



Health inequality in Nordic welfare states

- more inequality or
the wrong measures?

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Abstract

Several empirical papers have indicated that the health inequalities in the Nordic welfare states seem to be at least as high as health inequalities in other European countries even if the Nordic states have a more egalitarian income structure. This is in contrast to standard economic theory that predicts that income equality should lead to health equality everything else equal. We argue that there may be a straightforward explanation why Nordic countries appear to have a steeper health gradient than other countries. Health and income are related, and the correlation between income and health will be weaker the more noise there is in terms of other determinants of income. If the Nordic countries have succeeded in reducing the impacts of other determinants of income, like social class, then the correlation between income and health will be stronger in the Nordic countries. This story also holds for other measures of health inequality. However, if the causality is running from income to health, there may be a reason why health inequality is higher in more egalitarian states based on cognitive stress theory. We argue however, that even in this case the difference between Nordic states and the rest of Europe may be a result of poor measures.

1. Introduction

In 1997, a paper was published that attracted quite a lot of attention internationally. Mackenbach et al. (1997) made a comparison of socio-economic inequalities in morbidity and mortality for several countries in Western Europe. Inequalities in health were found in all countries, but the Nordic countries, and especially Norway and Sweden, had the largest relative inequalities in health when it came both to morbidity and mortality by level of education, occupational class and income.⁴ Thus, egalitarian welfare states as the Nordic countries had higher relative inequalities than more class orientated societies. Later papers have also partly confirmed these conclusions. Van Doorslaer and Koolman (2004) used the European Community Household Panel to compare income-related inequalities in self-assessed health in 13 EU countries. Concentration indices were used to measure inequality in health, and inequality was decomposed into its determining factors. Denmark was the only Nordic country in this study, but it was found to be one of the countries with the highest degree of health inequality, even if it was the country with the lowest income inequality among the countries studied. The income related health inequality in Denmark was mainly due to the fact that early-retired individuals have much worse health and are strongly concentrated among the lower income groups. Norway was not included in the study, but Grasdahl (2003) made some calculations for Norway based on data from Statistics Norway that are comparable to the data from European Community Household Panel, and using the same methodology as van Doorslaer and Koolman (2004). She found that income related health inequality in Norway would be close to the median of the observations even if Norway is among the European countries with the lowest income inequality.

New studies find a similar pattern. Mackenbach et al. (2008) is a following up of the 1997 study. While the earlier study only covered 10 Western European countries, the new study covers 22 European countries including Eastern Europe. Data on mortality and self-assessed health collected from national sources are used, and they were classified according to education, occupational class and income. Based on health inequality measures (relative index of inequality and the slope index of inequality), Mackenbach et al. (2008) find the highest socio-economic health inequality based on mortality to be in Eastern Europe, whereas Southern Europe has the lowest inequality. However, when it comes to self-assessed health, the Nordic countries and England are the worst, particularly for income related inequalities. The authors find this surprising due to the “long histories of egalitarian policies” in Nordic countries, but point to

⁴ Several indicators of morbidity or health were used such as perceived general health, chronic conditions, long-term disability and any long-standing health problems. To measure inequality they used measures such as odds ratios for morbidity as well as two indexes of inequality.

lifestyle-related risk factors and especially smoking as one possible reason for the results. Finally, Eikemo (2008) also contributes to this literature. Using data on self-reported health from data from the European Social Survey, he concludes that the lowest health inequalities in Europe are found in Germany, France, Switzerland, Belgium, Netherlands and Luxembourg, and not in the Nordic countries.

To sum up, the empirical literature does not seem to find more equality in health for countries with a more egalitarian income structure. In this paper we will, however, argue that the conclusion that health inequality is high in Nordic countries compared to the rest of Europe is not necessary warranted. The measures of health inequality used in the studies above do show that different groups of the population have different health status and hence indicate inequality, but comparisons of socio-economic health inequality over time⁵ and between countries are problematic. The problem is simply that the common measures on socio-economic health inequality use two variables, some measure of health and then a socio-economic variable such as income, education or social standing. These measures are just as much influenced by changes in income distributions or distribution of education, as they are influenced by distributions of health. A change towards a more even income distribution will have the same effect as a change towards a more uneven distribution of health. Therefore, a policy that successfully improves both the income of the poorest and offer health services to the poor may still yield a steeper social health gradient. A great success in terms of distributional policy may be reported as a failure. This does not mean that the empirical results from the literature are wrong. We cannot rule out that higher inequality indicated by these measures actually means that there has been a more uneven health distribution. Thus, we cannot tell if the measures are wrong or right but that they are, for this reason, meaningless. Below, we will explain this further.

2. Measuring inequality

There are two distinct strands in the literature of health inequality. The first measures the overall inequalities of health based on individual inequality, and is more or less in line with the literature on income inequality. Wolfson and Rowe (2001) call this the *univariate approach*.⁶ The second strand of literature, called the *bivariate approach*, looks at a subset of health inequalities, such as

⁵ Comparisons over time are problematic as the different groups will differ. One example is that the health gradient based on education for women in many developed countries has been steeper after the Second World War (see, e.g., Zahl et al., 2003, for a study on Norway). But the group of low educated women today is totally different than it was 30-50 years ago. So the inequality measure may not give us much information.

⁶ One example of this is to make a Lorenz curve for health and calculate the corresponding Gini coefficient.

those occurring across the distribution of a measure of socio-economic status.⁷ For an overview over measures of health inequality, see, e.g., Wagstaff et al. (1991).

Our focus is on the bivariate approach, which bundles both health inequality and socio-economic inequality in one measure. But before discussing this approach, it is useful as a benchmark to discuss income distribution. There is a huge literature, some starting from a discussion of what properties we would like a measure of inequality to satisfy, and from that deriving the measure of inequality (see, e.g., Atkinson and Bourguignon, 2000). We will abstract from that and focus on an element that is almost too obvious to mention, and for this purpose consider a simple measure like the total income of the 10% poorest compared to the total income of the 10% richest. Note that the poorest and the richest must be defined in terms of the same income measure. Hence to measure income distribution we *only* need information about income.

Now, take one of the most used measures within the bivariate approach: odds ratios (see also below). A typical odds ratio compares the health of those with low income to the health of those with high income. To compute the odds ratio we thus need two types of information; information about *health* for the two groups and information about *income* to identify those with low and high income. Odds ratios will change due to changes in any of these two variables. That is, the odds ratio will change if the health distribution changes or if income distribution changes. The same argument applies irrespective of how health is measured (e.g., a subjective measure or mortality)⁸ and how the top and bottom groups are defined (in terms of income, education or social status). In all cases there are two variables involved, and an increase in the odds ratio may reflect a change in any one of them or a combination.

What is even worse: a change toward a more even income distribution will have the same effect on the odds ratio as a change toward a more uneven distribution of health. Both changes will lead to higher inequality using odds ratios. Thus we cannot tell whether a higher odds ratio is bad news (more inequality) or good news (less inequality). Actually, if both income and health are distributed more evenly, the odds ratio may still increase if the income change dominates. A success in terms of both income distribution and health distribution may thus appear as a problem. We will outline these arguments further below.

⁷ See Wagstaff and van Doorslaer (2004) for an approach to bring these two strands together in a unified measurement methodology.

⁸ As the main points of this paper are theoretical, we do not provide a clear definition of health. We only need to assume that health is a measurable variable, either as a subjective (e.g., self assessed health) or an objective measure (e.g., morbidity or mortality).

3. The effect of more equal income distribution on health inequality

To prove these claims we need to consider the different bivariate measures of health inequality⁹ more closely within an analytical framework.

We start with a common measure in the literature, namely the *social gradient in health* (see, e.g., Marmot, 2004; Marmot and Wilkinson, 2006). The social gradient is basically a measure of correlation between health and a socio-economic measure such as education, income or other measurements of social status.

Assume that individual income, y , is a linear function of some measure of health, h , other factors, a , and a normal distributed residual term, e .¹⁰ The foot script i refers to the individual, and ϕ and μ are coefficients.

$$(1) \quad y_i = \phi a_i + \mu h_i + e_i$$

Now, assuming all components are independent, the correlation between income and health is then

$$(2) \quad \rho(y, h) = \frac{\mu \sqrt{\text{var}(h)}}{\sqrt{\phi^2 \text{var}(a) + \mu^2 \text{var}(h) + \text{var}(e)}}$$

where the correlation goes from 0 to 1, with 0 meaning no correlation at all, while 1 is perfect correlation.

Note first that $\rho(y, h)$ is declining in ϕ , thus as other factors become less important the correlation between income and health declines. The intuition is simply that if income was determined directly by health, the correlation would be perfect, but the more components are added, they will have an impact too, and the correlation is no longer perfect. If ϕa_i is interpreted

⁹ The studies referred in the introduction use several measures of health inequality. Mackenbach et al. (1997) use odds ratios for morbidity as well as two indexes of inequality, a relative index of inequality that is actually a rate ratio or an odds ratio as well as the dissimilarity index. Mackenbach (2008) also use the relative index of inequality and the slope index of inequality. Both these indices are ratios between the lowest and the highest ends of the socio-economic scale. Dorslaer and Koolman (2004) use concentration indices and Eikemo (2008) uses odds ratios.

¹⁰ Thus the causal link goes from health to income.

as the impact of class, or parental income, then the more egalitarian the society is, the lower is ϕ . Hence, we would expect the highest correlation in the most egalitarian societies.¹¹

Thus if the distribution of h_i is the same in all countries, we expect the “social gradient” in health to be steeper in egalitarian societies. This is true provided that health inequality, μ , is the same in both societies. Thus, if the correlation is the same in egalitarian societies as in less egalitarian ones, that would reflect that health inequality is reduced just as much as other sources of inequality. A similar correlation in different countries is thus a signal of the success of the Nordic welfare state.

Similar arguments will apply to other measures of health inequality, comparing health in different income groups. We first take a look at *ratios*. The most common ratio used is *odds ratios*. They compare the top 10% of the income range with the lowest 10%. The weakness is that this measure does not tell anything about 80% of the population, i.e., it does not take the whole population into account. This is also the case for *rate ratios* which are used to compare rates, e.g., between different age groups, different genders etc. Further, the *relative index of inequality* is also a ratio. It calculates the mean health status of each socio-economic group and then ranks the classes by their socio-economic status. It then presents the result as a ratio between the lowest and highest socio-economic groups. Based on this inequality index, we can estimate the *slope index of inequality* as the slope of the regression line showing the relationship between a class’s health and its relative rank in the socio-economic distribution. This is also usually expressed as a rate.

¹¹ Note that if $\mu = \phi$, then the correlation will be independent of the ϕ for $\text{var}(e) = 0$.

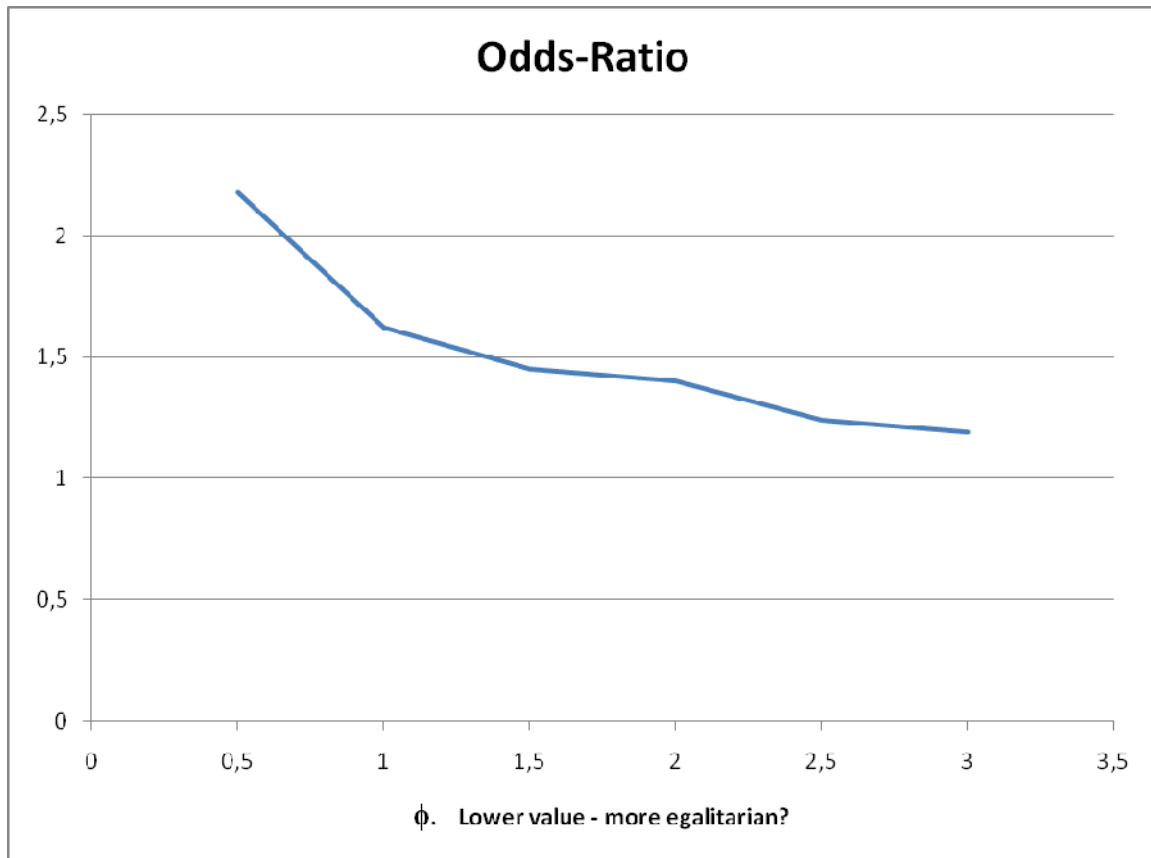


Figure 1: Odds ratios for different values of ϕ .

To see the implications of using a ratio measure, we have generated a simulated population of 10,000 individual, using equation (1).¹² Here we assume that the variables a and e are normally distributed with mean 0 and standard deviation 1 and 0.5 respectively, while h is uniformly distributed between 0 and 1. Figure 1 gives the odds ratios when ϕ is in the range from 0.5 to 3. Low values of ϕ represent an egalitarian society where other factors are less important, while high values represents the societies where other factors, like class background, are important. The reported health ratios are between those of the highest 10% of the income range and those of the lowest 10%.

As we see from the figure, the ratio increases with egalitarianity. Note that a ratio equal to 1 corresponds to no inequality. Thus, according to this inequality measure, the social inequality in health is much higher in the egalitarian country even if the health inequality is the same (distributions of h are equal) and there is lower income inequality in the egalitarian society. Odds ratios increase when income equalize. The intuition can be explained as follows: There are

¹² These calculations are simply made in an Excel spreadsheet, which is available from authors upon request.

mainly three factors that may contribute positively for an individual to be in the lowest 10% income group: Low class background, low health or bad luck.¹³ With a more egalitarian policy, the impact of class background is lower, and there are few individuals of low class (but possibly good health) in the bottom 10% of the income distribution. In the less egalitarian society however, a larger share of the individuals in the bottom 10% of the income distribution are there due to their class and not their health. As a consequence the bottom 10% has more people with good health in the less egalitarian society. A similar argument explains why the less egalitarian society has more people with bad health (but high class) in the top 10% of the income distribution.

If we have a measure of health that is continuous, one can use the *concentration curve*. This curve takes socio-economic status into account by plotting the cumulative share of total income (or another measure of socio-economic status) against the cumulative share of total health. Based on this we can calculate the *concentration index* which is between 0 and 1, and where a high number reflects inequality.¹⁴

Within the same model and the same distributions for the variables, we can draw the concentration curve, see Figure 2. In the figure, population is ordered by income along the horizontal axis, while the vertical axis shows accumulated health. The concentration index is twice the area between the curve and the 45-degree line.¹⁵ As seen from the figure, the concentration index increases as income equalizes, the measure thus indicates that inequality increases. Thus, also this inequality measure finds larger inequalities in the egalitarian country than in the less egalitarian country even if health is equally distributed and the egalitarian country has less income inequality. The intuition is the same as before: there are people with good health among those with low earnings and vice versa in the less egalitarian country, which is not the case in the egalitarian country.

¹³ Other factors such as a high value of leisure may also count.

¹⁴ One weakness of this measure is that it implies some unattractive ethical assumptions such that it is always better to reduce health in higher social classes in order to increase it in lower classes, see Fleurbaey and Schokkaert (2007).

¹⁵ The exact equation for the concentration index (CI) is $CI = 1 - 2 \int_0^1 L(s) ds$, where $L(s)$ is the concentration curve.

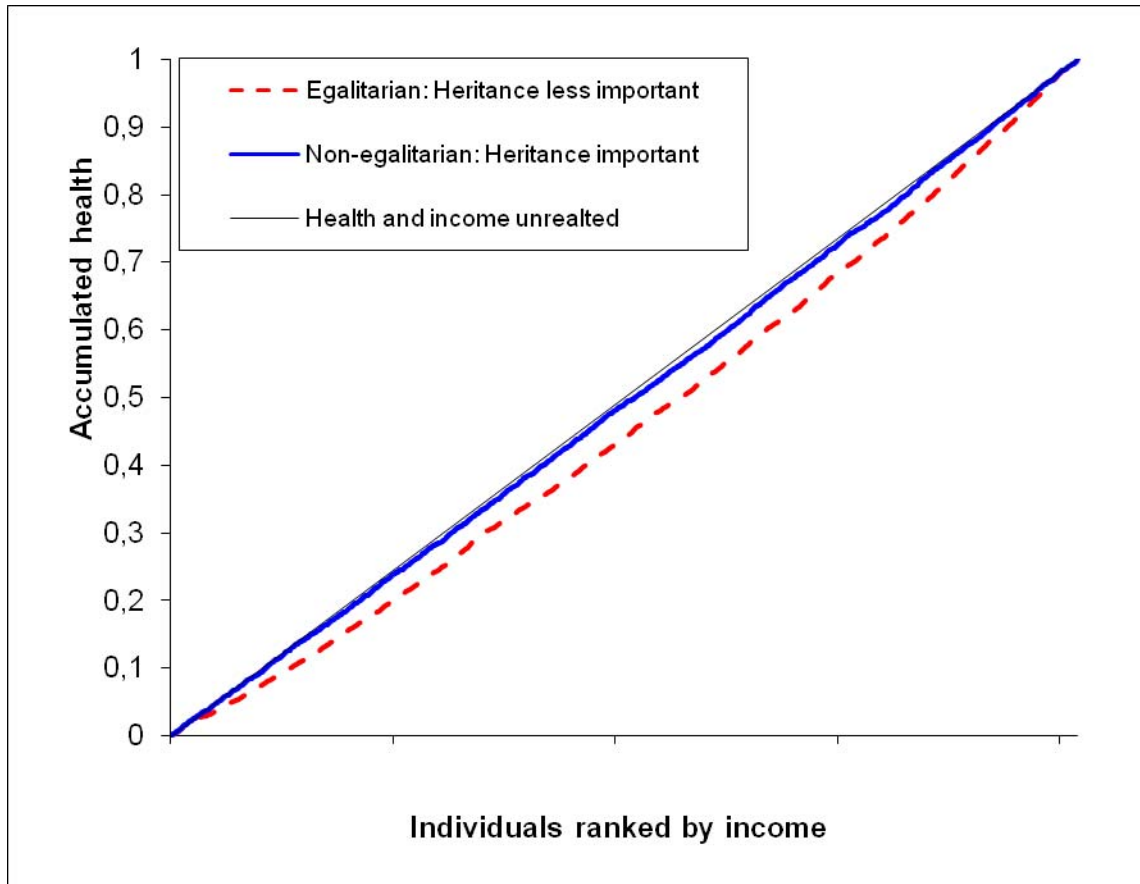


Figure 2: Concentration curves for the egalitarian and less egalitarian country based on equations (1) with ϕ equal 1 and 5 respectively, assumptions otherwise as for Figure 1

The model above is admittedly very simple, but still it points at an important issue in the interpretation of the correlation between income and health. Even with a more complex model the basic intuition will be the same as long as the main causal link is from health to income: if the impact of other sources of income inequality is reduced, the correlation between income and health will increase.

We have represented the Nordic welfare states with a reduction in the parameter ϕ . If a is interpreted as a representation of family background, then reduced ϕ amounts to increased intergenerational social mobility, and it may be questioned if this is the basic mechanism for reducing income inequality in Nordic countries. An argument in favour of this representation is the public institutions for financing education that make education accessible for students with low-income parents. Note, however, that a reduction in the variance of the error term, e , would have a similar implication. The basic intuition is the same, reducing other sources of income inequality enhances the relative importance of health.

4. Direction of causality

The alert reader has noted that the argument above presumes that poor health contributes to poor income, indicating a causal direction from health to income. That there are instances where poor health causes low income seems hard to deny, disabled persons living of pensions are obvious examples. For instance, as mentioned in the introduction, van Doorslaer and Koolman (2004) found that in Denmark early-retired individuals have much worse health and are strongly concentrated among the lower income groups. The causality here seems to go from health to income. But, it is less obvious that this is the only direction of causality, e.g., loss of income may cause depressions or lower access to health services. Similarly, higher education increases the knowledge about health, and a high social status may have psychological effects that increase well-being and health (Marmot, 2004). Both these mechanisms would yield a causal link from income or education to health. Poor social network may be harmful both to professional career and to health, indicating a causal link from a common outside explanatory variable. As there is some controversy about the direction of causality between income and health, it is worth discussing the same measures under alternative assumptions about causality.

The argument above easily generalizes to the case where differences in both income and health are *caused by the same underlying causes*, e.g., genetics or social networks. To illustrate this, consider the following model, where one factor such as genes, g , has an impact on both income and health:

$$(5) \quad y_i = \phi a_i + g_i + e_i$$

$$(6) \quad h_i = g_i + u_i$$

Here, both u and e are random terms. Once again if the impact of a is reduced, g explains more of the variation, and the correlation between y and h will increase.

The argument does, however, not carry through immediately if the causality is from income to health. If low income is causing poor health the simple equation would be

$$(7) \quad h_i = \phi a_i + \mu y_i + e_i$$

Now if the variance in y is reduced due to egalitarian policies, the correlation between h and y should decline (see equation (2) replacing h with y).¹⁶ Moreover, the Nordic welfare states attempts to provide the same access to health services irrespective of income, and hence the impact of income, i.e., μ , is reduced. This should similarly reduce the social gradient. Thus, if the main causal link is from income to health, then the steep gradient in Nordic countries may be a reason for concern after all. But this direction of causality is the only one where the standard measures make sense. The prerequisite for using measures like odds ratios and social gradient and especially compare them over time and between countries is to prove that the causal link from income to health is the dominating one. However, doubts about this causality have been raised. For instance Adams et al. (2003) conclude that they cannot reject a hypothesis that there exist no such causal link. Moreover, we will argue below that even if there is a strong causal link from income to health, measures like odds ratios and the social gradient may overstate the difference between Nordic countries and the rest of Europe.¹⁷ So, let us turn to the problems that arise in the case of income causing health through emotional stress mechanisms.

Cognitive stress theories (e.g., Eriksen and Ursin, 2002,2004) argue that a gradient in such stress may explain the gradient in health. Animal studies show that low status males (with poor perspectives of mating) have high levels of stress hormones (Sapolski, 1993). High levels of stress hormones may be detrimental to health. How can this affect health inequality?

For this purpose we will only sketch the main idea informally. Central to the argument is that low income, low education and certain occupations all characterize low social status. If low status causes stress that is harmful to the individual's health, health among low status groups may be lower. But why should this problem be stronger in Nordic countries? A possibility is that in a society with equal opportunities, there is no one else an individual can blame if he or she ends up in a low status position. Hence, the detrimental stress due to low status may be stronger in egalitarian societies. We do not rule out that there is something to this story. Indeed, in a companion paper (Brekke et al., 2009) we develop a formal model to capture this argument. Here we will only point to the possibility that even with this story the health inequality measures discussed above may be poor measures.

The problem may appear with the reasonable assumption that status is relative; the status and hence the cognitive stress associated with a certain income depends on the income of friends

¹⁶ Note that we use the same parameter symbols as in equation (1) even if the interpretations of them are different. This is mainly done to make easy comparisons with equation (2).

¹⁷ Actually, our project started with the hypothesis that health distribution in Nordic countries is more uneven than in southern Europe and that emotional stress theory could explain this. We then discovered that under plausible hypotheses the measures are likely to overstate the difference. Only later we discovered that with reversed causality, the problems with the measures were much worse.

and relatives. The health of an individual will then depend on relative income y_i / \bar{y}_i , where y_i is the individual income and \bar{y}_i is the level of income of friends and relatives. In a perfectly egalitarian society, family background should play a minor role in determining an individual's income. In other words, there are small differences in income between different families. Similarly, the income of classmates will be rather independent of which class a particular individual attended, as there are no bad and good schools with successful egalitarianism. In such a society individual income will be a good proxy for relative income and thus also a good predictor of health. Now, in a highly class structured society, an individual coming from a rich family is likely to be rich and also have rich relatives, and the individual most likely attended a good school with other children from rich families. This individual will, thus, have rich friends and relatives, and \bar{y}_i will be large. For those coming from a poor background, \bar{y}_i will similarly be low. With huge variation in \bar{y}_i , absolute income y_i is a poor proxy for status and hence a bad predictor of health. Thus, if income causes health through status and cognitive stress, we would expect a stronger correlation between income and health in egalitarian societies. Again the problem is not that health is more uneven in egalitarian societies, but that we lack the relevant data, in this case \bar{y}_i .

Some individuals of intermediate income may come from a rich background with rich relatives and friends, while others with the same income may come from a poor background with poor relatives and friends. While their absolute income is the same, their income relative to their reference group may be very different and, hence, the level of cognitive stress will be very different too; for intermediate income, those with a rich background will experience more stress than those from a poor background. All the measures of health inequality will only be sensitive to average health within the income group, thus underreporting the correlation between status and health. The more important such background variables are, the more will the correlation be underreported. Thus, the largest underreport will be in the least egalitarian societies. Here, the absolute income diverges more from the relative income, and there will be more people with good health in the intermediate income group. The correlation between health and income will, therefore, be lower in the least egalitarian society, even if health inequalities are not necessary different. Hence, the difference between the Nordic countries and the rest of Europe may also in this case be due to problems with the measures. For more details on this argument, see our companion paper, Brekke et al. (2009).

5. Conclusions and policy recommendations

The empirical results on socio-economic inequalities in health (e.g., Mackenbach et al., 1997; van Doorslaer and Koolman, 2004; Mackenbach et al., 2008; Eikemo, 2008) are often interpreted as indicating that health inequality is worse in Nordic countries than in other parts of Europe. We have argued that the measures used in these and other similar studies cannot be used to make such inferences.

Most measures of health inequality used in the literature use two variables (the bivariate approach), income and health, education and health etc. When health is studied relative to income, changes that affect the income of individuals but leave their health unaffected will show up in the measures of health inequality, even when the health of no individual changes. Assuming that the causal link runs from health to income, we have seen that a steeper social gradient may reflect either that income distribution has improved or that the health distribution is worse, thus we cannot even tell if the underlying change is an improvement or not. Therefore, the measures are meaningless. Even under the assumption that the causal link is from income to health, we have argued that the difference between Nordic countries and the rest of Europe may be due to problems with measurement without reflecting realities of health inequality.

The problems discussed above only apply to bivariate measures. An alternative that avoids these problems is the univariate approach. If we have a measure of health that is continuous, one measure for inequality in health that takes into account the whole population is the *Lorentz curve* and the related *Gini coefficient*. This measures the health inequality in the population, but it does not reflect whether the inequality is related to socio-economic status. Arguments in favour of this health inequality measurer are also found in, e.g., Fleurbaey and Schokkaert (2007), while Gakidou et al. (2000) argue for focusing on the distribution of health expectancy across individuals. On the other hand, it is interesting to know who has bad health; are they overrepresented in the lower income classes? Univariate approaches give no information about this. Bivariate measures are thus needed, but need a better theoretical foundation. See Fleurbaey (2006) for an attempt to provide such a foundation.

Should the Nordic governments be concerned about the health gradient? Sure, they should, just like any other government, but not more so than other European countries. Even if empirical studies do find a steeper gradient than in other European countries; this may be because the welfare states have exposed the gradient.

Measures of gradients or odds ratios do illustrate a real issue that those who have low income are also worse off in other areas of life, in this case health. This should be taken very

seriously. What is not warranted, however, is to draw inferences from comparison of odds ratios over time or between countries. Our analysis does, however, indicate that if bivariate measures like odds ratios fall while the income inequality is non-increasing, this does indicate improved health equality. To proceed, we think it is mandatory to discuss exactly what we want to measure and to develop indicators that do deliver.

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