Associations between relative income and mortality in Norway: a register-based study

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Background: Current research on health inequalities suggests that not only an individual’s absolute level of income but also his/her relative position in the income hierarchy could have health consequences. This study examines whether relative income was associated with individuals’ mortality in Norway during the 1990s. Methods: Data were formed by linkages of Norwegian administrative registers. This study analyses 1.68 million men and women (age group: 30–66 years) with disposable income (1993) in the range 60 000–210 000 Norwegian Kroner. Relative income was calculated as deviations in per cent from the median income in the surrounding residential area. The outcome variable was deaths in 1994–1999. Effects of relative income on mortality were estimated by multiple logistic regression analyses, separately in 13 narrow brackets of absolute income. Adjustments were made for sex, education, marital status, and other individual-level mortality predictors. Results: Low relative income compared with the median in residential areas with populations above 20 000 inhabitants was associated with higher mortality among those with medium and lower absolute income. The excess risk increased progressively the lower the level of absolute income. Among those with higher absolute income, however, relative income was not associated with mortality. Moreover, when relative income was considered in relation to the median in small municipalities, almost no effect on mortality was observed. Conclusion: In Norway during the 1990s, having low relative income constituted an additional mortality risk among individuals with middle or lower absolute incomes and when relative income was calculated in relation to the average in medium-sized or larger regions.

Keywords: absolute income, mortality, relative income

Introduction

In current research on health inequalities a distinction is drawn between the absolute income hypothesis and the relative income hypothesis. The former states that income tends to be associated with health because higher incomes enable more consumption of health-enhancing goods and services. The relative income hypothesis, on the other hand, suggests that how one’s own income compared with other people’s incomes is also consequential for health. Thus, it is claimed that having lower income than the average in one’s residential area will tend to influence health negatively, independent of the effects of the actual level of income.

Relative income can be defined as rank within an income distribution, or as the distance between own income and the average (or some other benchmark, for instance the highest quartile) in a particular income hierarchy. Associations between relative income and health could emerge because income, besides its purchasing power, also has symbolic value and social meanings. Low placement in the income hierarchy has to be selected in order to calculate an individual’s relative income. Various considerations are involved when this choice is made, and reference groups could be delimited both by geographical space (e.g. neighbourhoods, metropolitan areas, countries) and by social divisions (e.g. occupations, firms, ethnicity).

Often, the relative income hypothesis is linked to the theory of relative deprivation which claims that people take the standards of significant others as a basis for self-appraisal and evaluation (p. 40). It is suggested that people tend to compare their situation with that of a particular reference group, and if own income is below what they feel they are entitled to, stressful feelings could arise. Accordingly, the experience of being highly placed in the income hierarchy could generate high self-esteem and social prestige, while those who become conscious of their inferior positions could suffer from frustration and low self-esteem. Social comparisons are not the only mechanisms which could generate associations between relative income and health, however. The relative poverty explanation implies that having low income compared with the standards of one’s community will make participation on common social arenas difficult. Such social exclusion could foster harmful lifestyles also when the deviations between own income and the average in society are not explicitly recognised. Moreover, the income hierarchy corresponds to a hierarchy of power, and associations between relative income and health could emerge because high locations in the power hierarchy entail high degrees of control over one’s own destiny while low locations mean alienation and powerlessness.

Two topics typically arise when studying health effects of relative income. First, a reference group or a specific income hierarchy has to be selected in order to calculate an individual’s relative income. Various considerations are involved when this choice is made, and reference groups could be delimited both by geographical space (e.g. neighbourhoods, metropolitan areas, countries) and by social divisions (e.g. occupations, firms, ethnicity).

Second, it may be problematic to distinguish statistically effects of relative income from effects of absolute income. The two are of course perfectly correlated within one specific income hierarchy, and in many data sets the two types of effects are not easily separated. Sometimes the relative income hypothesis is conflated with the hypothesis that higher income inequality in an area leads to more health problems. If health problems increase with higher levels of income inequality, this could indicate detrimental effects of low relative income, since
higher income inequality usually means that more people have low positions in the income hierarchy. However, associations between income inequality and health could arise because of different types of mechanisms, for instance by a concave relationship between absolute income and health or by contextual effects in terms of the income distribution’s consequences for social cohesion.\textsuperscript{1,11}

Accordingly, the large number of studies of the relationships between income inequality and health\textsuperscript{1,11–15} constitute only indirect tests of the relative income hypothesis.\textsuperscript{2} A more strict interpretation of the relative income hypothesis is that it claims that individuals’ relative position in the income distribution affects their health, no matter whether overall income inequalities in this distribution are large or small. Studies which directly address the relative income hypothesis in this sense seem to be few.\textsuperscript{1} One Swedish study\textsuperscript{16} discovered no separate effect of relative income on mortality above the absolute income effect. Another study, however, based on a Nordic database,\textsuperscript{17} found that rates of limiting longstanding illness increased with decreasing relative income, after adjusting for respondents’ purchasing power. This effect was however primarily observed among those with fairly high incomes.

**Design**

The present study uses a large data set in order to analyse whether relative income was associated with mortality in Norway during the 1990s. It examines whether individuals’ relative income, defined as the deviation from the average in the community where the individual resided, was associated with their mortality, after adjusting for absolute income and various other mortality predictors. Thus, reference groups were delineated in terms of the population in the surrounding geographical area. Whether the social forces linking relative income to health operate primarily at proximate geographical levels (e.g. local communities) or at the level of larger geographical units is a contested topic. This question is addressed in this study by exploring the effects of relative income with respect to two different types of geographical units: medium-sized/larger regions and small municipalities.

The difficulty of discerning between effects of absolute and relative income is tackled by using an approach similar to an earlier study.\textsuperscript{17} The study population was divided into narrow brackets of absolute income, i.e. into subsamples which had practically the same resources available for purchasing health-enhancing goods and services. As the subsamples with same levels of absolute income were distributed across communities (geographical areas) with different average income, the relative income within each bracket will vary, and the present study examined how these variations were associated with mortality.

**Methods**

The data material were constructed by Statistics Norway. The population register as of 31 December 1992 was linked to various administrative registers, using the personal identification number.\textsuperscript{18} Data used in this study consist of men and women in the age group 30–66 years in 1993 who were alive at the end of 1993 and whose vital status could be followed until the end of 1999 (about 1.88 million individuals).

Information from the income register 1993 was available for 99.50% of this population. Income data were combined with family information in order to calculate the absolute income level in terms of each individual’s disposable income in 1993. All incomes of family members, net of taxes, were added and adjusted for the family’s composition of consumption units (first adult = 1, other adults = 0.7, each child <18 years = 0.5).

The study population was divided into 13 narrow income brackets in the range between 60 000 and 210 000 Norwegian Kroner (NOK) of disposable income. Those lower and higher on the income scale (3.3 and 6.6%, respectively, of those with income information) were excluded because of difficulties in making narrow income brackets with sufficient number for analyses.

Information about place of living was given by the municipality code. Norway’s 439 municipalities at that time varied very much in size: about 90 had less than 2000 inhabitants, while only four had more than 100 000. First, all municipalities were grouped according to the Norwegian version of the European Union’s NUTS level 4 classification of economic regions.\textsuperscript{19} Economic regions are defined as adjacent municipalities which approximate a common labour market and usually have an urban centre. The original classification divided Norway into 90 economic regions, but since several regions were rather small, the smaller ones were attached to their larger neighbour region. Thus, a sample of 63 regions with populations 20 000–475 000 was made. Within each of these regions, the median of disposable income for all individuals in the age group 30–66 was calculated. The relative income of each individual was calculated as the percentage of the median in his/her home region.

The second small-area sample was constituted by all municipalities with populations 2000–9999. In 1993, 249 Norwegian municipalities were of this size. Municipalities with less than 2000 inhabitants were excluded because many of them had few inhabitants in the selected age categories. Median disposable income within each of the 249 municipalities and each individual’s relative income were calculated as in the previous sample.

Odds ratios for dying in 1994–1999 were analysed by multiple logistic regression, using SPSS version 12.0, separately for the two samples of geographical areas and separately for each income bracket. The models were adjusted for eight individual-level variables: sex, age, education (as registered in the educational register in 1992), marital status (end of 1992), Norwegian/foreign-born, recipient of disability pension in 1992, recipient of other health-related benefits in 1992, and recipient of unemployment benefits during 1992. As the focus in this study is effects of relative income, coefficients for the control variables are not reported.

**Results**

Median disposable income varied from 110 100 to 150 500 NOK among the 63 regions; the corresponding variation in the 249 small municipalities was 103 700–141 800 NOK (table 1). Initial analyses showed that mortality decreased substantially with increasing levels of disposable income; moreover, mortality was higher among men, among unmarried/previously married, among low educated, and among recipients of benefits (results not shown in tables).

Within each bracket of disposable (i.e. absolute) income, relative income varied considerably (tables 2 and 3). In the multiple logistic regression analyses separately for each income bracket, effects of relative income were estimated as the odds ratios for dying in 1994–1999 per 10% decrease in relative income, adjusted for the set of individual mortality predictors. Results as regards the sample of 63 regions are shown in table 2. For the higher income brackets (160 000 NOK or more) no significant effect of relative income could be observed. For those with medium levels of absolute income (100–160 000 NOK) significant, although small, effects of decreasing relative income were found. For those with even lower levels of absolute income (<100 000 NOK), more pronounced effects on mortality of decreasing relative income emerged, and this effect increased progressively the lower
the level of absolute income. In the lowest income bracket analysed here (60–70,000 NOK), odds ratio for dying in 1994–1999 per each 10% decrease in relative income was 1.35 (95% CI: 1.23–1.50).

In the sample of 249 small municipalities (table 3), variations in relative income had no effect on mortality except for the very lowest income bracket (60–70,000 NOK).

Discussion

The findings indicate that in Norway during the 1990s, mortality was associated with relative income under certain conditions. When individuals’ income was compared with the median in their residential regions (with populations exceeding 20,000 inhabitants), significant mortality effects of decreasing relative income were observed for those with medium and lower absolute income. Among them, the relative position in the income hierarchy constituted an additional risk for mortality, over and above the effects of their absolute income and other individual-level mortality predictors, and this additional risk increased progressively the lower the individual’s absolute income. Among those who had fairly high absolute income, however, no effects of relative income were found in these medium-sized and larger regions. Furthermore, when relative income was defined as the deviation from the median in small municipalities, effects of relative location in the income hierarchy could only be discerned among those at the bottom of the income scale analysed here. Accordingly, decreasing relative income tended to raise mortality risk, but this occurred primarily as regards residential regions with population size of at least 20,000 inhabitants and primarily among individuals whose absolute level of income was in the lower part of the income hierarchy.

Methodological considerations

The advantages of this data material are the large and unbiased study population, information with high validity and few missing values on specific variables. The information in the registers are sometimes wrong, of course because of tax evasions, education from abroad not registered in the national educational register, imprecise registration of cohabitant couples, etc., but it is not plausible that such errors would seriously bias the results.

One possible limitation is the adjustment for absolute income. It was not feasible to include both absolute and relative income in the same regression models because of multicollinearity (in the study population, Pearson’s r between absolute and relative income was 0.961). Test analyses showed that within each separate income bracket variations in absolute income did not have significant effects on mortality (results not shown). The assumption underlying the study design is that purchasing power within each income bracket was similar, but this presupposes that price levels were similar in different parts of the country. Housing prices are higher in large urban areas, but other goods are sometimes more expensive in rural areas because of transportation costs. The latest available investigation of regional price differences found these to be very small, and the fact that no trade unions include ‘metropolitan areas allowances’ in their wage bargaining suggests that regional price variations are no important issue. Another possible complication is public spending. If levels of social investments varied between municipalities, inhabitants in high-spending areas could enjoy a better material standard than indicated by their absolute income. As Norway is a fairly homogeneous country where national legislation generally regulates local social investments, it is not likely that public spending differs in a consequential way.

Therefore, we suggest that the adjustment for purchasing power in this study has been adequate. Rather, one could raise the question about overadjustment. The approach utilised here isolates the unique effects of relative income after control-
The regions which include the three largest cities (Oslo, Bergen, Trondheim). This led to some attenuation of the effects of relative income, but the main pattern of results was the same as shown in table 2.

**Interpretation**

Accordingly, we believe that the findings are robust indications that with respect to Norwegian middle-sized and larger residential regions, mortality risk during the 1990s increased with decreasing relative income among those placed in the middle, and especially in the lower, parts of the income hierarchy. Immediately, one would believe that a welfare state such as Norway have institutional mechanisms which ameliorate detrimental health effects of relative placement in the income hierarchy. The analyses presented here, however, indicate that even well-developed welfare states are not necessarily able to avoid harmful health effects of low relative income. Nevertheless, it should be kept in mind that the absolute income effect on mortality (also after adjusting for other individual-level mortality predictors) is always strong in these data, but the somewhat surprising finding is that in addition, low relative income also had a distinct effect on mortality under certain circumstances.

It is however not evident what kind of social processes lies behind the observed results. It can be suggested that absolute income above the national average somehow tends to protect against detrimental health effects of relative placement in the income hierarchy. The increased mortality risk associated with decreasing relative income occurred primarily among those placed in the lower quartile of the income scale. Those who were economically disadvantaged in an absolute sense seemed therefore also more susceptible to harmful health effects of low relative income. The reason could perhaps be that health-damaging feelings of relative deprivation primarily arise when economic resources generally are small, or because the combination of both low absolute and low relative income leads to social exclusion.

However, the results constitute also a challenge to the relative deprivation interpretation. Effects of relative income were almost absent in small municipalities where social life supposedly is fairly transparent, but appeared primarily in regions where one would assume that the social setting is more opaque. The relative deprivation interpretation usually implies that detrimental health effects of relative placement in the income hierarchy are connected to people's knowledge of their relative positions. The results suggest on the contrary that relative income effects emerge primarily under circumstances where one would assume that people, by and large, are more ignorant about their relative placement in the income hierarchy. It could be that social comparisons and knowledge about relative positions certainly occur in small communities, but that these communities also have higher levels of social integration which counteract tendencies that people with low relative income feel relatively deprived or are excluded from social arenas. Moreover, it may be that features of social life in small municipalities imply that income means less for one's standing in the community, while in larger, presumably more anonymous, societies, one's relative position in the income hierarchy is more consequential for social inclusion and feelings of relative deprivation. These are however speculations which cannot be examined further on the basis of the data available for this study, and further research is necessary for exploring these (and other) interpretations.

**Acknowledgements**

This study was supported by The Research Council of Norway (Project 163970/V50). Data were provided by Statistics Norway.

Conflict of interest: None.
Key points

- This study addresses the controversial question whether relative position in income hierarchies affects health.
- In Norway during the 1990s, low relative income was associated with higher mortality after adjusting for conventional mortality predictors.
- This effect occurred only among those with medium and lower absolute income and only in medium-sized or larger regions.
- The results point to possible negative health consequences of inegalitarian income distributions.

References


Received 9 August 2005, accepted 20 December 2005