



The associations of household wealth and income with self-rated health – A study on economic advantage in middle-aged Finnish men and women

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ABSTRACT

The economic resources available to an individual or a household have been hypothesised to affect health through the direct material effects of living conditions as well as through social comparison and experiences of deprivation. The focus so far has been mainly on current individual or household income, and there is a lack of studies on wealth, a potentially relevant part of household resources. We studied the associations of household wealth and household income with self-rated health, and addressed some theoretical issues related to economic advantage and health. The data were from questionnaire survey of Finnish men and women aged from 45 to 67 years, who were employed by the City of Helsinki from five to seven years before the collection of the data in 2007. We found household wealth to have a strong and consistent association with self-rated health, poor health decreasing with increasing wealth. The relationship was only partly attributable to the association of wealth with employment status, household income, work conditions and health-related behaviour. In contrast, the association of household income with self-rated health was greatly attenuated by taking into account employment status and wealth, and even further attenuated by work conditions. The results suggested a significant contribution of wealth differentials to differences in health status. The insufficiency of current income as the only measure of material welfare was demonstrated. Conditions associated with long-term accumulation of material welfare may be a significant aspect of the causal processes that lead to socioeconomic inequalities in ill health.

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Introduction

Studies on inequalities in economic resources as a cause of inequalities in ill health have mostly focused on the effect of income level on mortality and poor overall health status, and there is very little literature on the contribution of household wealth. It is likely, as we discuss in more detail later, that the effects of wealth and income on health are to a large part interconnected, and the mediating mechanisms are likely to be similar. Nevertheless, as wealth is an important part of household economic resources, focusing on income only may be an impartial approach to study the potential effects of household economic position on health. Several previous authors (e.g. Braveman et al., 2005; Ecob & Davey Smith, 1999) have noted the problems of assuming that income data alone can account for the living standard of individuals and households.

Household wealth is likely to reflect long-term living conditions, which is of particular importance given that income data is often

available for comparably short time periods only. Data from Britain have showed that there is notable short-term variation in income particularly at the extremes of the income distribution (Jarvis & Jenkins, 1998). Given that illness, disease and death can in most cases plausibly be understood as phenomena caused by an accumulation of influences over the life course rather than momentary risks of becoming ill at a certain point of time, it is justified to assume that the long-term accumulation of economic resources is important. Previous results showing stronger association of long-term than current income with health (Benzeval & Judge, 2001) support this assumption. The distribution of wealth is also more unequal than that of income, indicating that additional information on social inequalities is contained in data on wealth.

Whether economic advantage contributes to inequalities in ill health largely involves the question of whether the standard of living and consumption potential affect health. If income and wealth can be attributed an independent causal contribution to social inequalities in health, the mechanisms mediating this effect are likely to involve consumption potential in some way. Although many other social advantages correlate with wealth and income,

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the degree to which they can be seen as caused by economic position is questionable. Although income determines current consumption potential more directly, wealth may affect living costs and contributes, in particular, to the acquisition of permanent resources, such as real estate or vehicles.

Theoretical issues

Three themes are central to explanation of the association of economic position with ill health and mortality. The first of these concerns the degree to which ill health leads to disadvantaged economic position. It is evident that ill health can seriously affect a person's ability to secure gainful employment, and thus it is mainly a question of the magnitude and scope of such processes in a population compared with the potential causal pathways.

Secondly, the association could reflect the covariation of economic advantage with other aspects of advantaged socioeconomic position, and not be genuinely causal. To be more exact, the issue is whether the differences in consumption potential and in the material standard of living cause the association, and not the fact that income covaries with exposure to detrimental work conditions, for example.

Thirdly, even if it is accepted that economic position has a causal effect on the development of ill health and mortality, there is still the question of why the ability to consume is important to health. Causal explanations about the nature of the interdependence fall into two main categories.

The material explanation is that commodities and services acquired through the use of private economic resources affect health, and that commodities that people with little money can afford to acquire are significantly more detrimental to health than the corresponding commodities people with more money to spend can afford. This hypothesis further requires that people acquire commodities that are beneficial, or in many cases less damaging, to health, if they have the necessary financial resources to do so (although not necessarily consciously in the interest of promoting their health).

The second type of explanation concerns how people see their and others' positions in society, and the degree to which commodities as signs of status capable of influencing human interaction rather than concrete objects and physical environments are related to mental states that are detrimental to health. This explanation is related to the theoretical notion of relative deprivation, according to which the inability to acquire what is considered to belong to the good life and thus the inability to lead a good life relative to social norms, and the lack of social status attached to such acquisitions, cause chronic mental distress (Wilkinson, 1999). It could also be said that the distress is caused not by the person's interpretation as such, but by other people's behaviour towards someone who lacks the signs of status. According to stress theory it could be assumed that distress caused by low status may lead to somatic disease and ultimately even death (Marmot, 2005).

Both types of explanation assign causal importance to income level, but in the case of the latter this is not necessarily only to do with consumption potential. Both income as such and the commodities it makes available may be relevant.

Empirical evidence on economic position, illness and mortality

One empirical approach to testing whether limited consumption potential causes ill health and mortality is to use different measures of income. Household income net of taxes and income transfers and adjusted for household size is the closest operationalisation of the degree of freedom in consumption choice, and could be assumed to be the best estimate of causal effects related to

consumption. Nordic studies have found weaker associations with ill health and mortality for household disposable income than for gross household or individual income (Fritzell, Nermo, & Lundberg, 2004; Martikainen, Valkonen, & Moustgaard, 2009; Rahkonen, Arber, Lahelma, Martikainen & Silventoinen, 2000), which suggests that a significant proportion of the observed inequalities in ill health measured in terms of individual gross income are the result of factors other than the causal effect of consumption (Martikainen et al., 2009).

Another discussion concerns the form of the association of income with mortality and ill health. There is a widely held view that a curvilinear association with diminishing health gains relative to increasing income is more compatible with the causal effect of standard of living than a linear association (see e.g. Der, 2001), although the grounds for this assumption are often not clearly indicated. It is not unproblematic to claim that differences in material living conditions are less important above the average income level than below it given the lack of data on actual living conditions. Nevertheless, empirical results from the U.S. have confirmed a curvilinear association with mortality (Backlund, Sorlie, & Johnson, 1996), the effect of income levelling off at the higher end of the range. Similar curvilinearity has also been found for the association of income with self-reported morbidity measures in Swedish and British populations (Blaxter, 1990; Ecob & Davey Smith, 1999; Fritzell et al., 2004) although different measures of health applied to the same data showed both curvilinear and linear associations (Der, Macintyre, Ford, Hunt, & West, 1999). In a study comparing seven Western European countries, Mackenbach et al. (2005) found a clearly less steep effect on self-rated health in the highest income quartile than in mid-range incomes in them all, but the results for the lowest income quartile varied. Mortality data from Finland covering 1991–1996 showed a mainly linear association, with only weak signs of a levelling off at high incomes (Martikainen, Mäkelä, Koskinen, & Valkonen, 2001), whereas recent Finnish data on mortality during the period from 1998 to 2004 indicated curvilinear associations before adjustment for other aspects of socioeconomic position, but only weak associations after adjustment (Martikainen et al., 2009).

There have been attempts to separate objective purchasing power and relative income level (Åberg Yngwe, Fritzell, Burström, & Lundberg, 2005). However, the problem seems to be that when income measured in absolute units is accounted for the remaining effect of the distance of an individual from the population average income potentially measures for the effects of all other dimensions of socioeconomic position. Such effects are not necessarily causally mediated by 'relative deprivation stress'. Pathways could include the effects of social class mediated through work conditions, and the potential effects of education mediated through behavioural patterns.

Some authors have argued that area-level income inequalities could be used as an indirect test of the contribution of social comparison to inequalities in health (Kawachi, Subramanian, & Almeida-Filho, 2002). Studies comparing the effects of household income and income inequalities on ill health and mortality across different states in the U.S. have reported some contributions of income inequalities to morbidity and mortality in excess of individual income (Kennedy, Kawachi, Glass, & Prothrow-Stith, 1998; Lochner, Pamuk, Makuc, Kennedy, & Kawachi, 2001). It is nevertheless questionable whether fractionalising the effect between individual and area-level measurements of income can reveal very much about the underlying mechanisms of the effect of income level on ill health when no other information on living conditions is available. Either measurement could relate to both material effects and social comparison.

Household wealth has been addressed in previous studies mainly using proxies such as house ownership or access to car. Several British studies (e.g. Blane, Bartley, & Davey Smith, 1997; Macintyre, Ellaway, Der, Ford, & Hunt, 1998), as well as a recent Finnish study (Laaksonen, Martikainen, Nihtilä, Rahkonen, & Lahelma, 2008) have found associations of home ownership with illness and mortality in excess of income, and these results may be interpreted as pointing to the importance of accumulated wealth as a material resource. Studies directly focusing on wealth and ill health are rare, however. Results from the Whitehall studies on middle-aged British civil servants have indicated that wealth is associated with lower prevalence of poor self-rated health and clinical conditions in excess of the effect of income (Martikainen, Adda, Ferrie, Davey Smith, & Marmot, 2003; Perel et al., 2006). Other recent studies have also reported associations of household wealth with stroke (Avendano & Glymour, 2008) and with psychological distress (Carter, Blakely, Collings, Gunasekara, & Richardson, 2008).

Objectives of the study

Further studies on the potential effect of wealth on illness could provide valuable evidence to strengthen the general inference about the contribution of economic resources and the standard of living to inequalities in ill health. Thus our objective was to study the effects of household wealth as well as household income on less-than-good self-rated health. The study was cross-sectional, but in taking into consideration potential reverse causation we included employment status as a covariate in the analyses. We also included factors that might covary with economic resources but are not caused by them in an attempt to counter the confounding from other aspects of socioeconomic position. We did not adjust for social class or education because it seemed more justified to adjust for the conditions that are hypothesised to mediate their effects. Therefore we included measures of work conditions in the analysis. Health-related behavioural patterns were also considered, although it is much less clear whether they are causally independent of economic resources. However, testing for the contribution of health-related behaviour could help in identifying the potential mechanisms determining the effects of economic resources on health.

Methods

Data collection and participants

The data used were derived from the Helsinki Health Study cohort follow-up questionnaire survey. The participants were men and women who were employed by the City of Helsinki in 2000, 2001 and 2002, and were born between 1940 and 1962. The organisation of the City covers a wide variety of services, including, but not limited to, health care, social services, education, transport and public administration. The baseline survey covered all employees in applicable ages (Laaksonen, Aittomäki, et al., 2008). The follow-up questionnaires were mailed in 2007 to 8794 persons who had responded in the baseline survey five to seven years earlier. Data from the follow-up questionnaire was used in this study because the question on household wealth was not included in the baseline questionnaire. The response rate of the baseline survey was 67 percent. There were 7332 valid follow-up responses, and the follow-up response rate was 83 percent. A total of 669 respondents did not answer the item about household wealth, and a further 154 were excluded from the analysis because of missing data in other items. Thus the final data set comprised 6509 analysed questionnaires. The study protocol was approved by the ethical committees at the Department of Public Health, University of Helsinki, and at the City of Helsinki health authorities.

Table 1 shows the distributions of gender, age and employment status among the respondents. The City of Helsinki employs far more women than men, reflecting the skewed gender distribution of occupations in health care and social-welfare services, and correspondingly, 81 percent of the study participants were women. There were fewer in the oldest age group than in the others because all of the participants were employed at the baseline. At the time of the follow-up survey, 17 percent of the respondents had retired on the grounds of age, and seven percent were outside employment for other reasons: 257 were on disability pension or had been on sick leave for more than six months, and 53 were unemployed or on unemployment pension.

Measures of income and wealth

Both the income and the wealth measurements were based on questionnaire items. The respondents were asked to assess the monthly disposable income of their household, in other words income after taxes and public income transfers (seven response categories). Wealth was measured by asking the respondents to assess the total value of their household possessions, including house or apartment, other real estate and vehicles, and subtract from this their debts and loans, including mortgages (ten response categories).

The analysed variables were constructed from the original items as follows. The categories were replaced with the respective means of the upper and lower limits to provide scaled variables with units in Euros. These were divided by a coefficient accounting for household size, calculated according to the OECD standard (OECD, 1982). The resulting household-equivalent measures were used as continuous variables in the main analyses, and were recategorised into deciles in order to produce categorical variables that would graphically illustrate the form of association with self-rated health. In order to facilitate comparison of the effects of income and wealth we removed the scale effect by dividing the values of the continuous variables by the distance between the first and second tertile points. The distributions of household-equivalent income and wealth are reported in Table 2 in evenly ranged categories. For comparison, we also estimated the distribution of household-equivalent disposable

Table 1
Distributions of gender, age, employment status and self-rated health.

	<i>n</i>	%
<i>Gender</i>		
Men	1268	19
Women	5241	81
<i>Age</i>		
45 to 49	1288	20
50 to 54	1354	21
55 to 59	1416	22
60 to 64	1670	26
65 to 67	781	12
<i>Employment status</i>		
Full-time employed	4501	69
Part-time employed	424	7
Pensioner	1127	17
Other non-employed	457	7
<i>Self-rated health</i>		
Excellent	426	7
Very good	1490	23
Good	2749	42
Mediocre	1665	26
Poor	179	3
Total responses analysed	6509	

income in the general population using a data set which represented an 11 % random sample of the Finnish population in 2003 and derived income data from tax registers (permission TK-53-1783-96) (Table 2). The distributions were similar among the participants of our study and in the employed population of corresponding age in the Helsinki region. In the Finnish general population average income was lower. This is likely to be due to the lower proportion of people outside employment among the participants than in the general population. The rank correlation between the studied income and wealth measures was .47, which corresponded with the correlation estimated from tax data.

Ill health

Ill health was measured on one-item, five-category self-rated health scale, and those with less-than-good self-rated health, 28 percent of the participants (Table 1), were categorised as having a poor health status. Less-than-good self-rated health is a widely used measure in social epidemiology, and has been found to correlate with many objective measures as well as to predict mortality (Idler & Benyamini, 1997; Jylhä, Volpato, & Guralnik, 2006; Mackenbach, Simon, Looman, & Joung, 2002).

Adjusting variables

Data on employment status were also derived from the follow-up questionnaire, the categories being full-time employed, part-time employed, pensioner and other non-employed.

Data on work conditions were derived from the baseline questionnaire, and were thus gathered five to seven years earlier than the time when ill health, income and wealth were measured. The follow-up questionnaire also included data on work conditions, but as not all the participants were employed at the time of the follow-up, it was decided to use the baseline data. The measurements included overall work demands and job decision latitude taken from Karasek's Job Content Questionnaire (Karasek et al., 1998), and a six-item inventory on physical work demands.

Data on health-related behaviour included the amount of alcohol consumed weekly (in terms of the number of standard portions,

corresponding to 12 g of pure alcohol), the number of cigarettes smoked daily, and a quantification of leisure-time physical activity (four items, applied as approximate MET units). All were applied as continuous variables, alcohol consumed including a knot at 100 g to account for the curvilinearity of the effect on illness.

Statistical methods

A series of nested logistic regression models was used to examine the associations of household income and household wealth with less-than-good self-rated health. New covariates are added in each consecutive modelling step in order to test for the contribution of competing determinants. The results are reported as odds ratios and their 95 percent confidence intervals, and as percentage changes in the beta estimates when new covariates were added.

In order to graphically illustrate the form of association between both income and wealth and self-rated health, we inserted income and wealth in deciles as categorical variables into the models (Figs. 1 and 2). The associations were not linear, and we therefore used piecewise regression (see Mackenbach et al., 2005; Smith, 1979) in the models that applied income and wealth as continuous variables (Table 3). 'Piecewise' refers to adding an additional term which accounts for the change of the linear effect above, or below, certain value of a continuous covariate, in this case income and wealth. We allowed the slope to change at the second tertile point, basing this choice on visual inspection, and further confirming the choice by testing models with differently placed terms.

At first, two separate regression models were constructed in order to measure the effect of household income on the one hand and household wealth on the other on less-than-good self-rated health, adjusted for gender and age. Employment status was added in the second step. Thirdly, we constructed a model with both income and wealth, as well as employment status, as covariates in addition to gender and age. Finally, we assessed the effect of adding work conditions and health-related behaviour to the model. The reported data are from models in which the genders were analysed together, but we also tested for gender differences by carrying out separate analyses for men and women.

Table 2

Distributions of household-equivalent disposable income (monthly) and household-equivalent wealth in the study population, and of household-equivalent disposable income in the Finnish general population as well as employed population in Helsinki region.

	Study population		Employed population in same area ^a		General population ^a
	n	%	%	%	%
<i>Household monthly disposable income</i>					
Below 500 Euros	25	0	2		4
500–999 Euros	530	8	5		19
1000–1499 Euros	1920	30	24		34
1500–1999 Euros	1581	24	31		25
2000–2499 Euros	1599	25	19		11
2500–2999 Euros	216	3	10		4
3000–3499 Euros	396	6	3		1
Above 3500 Euros	242	4	5		2
<i>Household wealth</i>					
Below 75,000 Euros	2241	34			
75,000–149,999 Euros	1609	25			
150,000–224,999 Euros	1036	16			
225,000–299,999 Euros	634	10			
300,000–374,999 Euros	445	7			
375,000–449,999 Euros	29	0			
450,000–524,999 Euros	234	4			
Above 525,000 Euros	281	4			

^a Estimated from an 11% random sample of the Finnish population in 2003, limited to corresponding age groups. Data from tax registers, comparable data on wealth not available.

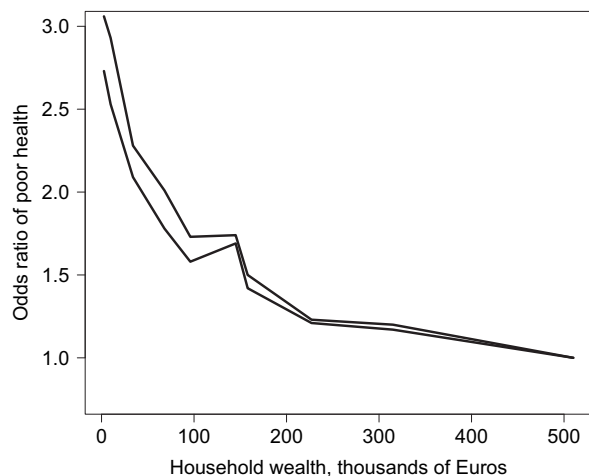


Fig. 1. The association between household-equivalent wealth and less-than-good self-rated health. The higher curve is adjusted for gender and age, the lower one for gender, age, employment status and household income.

Results

The associations of household-equivalent disposable income on the one hand, and of household-equivalent wealth on the other, with less-than-good self-rated health are illustrated in Figs. 1 and 2. In both cases the associations were strong below the second tertile point, although the relationship between wealth and health was more consistent. The beta estimates for the change in the linear slope at the second tertile point were statistically significant ($p < 0.0001$) for both income and wealth, thus confirming curvilinearity. The slopes above the tertile point were gentle, albeit statistically significant when income and wealth were modelled separately.

When separate models were constructed for men and women the dependence of self-rated health on income was weaker among the men and curvilinearity was not confirmed among the men, whereas the results concerning wealth were similar for both genders. Given that the gender difference in the effect of income was not statistically significant, it was considered warranted to analyse the genders together.

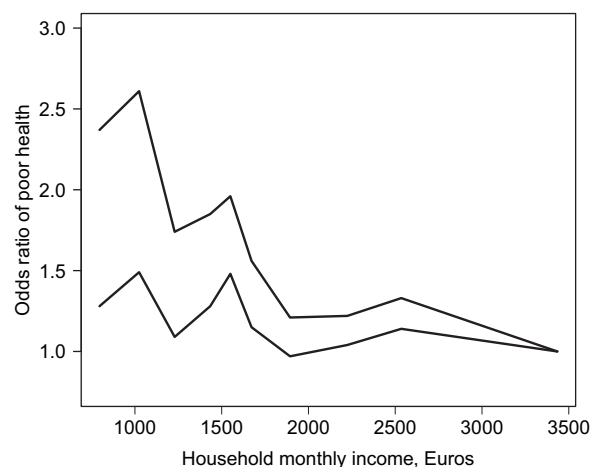


Fig. 2. The association between monthly household-equivalent disposable income and less-than-good self-rated health. The higher curve is adjusted for gender and age, the lower one for gender, age, employment status and household wealth.

The changes in the dependence of self-rated health on income and wealth between the modelling steps are reported in Table 3. We focus our attention on the dependence below the second tertile point, as effects above this point were smaller and not statistically significant in models 3, 4 and 5. Adjusting for employment status accounted for approximately one fifth of the dependence on income, but changes in the dependence on wealth were negligible. When income and wealth were both in the same model and employment status was adjusted for, more than half of the original association with income was accounted for, whereas the association with wealth attenuated only slightly. Adjusting for work conditions further attenuated dependence on income but did not change the dependence on wealth. Adjusting for health-related behaviour, in contrast, resulted in a small attenuation in the case of wealth, but there was no change concerning income.

Discussion

Inequality of economic resources is one of the fundamental dimensions of social stratification, and it cannot be overlooked as the underlying macrosocial structure in causal processes that may cause social inequalities in ill health. Most studies on the effect of material resources on health have been based on income, on which data is readily available. However, income does not fully capture differences in economic resources and consumption potential. Wealth accumulated from life-time income and inter-generational transfers is another defining element of an individual's or a household's economic position. Explanations referring to consumption and standard of living as potential causal factors should therefore take both wealth and net income differentials into account.

Main results

Our study concerned the associations of both household income and household wealth with less-than-good self-rated health. We studied a middle-aged, mostly employed but partly retired sample of Finnish men and women, and found low household wealth to be strongly associated with poor self-rated health. The association was curvilinear, the effect levelling off at the higher end of the scale, and remained strong even when the contributions of disposable income and employment status were accounted for. In contrast, the association between household disposable income and self-rated health was greatly affected when the contributions of wealth and employment status were accounted for. Taking into account work conditions did not notably change the dependence on wealth, and health-related behaviour made only a small contribution to the association between household wealth and self-rated health.

Similar results have been reported with regard to British civil servants. Martikainen et al. (2003) found low household wealth to be particularly strongly associated with poor self-rated health. This was somewhat diminished by adjustments for employment status as well as education, occupational position and health status eleven years earlier, but much less so than the associations of both individual and household income with poor self-rated health. Household wealth was also a predictor of mental symptoms, particularly among the men, and Perel et al. (2006) further reported that low wealth was strongly associated with higher prevalence of metabolic syndrome in the same population. There are no other closely comparable studies, although Avendano and Glymour (2008) found wealth to be more strongly associated with stroke than income at ages from 50 to 65 in a U.S. population. The results are also, to a certain extent, compatible with the findings of Benzeval and Judge (2001), who reported a stronger association of long-term average income than current income with health.

Table 3

Less-than-good self-rated health as a function of household-equivalent disposable income and household-equivalent wealth, adjusted for age, gender, employment status, work conditions and health-related behaviour. Odds ratios (OR), 95 percent confidence intervals (CI) and percentage changes in model estimates (%C)^a from piecewise logistic regression.

	Effect below the 2nd tertile point ^b			Effect above the 2nd tertile point ^c		
	OR	CI	%C	OR	CI	%C
<i>Household disposable income</i>						
1: Gross, adjusted for age and gender	0.73	0.67–0.79		0.90	0.83–0.97	
2: Adjusted for employment status, age and gender	0.78	0.71–0.85	–22	0.89	0.82–0.96	12
3: Income and wealth in the same model, adjusted for employment status, age and gender	0.89	0.81–0.97	–42	0.94	0.87–1.03	–58
4: The same as three + adjustment for work conditions	0.95	0.87–1.05	–21	0.96	0.88–1.05	–17
5: The same as four + adjustment for health-related behaviour	0.95	0.86–1.04	1	0.95	0.87–1.04	8
<i>Household wealth</i>						
1: Gross, adjusted for age and gender	0.65	0.59–0.72		0.93	0.89–0.98	
2: Adjusted for employment status, age and gender	0.66	0.60–0.72	–3	0.93	0.88–0.97	15
3: Income and wealth in the same model, adjusted for employment status, age and gender	0.69	0.62–0.76	–11	0.95	0.90–1.00	–37
4: The same as three + adjustment for work conditions	0.71	0.64–0.79	–8	0.97	0.92–1.02	–33
5: The same as four + adjustment for health-related behaviour	0.77	0.69–0.85	–17	0.98	0.92–1.03	–8

^a Percentage changes in the model estimates calculated as the difference from the previous model divided by the estimate in model 1.

^b Scales removed by dividing the values by intertertile range. OR can be interpreted as the difference per 559 Euros increment in monthly disposable income and 89,383 Euros increment in wealth. Locations of the second tertile point are at 2001 Euros of income and 155,526 Euros of wealth.

^c The term for change of effect has been reversed. Reported estimates are for the full effect above tertile point, not estimates for change of effect. Change of effect at tertile point was statistically significant in all models for wealth, and in models 1 and 2 for income.

Methodological considerations

Adjusting household income for household size is a standard procedure. The number of persons in the household obviously affects monthly expenses and the extent of consumption choice in larger households is smaller and the living conditions probably less favourable than in smaller households with similar income. It is not clear, however, whether the same is true of wealth. As the potential benefits of wealth are not 'spent' on a daily basis, but are rather relatively constant (e.g. better area of residence or access to car), the number of people sharing them does not necessarily diminish the advantage as much as in the case of income. We nevertheless chose to consider wealth adjusted for household size in order to avoid inconsistency in the measurements. We also conducted analyses in which wealth was not adjusted, and the only difference compared to the results presented was slightly stronger association between household wealth and self-rated health.

It is also possible that, to some degree, wealth measures the effect of unreported income when income measurement is based on self-reports. Respondents asked to estimate their household's monthly disposable income may not take into account sources that do not generate income every month. Both earned and capital income may include less frequent inputs, but the proportion of such sources of the total income may be comparably small, and the income distribution estimated from tax registers suggested that our income data are unlikely to be significantly biased. Inter-generational transfers of assets might have a more significant effect on household resources, and are unlikely to be reflected accurately in any income measurement.

Including employment status in the analysis somewhat reduces the problems related to cross-sectional design and potential reverse causation, i.e. the association being attributable to the detrimental effect of poor health on both income and wealth. The studied participants were all employed five to seven years before the data were collected, and the primary type of reverse causation that could be expected would be loss of income on account of loss of work ability due to diminishing health during adult life. However, employment status accounted for only a fifth of the association between income and health among the studied participants, and made no contribution to the association between wealth and health. It is possible that some participants experienced

periods of unemployment or long-term sickness absence after which they returned to work. However, because data on current income are not affected by past periods of low income, it may be that the true effect of low income on health is underestimated rather than overestimated. It seems unlikely that ill health as the cause of low income and wealth would be a major explanation for the associations observed.

Because of similar employment conditions in near past, the studied population is more homogeneous with respect to past, and to some degree also current conditions, than the general population. Variation in economic position in the general population is somewhat larger than in the study population, but the income distributions estimated from our data and from population data suggested that our results are likely to be generalisable at least to the employed population in Finland.

Gender differences in labour market participation are not likely to affect our results to a notable degree, as differences in labour market participation between the genders in the studied population were small. Although gender inequality in earnings affects the household resources of women living without a partner, inequality in resources does not imply a difference in the association of resources with health at the individual level. We found no evidence for gender differences in the associations between household resources and self-rated health, but these results may need to be verified in data more representative of men.

Similar considerations apply to the potential impact of income-redistribution policies. While income-redistribution may limit the total impact of inequality of economic position on health in a population by changing the distribution of resources, the dependence between household economic conditions and health as such is not necessarily affected. In the beginning of 1990s Finland had relatively low income inequalities, but income inequality has increased markedly across the last ten years (Statistics Finland, 2008). The results of Mackenbach et al. (2005) suggest that the slope for decreasing poor self-rated health with increasing income is similar in Finland as in other Western European countries, at least concerning middle-income range. Whether other social-policy-related issues, such as free university education and highly regulated pension policies, affect dependencies between economic position and health remains an open question.

The classic materialistic explanation

In the introduction we reviewed alternative hypotheses concerning the mechanisms through which economic advantage may affect the development of ill health. In keeping with the material explanation, consumption potential may be assumed to be a significant factor because in general higher-quality commodities are better for health, and the effect of wealth is that it makes a higher proportion of income available for spending on whatever is deemed desirable or necessary. Those with more wealth have a wider range of consumption choices than the less wealthy, even assuming similar income. The majority of the study participants were home owners, and having low net wealth is likely to be associated with high mortgages.

The aspects of living conditions that are determined by individual or household economic resources and may affect the development of ill health are numerous. Housing conditions in general affect the microbial environment via heating, air-conditioning, piping, confined perimeters and particularly moisture damage. Although not all healthy food is expensive, the combination of what is otherwise desirable and healthy may be more expensive, and the quality of lunch eaten out may be particularly dependent on the amount of money spendable on a daily basis. The degree of choice with regard to free-time activities is obviously limited depending on the money available, and although, again, not all forms of exercise are expensive, those that are may be more desirable for other than health reasons and are therefore more likely to be pursued if affordable. Finally, access to private health-care services and the ability to pay for medication cannot be completely overlooked, as the availability of public services is limited in some areas such as dental health care and ophthalmology. In the light of recent clinical speculation on the contribution of dental health to cardiovascular disease (Little, 2008), such seemingly minor shortfalls in public services might be more relevant than we would at first guess.

Although doubts have sometimes been expressed about the plausibility of simple materialistic explanation for social inequalities in ill health in affluent countries, it is evident that living conditions are different among the wealthy and the less wealthy, and at least some plausible health-effect mechanisms can be identified (see also Blane et al., 1997). Our results support the assumption that consumption potential is a significant causal element, but they raise questions about why the effect of wealth should be stronger than that of income. Housing conditions in particular are more dependent on accumulated wealth than on income when a large proportion of the participants are home owners, but the effect of wealth on self-rated health seems to be too strong to be plausibly attributable to housing alone.

Lynch, Kaplan, and Salonen (1997) emphasised the potential dependence between material advantage and health-related behaviour, assuming that socioeconomic disadvantage particularly in the form of a low living standard conditioned behavioural patterns such as food habits, drinking, smoking and physical exercise. Demonstrating the directions of causation in connections between personal habits, socioeconomic disadvantage and illness is rather difficult, however. Our data revealed that adjustments for alcohol consumed, cigarettes smoked and leisure-time physical activity affected the association between wealth and poor self-rated health only slightly, thus suggesting that the potential contribution from health-related behaviour conditioned by a lack of wealth is likely to be relatively small.

Possibly a more common concern among epidemiologists is that the association of economic resources with health outcomes might be spurious because it could be the result of confounding from cultural differences in health-related behaviour between social classes and educational groups. It is disputable whether making

a complete separation between the hypothesised 'class norms' for behaviour and inequality with respect to material affluence is entirely defensible, but since no marked contribution of health-related behaviour was observed, the data did not indicate that this would be a major concern.

Deprivation and social comparison

The idea of 'relative deprivation' was developed in studies on poverty and social equity (Runciman, 1966; Townsend, 1979). In the context of studies on the social determinants of health, however, the term is used somewhat ambiguously, but could be taken to refer to the assumption that inequality of economic resources affects health mainly because the failure to acquire commodities that are morally valued and desired is a social dishonour and a cause of distress. Åberg Yngwe, Fritzell, Lundberg, Diderichsen, and Burström (2003) (see also Åberg Yngwe, Lundberg, & Burström, 2006), for example, suggest that being clearly disadvantaged in terms of what one can afford either in conscious comparison to a reference group, or in comparison to internalised norms regarding desirable conditions in life, may be a source of psychological distress capable of mediating the effect of income on health. It is possible to apply this kind of theoretical approach to the advantage provided by wealth as well, the implication being that wealth affects such comparisons: being wealthy means being able to acquire desirable long-term commodities such as a higher-value apartment, a holiday apartment and vehicles. It could even be the case that such possessions affect people's ratings of how well they are doing much more than their ability to buy expensive consumer goods, and wealth may be more important than income with respect to social comparison. However, there are no studies verifying that comparison in relation to a reference category accounts for some of the general inequalities in health by income level or wealth. After all, persons on an average income might feel as disadvantaged as the poor if they expected to achieve a higher standard of living.

There seems to be some confusion in the literature regarding the theoretical distinction between material mechanisms and social comparison as opposed to empirical distinction between 'absolute' and 'relative' income. Kawachi et al. (2002), for example, seem to assume that if the distance between an individual's income and the average income in the population, i.e. the relative income of that individual, has an effect on health in excess of the effect of individual income measured in absolute value, it is very likely to reflect social comparison. It could well be, however, that relative income so defined is only a further measurement of the kind of living conditions that are available to people with a certain absolute level of income, as argued e.g. by Lynch, Davey Smith, Kaplan, and House (2000). Relative income as a measure does not seem to distinguish between material mechanisms and social comparison completely plausibly.

Wilkinson (1999), Wilkinson and Pickett (2007) and Marmot and Wilkinson (2001), it seems, advocated the view that inequality in income distribution is the core of a very general social hierarchy in which many kinds of distinctions serve to increase both the moral value of and the opportunities for social advancement among those with more resources, and decrease them among the deprived. Marmot (2005), in particular, considered the overall moral assessment of one's social standing to be the source of distress that he assumed was the cause of a marked degree of social inequality in ill health. From this perspective differentials in wealth may seem like a mere additional distinction, and the fear of being judged a failure as a person because one does not have wealth is, as such, the relevant exposure. We feel justified in claiming that empirical confirmation or rejection of this theoretical approach is

difficult. It may not be possible to plausibly operationalise and measure distress due to low status, and thus its potential contribution as an intervening variable is difficult to observe.

It could be hypothesised that there is also a psychological element in the freedom of consumption choice that is not related to social comparison. Uncertainty with regard to whether one will always be able to afford all the commodities that ordinarily ensure smooth everyday living is not necessarily a question of whether what can be afforded signifies a high or a low social rank. It may rather be related to whether people are able more or less to maintain the living conditions they are used to, or that, in the given social context, are deemed to be appropriate minimal conditions on any social level. For example, the feeling of security afforded by owning one's home has been described as a psychosocial advantage (Kawachi et al., 2002; Macintyre et al., 1998). Dishonour on account of earning less than others is not necessarily such a key experience with regard to feelings of insecurity related to a lack of economic resources. This implies that deprivation is 'absolute' and 'material' rather than 'relative' in the sense that it is defined in terms of the same demands regardless of societal position, but it is 'psychological' or 'psychosocial' in the sense that the perception of being deprived (or of being in danger of becoming deprived) is a necessary mediator in the assumed causal chain. Although the conceptual complexity of deprivation has been acknowledged elsewhere (most notably in Sen, 1983, 1985), it is rarely discussed in the context of social epidemiology.

Conclusions

The causal contribution of household economic resources to socioeconomic inequalities in ill health was strongly supported in our study. The stronger and more robust effect of wealth than of income suggests that long-term accumulation of economic resources is highly relevant. Stability in terms of consumption potential may also be of significance. Wealth in particular is not directly affected by changes in labour market participation that may radically alter the current income level. These results point to the importance of considering long-term conditions of individuals and households whenever it is practically possible, as changes in health and illness are likely to develop over a considerable time span.

Whether the effect of economic resources on health should be understood in terms of material living conditions and the direct physiological effects of services bought on the consumer market, or whether it is a result of social comparison and mediated through psychological states caused by lower social status is a question that cannot be resolved here. It is far from straightforward to empirically test either hypothesis, because both involve intervening factors that are difficult to measure. In the case of material explanation the number of potential factors is overwhelming, whereas with the psychological explanation the proposed factor is rather conceptual and difficult to operationalise plausibly. There may be some room for theoretical improvement regarding the nature of deprivation, and whether not being able to comply with general consumption norms is necessarily a matter of social comparison and status hierarchies.

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