.01027)	28	0.00187 (0.00948)	0.02076 (1.49)	5
16. Tuberculosis	-0.01796** (0.00847)	26	-0.00010 (0.00755)	0.01786 (1.57)	8
17. Weight loss	-0.01771* (0.01002)	13	-0.01334 (0.00870)	0.00437 (0.33)	25
18. Varicose veins, leg ulcers	-0.01297 (0.00952)	16	-0.00953 (0.00906)	0.00344 (0.27)	28
19. Strain, unsolved problems, stressful situation	-0.01238 (0.01092)	34	0.00731 (0.01030)	0.01969 (1.31)	7
20. Diabetes	-0.01198 (0.00895)	23	-0.00526 (0.00913)	0.00672 (0.52)	20
21. Anaemia, low blood value	-0.01132 (0.01036)	12	-0.01476* (0.00989)	-0.00344 (-0.24)	33
22. Constipation	-0.00793 (0.01057)	33	0.00540 (0.00936)	0.01333 (0.94)	11

Table 3. (cont.)

DISORDERS AND DISEASES	CONCEN-TRATION INDEX 1990	RANK 1980	CONCEN-TRATION INDEX 1980	INDEX 1980-INDEX 1990 (T-VALUE)	RANK (1980-1990)
23. Lower back pain	-0.00537 (0.00777)	30	0.00490 (0.00750)	0.01027 (0.95)	16
24. Goitre	-0.00499 (0.00998)	29	0.00260 (0.00931)	0.00759 (0.56)	19
25. Difficulties to see	-0.00431 (0.00914)	14	-0.01214 (0.00936)	-0.00783 (-0.60)	36
26. Dizziness, vertigo	-0.00416 (0.00969)	27	-0.00003 (0.00938)	0.00413 (0.30)	26
27. Voiding difficulties, prostate, lower urinary tract infection	-0.00334 (0.00101)	37	0.00911 (0.00953)	0.01245 (0.90)	13
28. Chest pain	-0.00141 (0.00956)	24	-0.00362 (0.00872)	-0.00221 (-0.17)	32
29. Kidney disease	0.00283 (0.00989)	35	0.00861 (0.00996)	0.00578 (0.41)	22
30. Swelling of the legs	0.00367 (0.01021)	22	-0.00601 (0.00984)	-0.00968 (-0.68)	37
31. Arthritis/painful joints	0.00382 (0.00862)	19	-0.00861 (0.00818)	-0.01243 (-1.05)	38
32. Haemorrhoids	0.00562 (0.01013)	42	0.01895** (0.00928)	0.01333 (1.36)	12
33. Gall bladder	0.00611 (0.00987)	25	-0.00163 (0.00891)	-0.00774 (-0.58)	35
34. Heart attack, myocardial infarction	0.00659 (0.00892)	39	0.01222 (0.00870)	0.00563 (0.45)	24
35. Difficulties to sleep	0.00672 (0.00965)	31	0.00494 (0.00862)	-0.00178 (-0.13)	31
36. Painful shoulders	0.00963 (0.00812)	40	0.01344 (0.00806)	0.00381 (0.33)	27
37. Heart failure	0.01213 (0.00934)	8	-0.01830** (0.00895)	-0.03043 (-2.35)	43
38. Neurological disorder	0.01268 (0.00937)	10	-0.01674** (0.00807)	-0.02942 (-2.38)	42
39. Hernia	0.01522 (0.01056)	11	-0.01644* (0.00896)	-0.03166 (-2.29)	44

Table 3. (cont.)

DISORDERS AND DISEASES	CONCEN-TRATION INDEX 1990	RANK 1980	CONCEN-TRATION INDEX 1980	INDEX 1980-INDEX 1990 (T-VALUE)	RANK (1980-1990)
40. Cancer	0.01814** (0.00836)	38	0.01182 (0.00954)	-0.00632 (-0.50)	21
41. Overweight	0.02224*** (0.00863)	41	0.01657* (0.00968)	-0.00567 (-0.43)	34
42. Elevated blood pressure	0.02670*** (0.00974)	44	0.03247*** (0.00911)	0.00577 (0.43)	23
43. Difficulties to hear	0.03029*** (0.00886)	32	0.00535 (0.00859)	-0.02494 (-2.02)	41
44. Perspiration problems	0.04645*** (0.01052)	43	0.03002*** (0.00937	-0.01643 (-1.17)	40
Ill health	0.00699 (0.00875)				

Notes: *** denotes significantly different from zero at the 1% level, ** at the 5% level and * at the 10% level. In the **RANK (1980-1990)**-column, conditions with rank numbers 1 - 4 are positive and significant and conditions with numbers 41 - 44 are negative and significant. The conditions with rank numbers 5 - 40 are conditions that are similarly distributed for the two periods.

The ranking numbers shown in the last column refer to the differences between concentration indices for 1980 and 1990. We have ranked the differences between the two periods to study those conditions that have changed most dramatically. The diseases with a low rank number are those that have changed most between the two periods, and are unfavourable to the less well-off; a high rank number indicates diseases that have changed most in disfavour to the well-off.

6. CONCLUSION AND DISCUSSION

In this study, we have compared inequalities in health in Sweden in 1980 and 1990 for 44 disorders and diseases and investigated overall health inequalities in 1990. The general measure for self-reported ill health shows that health was not income-related in 1990[13]. However, the conclusion reached concerning the 44 diseases and disorders is that, in 1990, half of the 44 diseases and disorders are distributed unevenly and that the inequalities are mostly unfavourable to the poor. In general, the inequalities in the diseases and disorders were less obvious in 1980 than in 1990, even if the aggregate measure in 1990 shows an almost even distribution. The reason may be that people in general answer that they feel fit regarding their own general health condition, although they may have actually been suffering from one or more specific diseases during the last twelve months. These afflictions could have occurred many months in the past, but they are healthy at the time of interview and thus answer that they are in good health.

When we compare changes between the two periods, we have standardised for age and sex, as is a customary procedure in other studies. We could also have controlled for other variables (e.g., nationality) because there are reasons to believe that some of the inequalities we have found in our study may depend on variables other than income. Tuberculosis, for example, which afflicts the poor more than the rich in 1990, is more common among immigrants.

[13]Remember that our measure does not tell us anything about the direction of the causality; it only tells us that there may or may not be a relation between income and health or the specific disease or disorder. It does not say whether income affects or is affected by health or the specific disease or disorder.

Some inequalities can also be explained by information and how that information is used in different income groups[14]. Gastric ulcer, for example, which afflicts the poor more than the rich in 1990, may depend on more effective use of information in higher income groups in that they visit doctors and receive effective medicine at an early stage in their gastric pain. Better use of information may also be an explanation when we study the changes in the distribution between the two periods. Feeling of sickness, gastric pain, nervous problems and gastric ulcer are all diseases where there have been changes resulting in the poor section of the population being worse-off, and which may depend on information. Also, elevated blood pressure, which is a disadvantage to the rich, may depend on information; higher income groups visit doctors more frequently than lower income groups to control their blood pressure. In this way, the rich become aware of the potential disorder. Further, cancer may depend on better use of information by higher income groups, because these groups are more aware about the risks and visit doctors earlier. Thus, there is a greater likelihood of revealing the disease at an earlier time.

Most of the diseases and disorders were distributed similarly in 1980 as in 1990, although sometimes the distribution is uneven for both periods. Overweight and perspiration problems, for example, were unfavourable to the rich for both periods. However, this may not necessarily mean that higher income groups weigh more and have more perspiration problems, because higher income groups may define normal weight and perspiration differently than low income groups.

In this study, we calculated concentration indices for different self-assessed conditions in 1980 and in 1990 and compared these with one another. This calculation may not reveal fully the truth about the distribution of health, in that people in different income groups may have disparate evaluations about normal health status. Instead of using self-assessed measures in studies on health inequalities, it is possible to use so-called medical models and functional models. In these models, health conditions are assessed by questions concerned with functions (e.g., ability to run 100 meters, walk up stairs, etc.). Even though the disorders and diseases in our study are based on self-assessments, there are also medical diagnoses involved in the assessments. These diagnoses have, in many cases, been made by a physician. By comparing the self-assessed measure with the physician's diagnostic measure, it is possible to check the validity of the individual's responses. However, both the functional and the medical models are questions for further research.

REFERENCES

Blaxter, M. (1989), A Comparison of Measures of Inequality in Morbidity, in Fox, J, (ed.), Health Inequalities in European Countries. Gower, Aldershot. London.

Björklund, A., Palme, M., Svensson, I. (1995), Assessing the effects of Swedish tax and benefit reforms on income distribution using different income concepts. Tax reform evaluation. Report no. 13, August 1995. National Institute of Economic Research, Economic Council, Stockholm.

---

[14]We argue that higher educated people have higher wages and incomes than lower educated people.

Culyer, A. J. (1993), Health, health expenditure and equity, in van Doorslaer, E, Wagstaff, A, van Rutten, F (eds.), Equity in the Finance and Delivery of Health Care: An International Perspective. Oxford University Press. Oxford.

Fritzell, J., Lundberg, O., (red.) (1994), Vardagens villkor. Levnadsförhållanden i Sverige under tre decennier. Brombergs förlag. (The conditions of Daily Living).

Institutet för social forskning (1992), 1991 års levnadsnivåundersökning. Instruktions- och övningsformulär. Institutet för social forskning, Stockholms universitet. (Level of Living Survey 1991. Instruction and Practising).

Jansson, K. (1990), Inkomst- och förmögenhetsfördelningen 1967 - 1987. Bilaga 19 till Långtidsutredningen 1990. Finansdepartementet. (The distribution of income- and wealth 1967 - 1987. Appendix 19 to the Medium Term Survey 1990).

Jenkins, S. (1988), Calculating Income Distribution Indices from Micro Data. National Tax Journal, XLI, no. 1, 139-142.

Kakwani, N., Wagstaff, A., van Doorslaer, E. (1996), Socioeconomic Inequalities in Health: Measurement, Computation and Statistical Inference. Forthcoming in Journal of Econometrics.

Le Grand, J., Rabin, M. (1986), Trends in British Health Inequality, 1931-1983, in Culyer, A. J., Jönsson, B.,(eds.), Public and Private Health Services. Blackwell, Oxford.

Le Grand, J. (1987), Inequalities in Health. Some International Comparisons. European Economic Review, 31, 182-191.

Le Grand, J. (1989), An International Comparison of Distribution of Ages-at-death, in Fox, J., (ed.), Health Inequalities in European Countries. Gower, Aldershot. London.

The former people also have better possibilities to obtain information about health policies.

Lundberg, O., (1990), Den ojämlika ohälsan. Om klass- och könsskillnader i sjuklighet. Institutet för social forskning, avhandlingsserie 11. (Inequality in Ill Health. On class and sex differences in illness).

Lundberg, O. (1991), Causal Explanations for Class Inequality in Health. An Empirical Analysis. Social Science and Medicine, 32, 385-393.

Lundberg, O., Fritzell, J. (1994), Income Distribution, Income Change and Health: On the Importance of Absolute and Relative Income for Health Status in Sweden, in Levin, L. S., McMahon, L., Ziglio, E. (eds.), Economic Change, Social Welfare and Health in Europe.

Sundberg, G., (1996), Health, Work-Hours, and Wages in Sweden. Uppsala University, Departments of Economics.

Svensk Författningssamling (1982), SFS 1982:763. Hälso-och sjukvårdslag. (The Swedish Health Care Act).

Townsend, P., Davidson, N. (1982), Inequalities in Health: The Black Report. Harmondsworth, Penguin Books.

Wagstaff, A., Paci, P., van Doorslaer, E. (1991a), On the Measurement of Inequalities in Health. Social Science and Medicine, 33, 545-557.

Wagstaff, A., van Doorslaer, E., Paci, P. (1991b), On the Measurement of Horizontal Inequity in the Delivery of Health Care. Journal of Health Economics, 10, 169 - 205.

Wagstaff, A., van Doorslaer, E. (1994), Measuring Inequalities in Health in the Presence of Multiple-Category Morbidity Indicators. Health Economics, 3, 281-291.

van Doorslaer, E, Wagstaff, A. (1992), Equity in the Delivery of Health Care: Some International Comparisons. Journal of Health Economics, 11, 389 - 411.

van Doorslaer, E., Wagstaff, A. and Rutten, F., (eds.) (1993), Equity in the Finance and Delivery of Health Care: An International Perspective. Oxford: Oxford University Press.

van Doorslaer, E., Wagstaff, A., et al. (1996), Socioeconomic Inequalities in Morbidity: Some International Comparisons. Forthcoming in Journal of Health Economics.

Wilkinson, R. (1986), Introduction, in Wilkinson, R., (ed.), Class and Health. Tavistock, London.

Vågerö, D., Illsley, R. (1995), Explaining Health Inequalities: Beyond Black and Barker. European Sociological Review, 11, 219-241.