

MacIsaac, Sandra; Wilkinson, Richard G.

Working Paper

Cause of Death, Income Distribution and Problems of Response Rates

LIS Working Paper Series, No. 136

Provided in Cooperation with:

Luxembourg Income Study (LIS)

Suggested Citation: MacIsaac, Sandra; Wilkinson, Richard G. (1995) : Cause of Death, Income Distribution and Problems of Response Rates, LIS Working Paper Series, No. 136, Luxembourg Income Study (LIS), Luxembourg

This Version is available at:

<https://hdl.handle.net/10419/160808>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Luxembourg Income Study Working Paper Series

Working Paper No. 136

**Cause of Death, Income Distribution and Problems of
Response Rates**

Sandra McIsaac and Richard Wilkinson

December 1995

(scanned copy)



**Cause of death, income distribution,
and problems of response rates.**

SANDRA J. MCISAAC, PhD.
Dept of Applied Social Studies,
University of Keele.

RICHARD G. WILKINSON M.A., M. Med. Sci.
Trafford Centre for Medical Research,
University of Sussex,
and
International Centre for Health and Society
University College London.

Correspondence to:-

Richard G. Wilkinson,
Trafford Centre for Medical Research,
University of Sussex,
Brighton BN1 9RY
U.K.

Acknowledgement: This work was supported by the Economic and Social Research Council.

ABSTRACT

Aim: To identify the age-, sex- and cause-specific premature mortality rates contributing to the association between life expectancy and income distribution in developed countries.

Data: Income distribution was calculated for the 13 OECD countries and years for which the Luxembourg Income Study held data. Potential Years of Life Lost (1-65 years) by sex and cause, as well as age- and sex-specific all-cause mortality rates and Standardised Mortality Ratios for children 1-19 years were calculated from data supplied by WHO

Methods: On finding evidence suggesting that reported income distribution is strongly affected by low response rates in some income surveys, we used two measures of income distribution: that among households where the 'head of household' was aged less than 65 (weighted by response rates), and among households with children (among whom response rates are thought to be higher). Partial correlations and regressions controlling for year were used to analyse the relationship between mortality and income distribution.

Results: Both measures of income distribution showed broadly similar results. A more egalitarian distribution of income was related to lower all-cause mortality rates in both sexes in most age groups. All six major categories of cause of death contributed to this relationship. The causes of premature mortality contributing most were road accidents, chronic liver disease and cirrhosis, infections, ischaemic heart disease among women, and other injuries among men. Income distribution was associated not only with larger absolute changes in mortality from these causes, but also with larger proportionate changes. Suicides and stomach cancer tended to be more common in more egalitarian countries.

INTRODUCTION

There is evidence from a number of sources of a close association between the distribution of income within countries and average life expectancy. This was first demonstrated by Rodgers using data from around 1965 from 56 developed and less developed countries.¹ Le Grand reported that average age of death in a group of 17 developed countries was related to income distribution.² Analysing data from 70 rich and poor countries Waldmann found that if the real incomes of the poorest 20 percent of the population is statistically held constant, increases in the incomes of the richest 5 percent are associated with rising rates of infant mortality.³ Using mid century data from some 20 countries at various stages of development Steckel has shown that income distribution is an important determinant of height.⁴ He reported that the effect on height of a doubling of per capita income could be offset by "a modest rise of 0.066 in the Gini coefficient" of income inequality.⁵ Wennemo has shown very close relationships between infant mortality rates in developed countries and *relative* poverty.⁶ In a study of 59 countries Flegg found that income distribution had an important effect on infant mortality which was independent of the effects not only of variations in GDP per capita, but also of the provision of doctors and nurses, and of maternal education.⁷ These factors appeared to play much the same role in the determination of infant mortality rates in developed and in less developed countries. Wilkinson has reported relationships between income distribution and life expectancy on two sets of cross-sectional data and three sets of data on changes over time - all among developed market economies.^{8, 9} Working independently, both Kaplan and Kennedy have found income distribution and life expectancy to be closely associated among the 50 states of the United States, even after controlling for average incomes, absolute poverty and race.^{10, 11}

In total, at least eight different research workers or groups have reported statistically significant relationships between income distribution and measures of mortality, and a ninth has reported a relationship with height. Of these nine, one has used data exclusively on developing countries,⁷ three on a mixture of developed and developing countries^{1, 3, 4, 5} and five exclusively on developed countries.^{2, 6, 8, 9, 10, 11} In all, the relationships with mortality has been shown using ten separate sets of income distribution data. The association has been found to be independent of fertility, maternal literacy and education in developing countries, and of average incomes, absolute poverty, racial differences, smoking and various measures of the provision of medical services in developed countries.^{2, 3, 4, 10, 11}

To our knowledge no attempt to breakdown the association between income distribution and life expectancy or all causes mortality into the component age-, sex- and cause-specific mortality rates has yet been published. This paper is intended to provide that analysis for a group of developed countries in the hope that it might shed light on the processes linking income distribution and mortality. Rodgers' finding that income distribution was even more closely related to life expectancy at age five than it was to infant mortality implies that the relationship goes beyond that found with infant mortality.

We report here on premature mortality among the population aged under 65. This approximates the division between the population of working age, primarily dependent on earnings, and the retired population dependent on pensions. Recent evidence suggests that among a number of developed countries widening income differences during the 1980s have been associated particularly with a widening of differences in earnings.¹²

DATA AND METHODS

Income distribution data were taken from the Luxembourg Income Study (LIS) which holds electronic records of surveys of household incomes supplied by national governments.

After some data preparation to improve international comparability, LIS makes SPSS data files available for analysis via electronic mail. While additional data sets are added from time to time, at the start of this project LIS provided access to data from some 16 developed countries for between 1 and 5 non-consecutive years between 1967-91. We confined our analysis to 13 countries which are members of the Organisation for Economic Cooperation and Development (OECD) - the rich market economies. The 33 combinations of countries and years of data are shown in *table 1*. Because the aim was not to test the relationship but to identify the contributory age-specific and cause-specific mortality rates, we decide to use all the information available for these countries despite the recognition that several observations from the same country should not be regarded as truly independent.

Observations which were always several years apart and sometimes spanned as much as twenty years were likely to contain valuable additional information which, given the paucity of data, should not be lost.

Shares of personal disposable income (after taxes and benefits) were computed for each decile of the population, from the poorest to the richest, in each country at each date. To allow for the economies of scale accruing to households of two or more people, household

income was adjusted for household size using the LIS "subjective" equivalence scales.¹³ As a result of problems of the response rates in national surveys of household income (explained below) two sets of income distribution data were used: one confined to the distribution of income among households where the "head of household" was under 65 years old (HHLT65), and another for all households with children aged 18 years and under (CHILDHSE). We calculated the proportion of income received by each decile within these populations.

Death rates for the countries and years shown in table 1 were calculated from deaths and populations supplied by WHO from the World Health Statistics Data Bank. Data for Germany prior to unification were missing. We calculated 14 age-specific 'all causes' death rates for infants, 1-4 years, and for the 12 remaining 5-year age groups to 64 years of age for males and females separately. In addition we used two summary measures of mortality across age groups: Standardised Mortality Ratios for children 1-19 years, and potential years of life lost (PYLL) from deaths occurring between the ages of 1 and 65 for all causes combined and for each of the causes listed in table II. Both were standardised on the total OECD population in 1985. PYLL sum the differences between ages at death and 65 years according to formula 2.4 given by Romeder and McWhinnie¹⁴ and are expressed per 100,000 of the standard population.

It is clear that there is an important long-term decline in mortality which continues even when income distribution is unchanged. We believe that changes in income distribution are among the factors which may affect the rate of this improvement. To remove the background difference in mortality associated simply with the different years for which data were available (*table 1*), all correlations reported below are first-order partial correlations controlling for year and year was entered in all regressions as the first independent variable.

Response rates

We encountered a serious problem related to the response rates in the sample surveys of household income in different countries. Although earlier reports using data for the smaller number of countries previously available from LIS had shown the expected strong relationship with life expectancy,^{6,8,9} once the countries more recently added to LIS were included we found only weak evidence of an association. The relationship we had intended to break down into its age-, sex- and cause-specific components seemed to have largely disappeared!

As shown in table 1, response rates in surveys of household income sometimes fall as low as 50 percent. (The response rates shown in the table were taken from LIS country files. Where response rates were given for a country in a particular year but not in others, we have assumed that the rate remained unchanged if subsequent income surveys were part of the same series using the same methods.) We found four pieces of evidence suggesting that the relationship with national mortality rates was hidden by a tendency for response rates to be disproportionately low among the poor and, to a lesser extent, the rich compared to the rest of the population.

First, despite the possibility that societies with *genuinely* narrow income distributions might be more cohesive and so have higher response rates - producing an association between more equality and higher response rates, the LIS data shows an inverse relationship between response rates and equality. Regression analysis showed that lower response rates were associated with higher reported shares of income received by the lower deciles and lower shares by the higher deciles. The ratio of income received by the bottom 30 percent to the top 30 percent of households was significantly correlated ($r=0.35$, $p=0.03$) with non-response rates (*Figure 1*). This suggests that low response rates may loose the poor and/or the rich and lead to an underestimate of the extent of income inequality. Although a genuinely narrow income distribution may be reported on the basis of low response rates, the conspicuous lack of data above the diagonal in *Figure 1* shows that no country except Ireland has reported a wide income distribution using a survey with low response rates. It is also notable that Belgium is the only country to report a similar income distribution with very different response rates. Whereas other countries conduct new surveys at each date, the 1988 Belgium survey was a follow up of people who had responded to the 1985 survey. The non-response here was, unlike that in other countries, a failure to contact people who had previously responded.

Second, when countries were weighted by the *square* of the proportion responding (the square was chosen not by inspection but in order to discount countries with low response rates more heavily) the expected relationship between mortality and income distribution appeared (see *table 3*).

Third, the *Family Expenditure Survey*, which is the source of the British data held by LIS, has been found to under-represent the poor and, to a lesser extent, the rich. Its response

rates decrease with age, are lower among those born in Northern Ireland, the "new commonwealth" and Pakistan, and are lower among households with more than two cars.¹⁵ Response rates are also low among the self-employed who are known to be concentrated at both extremes of the income distribution.¹⁶ Nor is the pattern of lower response rates among rich and poor unique to Britain.¹⁷ Studies of response rates in social surveys more generally suggests that resentment of an invasion of privacy is among the most common reason for non-response and people are more likely to object to questions about money than almost any other subject.¹⁸ Reluctance to cooperate on these grounds may be more common among people whose incomes lie outside the normal range.

The fourth pointer concerns households with children which is the largest group for whom response rates were consistently high in the *Family Expenditure Survey*.¹³ Measures of the distribution of income exclusively among *families with children* were found to be strongly related to mortality rates whether or not the data was weighted. *Table 3* shows the weighted and unweighted correlations between various mortality rates and the share of income received by the poorest 30 percent in the HHLT65 and CHILDHSE income distributions.

In all analyses below we show how mortality is related to income distribution both among HHLT65 (weighted) and among CHILDHSE (unweighted). This allows the results of two quite different ways of dealing with low response rates to be compared: the first discounts countries with low response rates, and the second measures income distribution among families with children who are known to have higher response rates than the rest of the population. In terms of coverage, the former is more appropriate to mortality measured by PYLL before age 65, but a preference for unweighted data makes it desirable to include CHILDHSE though it covers 30-40 percent fewer people in most countries. Because of the large number of single mothers, CHILDHSE will cover a much smaller proportion of single men than women. This may be why the correlation between CHILDHSE and PYLL is not only weaker for men than women, but is weaker for men against CHILDHSE than against HHLT65 (*table 3*). As information was lacking on response rates in Finland and the first two of the four Swedish surveys (*table 1*), these cases are excluded from the weighted HHLT65 data.

RESULTS

Decile shares

Which part of the income distribution is most closely related to mortality? *Figures 2 a. & b.* show the strength of correlations between three all-causes mortality rates (infant mortality, SMRs 1-19 years and PYLL before age 65 years) and the share of income received by each decile *separately*. Correlations are negative among the poorer deciles showing that mortality rates tend to be lower where less well-off people receive a larger share of income. This pattern is reversed giving positive correlations among the richer deciles.

If decile shares of income are *cumulated* to show the proportion of income received by everyone below the 2nd, 3rd, 4th... decile etc. the pattern of correlations with mortality reach their strongest with the proportion of income received by the poorest 30 percent (*figures 2c. & d.*). However, in contrast to the picture for separate deciles, when accumulating the proportion of income received across deciles, the correlation weakens beyond the third but remains negative right up to the ninth.

Although the *all-causes* mortality rate is most closely related to the proportion of income received by the poorest 30 percent of the population, each specific cause has its own pattern. *Table 4* shows the deciles over which the cumulated share of income is most closely related to cause-specific mortality. Traffic accidents, for example, are most closely related to the share of income received by the poorest 20 or 30 percent (deciles 0-2 or 0-3) in each sex on both CHILDHSE and HHLT65. Here the correlations were close to 0.7 in all cases. Only statistically significant correlations ($p < 0.05$) are shown in *table 4*.

Age and sex

Figures 3 a. & b. show the correlations between age specific death rates 0-65 years and the share of income received by the poorest 30 percent of the population. Correlations are strongest among children and younger adults but a more equitable distribution of income is associated with lower mortality at most ages. The association weakens after age 25, particularly among men on the CHILDHSE income distribution. This may partly reflect the exclusion of adults in households without children from these income figures. As in *figure 2*, the associations are slightly stronger with female than male mortality when using the CHILDHSE income distribution, but there is no clear sex difference when using income among HHLT65.

Causes of death

The non-standardised regression coefficients showing the relation between changes in the share of income received by the bottom 30 percent of people among HHLT65 and CHILDHSE and PYLL from each cause are shown in the pie-charts in *figures 4 a.- d.*. These provide estimates of the contributions of the different causes to the association between income distribution and the all causes death rates. In both sexes and on both measures of income distribution, chronic liver diseases and cirrhosis, traffic accidents and infections come within the top four contributory causes. Eleven of the 12 regression coefficients for these three causes of death (for each sex on both measures of income distribution) were statistically significant: the exception was chronic liver disease and cirrhosis among women which just failed to reach significance ($p=0.06$) in relation to the HHLT65 income share.

Among women but not among men, the contribution of IHD deaths and "other" causes is statistically significant on both measures of income distribution. Among men the contribution of cancers is statistically significant against the CHILDHSE income share, and deaths from "other injuries" is significant on the HHLT65 income share.

Taking the PYLL from each cause per 100,000 of the OECD population as 100 percent, *figure 5* shows the estimated percentage reduction in each cause associated with a five percent increase in the income share of the least well-off 30 percent. The percentage reductions in each cause associated with this decrease in relative deprivation tends to be larger in relation to HHLT65 than CHILDHSE. However, it is apparent on both bases that chronic liver diseases and cirrhosis, traffic accidents and infections are important contributors to the all causes association partly because these conditions are disproportionately sensitive to changes in income distribution. Compared to CHILDHSE, income shares among HHLT65 are associated with bigger reductions in IHD, particularly among women, and in other injury, particularly among men. The estimated impact on cancers, respiratory and "other" causes is small on both bases.

DISCUSSION

Throughout this analysis levels of statistical significance must be treated with extreme caution. The requirement that observations are independent is compromised in the associations between mortality and HHLT65 income shares by weighting data, and in all measures of association by the fact that wherever it was available (*table 1*) several years of income distribution data have been included for the same country. Although it is impossible to show weighted data in the form of a scattergram, *figure 6* shows the unweighted relation between CHILDHSE and childhood SMRs (1-19 yrs) recorded in *table 3*. Inspection shows that the relation is not dependent on outliers or on the points for any single country.

We believe that the importance of the underlying issues and the lack of better internationally comparable income distribution data justifies the flawed methods we have been obliged to use here. Indeed, we believe that it may not be possible to take analysis of these issues much further on the basis of the international data currently available. The relationship between all causes mortality and income distribution was well established: our purpose was merely to gain some insight into its age-specific, sex-specific, and cause-specific components. The fact that the two measures of income distribution show broadly similar relationships to mortality (see *table 4 and figures 4 & 5*), despite the major differences between them, suggests that the findings are fairly robust. Not only are the populations included in HHLT65 and CHILDHSE substantially different, but the weighting of HHLT65 discounts the data from countries with low response rates and shows again that the relationship is not wholly dependent on which groups of countries are examined.

The evidence suggests that the association between income distribution and mortality is spread over most of life. The variations in the strength of the association across the age range may be partly a reflection of differences in the age groups covered by HHLT65 and CHILDHSE, and may also reflect the known tendency for response rates to decline with age.¹³

Although male mortality has sometimes appeared the more closely related of the two sexes to socioeconomic factors, our results provide no evidence that this is true in relation to income distribution. The stronger relation with female than with male mortality when using the CHILDHSE income shares (*figure 2*) may reflect the larger number of women included in households with children by virtue of their predominance as single parents.

The analysis by cause of death suggests that the contribution of traffic accidents is central - both in terms of its size and statistical significance. It might be thought that this is largely due to the fact that PYLL (1-65 yrs) emphasises the main causes of death at younger ages. But *figure 5* shows that a narrowing of income distribution is also associated with a bigger percentage reduction in deaths from traffic accidents than in deaths from most other causes. The association with chronic liver disease and cirrhosis appears substantial in each analysis and may indicate a relationship between alcohol consumption and income distribution which may also contribute to traffic accidents. However deaths from causes such as hepatitis are also included in this category. Deaths from "other injuries" among men and women are significantly related only to income shares among HHLT65. This may be because HHLT65 will include many single people, particularly men, prone to high accident rates, while CHILDHSE covers only those adults with children who are likely to adopt safer lifestyles.

Suicides, which are included in "other injuries", and stomach cancer both show a tendency to be more common in more egalitarian countries (see *table 4*). Some weight is lent to this finding by the fact that Japan, for which data was not available from LIS, has narrow income differentials as well as high suicide and stomach cancer rates. However, in Britain, parasuicide has been linked to unemployment among men¹⁹ and young men's, but not young women's, suicide rates have risen rapidly.²⁰ An association between male suicides and unemployment would run counter to any tendency for suicide to be more common in more egalitarian societies and may explain why that relationship is statistically stronger among women than men. Durkheim suggested that there were different kinds of suicide related to the degree of social integration.²¹ If our results are to be believed, "egotistic" suicide may be less important than Durkheim's other categories.

The likelihood that the association between income distribution and national mortality rates is accounted for largely by an effect of income distribution on health inequalities within countries is suggested by the very strong association ($r=0.87$) reported by van Doorslaer et al between inequalities in self-reported morbidity and inequalities in income in nine European countries.²² Their study was able to use income and mortality data for the same individuals.

Socioeconomic differences in mortality appear in different causes of death in different countries. Perhaps the underlying socioeconomic inequalities find expression through a

variety of national cultural patterns. In France, alcohol and cirrhosis are major contributors to excess mortality, but heart disease is not.²³ In Britain differentials in respiratory and cardiovascular disease have been particularly large.²⁴ In Finland accidents and cardiovascular disease have been important. However, our results show that as well as these differences, there are also some causes of death which are more frequently raised where income differentials are large. These may represent the most direct expressions of the effects of greater socioeconomic inequality. If we were to take the causes of excess mortality in Harlem, New York, as exemplifying the extremes of *relative* deprivation in the Western world, it is interesting to note how much the pattern of cause-specific mortality has in common with the pattern found in our international data.²⁵ The six highest SMRs were for deaths caused by drug dependency, homicide, alcohol, cirrhosis, disorders of new-borns and infections. Much as in our data, suicide was the only one of seventeen separate causes which was actually slightly lower in Harlem than in the USA as a whole. Kaplan found that wider income differences were associated with higher homicide across the 50 states of the USA and there is evidence that the same relationship holds internationally.^{10 26} Since Durkheim, it has been widely recognised that suicide and homicide tend to vary inversely with each other.²⁷

It is important to note that, as *figures 5a & b* illustrate, *all* the major categories of cause of death show at least some reduction associated with narrower income differences. Like health inequalities themselves, income distribution appears to involve a broad spectrum of conditions. It is likely that a number of social and psychosocial pathways relate mortality to income distribution. Deaths from traffic accidents, alcohol related deaths and deaths from other injuries make a plausible group of 'social' causes which might be affected by socioeconomic stress. It is perhaps too early to say whether psychoneuroendocrinology and psychoneuroimmunology will lend weight to the possible involvement of heart disease among women and of infections in this picture.^{28, 29, 30}

The prominent position of road accidents in a group of causes of death which may reflect socioeconomic stress is interesting. Road safety is clearly diminished by aggressive and competitive driving. Could it be that the amount of courtesy and cooperative behaviour road users show each other may be a sensitive indicator of people's attitudes to other members of society as unknown fellow citizens? Do they stop to let waiting pedestrians cross? Do they allow a car from a side road to enter a queue of slow moving traffic, or do they more often cut each other up in an effort to gain individual advantage? Road accidents

may be an example of a cause of death which would spread the increased risks associated with socioeconomic stress throughout society. The involvement of alcohol, and the possible link with homicide which others have reported, might lend plausibility to the hint in our data that deaths from "other injuries" among single men are involved. "Other injuries" includes homicide, all non-road accidents, poisonings and a proportion of deaths related to drug abuse. Perhaps we have here the beginnings of a picture of the effects of socioeconomic stress.

This work was funded by the Economic and Social Research Council.

REFERENCES

- ¹. Rodgers GB. Income and inequality as determinants of mortality: an international cross-section analysis. *Population Studies* 1979; 33: 343-51.
- ². Le Grand J. *An international comparison of inequalities in health*. Welfare State Programme Discussion Paper No.16, LSE 1987. The relevant section of this paper does not appear in other published versions.
- ³. Waldmann RJ. Income distribution and infant mortality. *Quarterly Journal of Economics* 1992, 107: 1283-1302.
- ⁴. Steckel RH. Height and per capita income. *Historical Methods* 1983; 16: 1-7.
- ⁵. Steckel RH. Heights and health in the United States. In: *Stature, living standards and economic development* edited by J. Komlos University of Chicago Press 1994.
- ⁶. Wennemo I. Infant mortality, public policy and inequality - a comparison of 18 industrialised countries 1950-85. *Sociology of Health and Illness* 1993; 15: 429-46.
- ⁷. Flegg A. Inequality of income, illiteracy, and medical care as determinants of infant mortality in developing countries. *Population Studies* 1982; 36: 441-58.
- ⁸. Wilkinson RG. Income distribution and life expectancy. *British Medical Journal*. 1992; 304: 165-8.
- ⁹. Wilkinson RG. Health, redistribution and growth. In: *Paying for inequality: the economic cost of social injustice*. Edited by A. Glyn and D. Miliband Rivers Oram Press, London 1994.
- ¹⁰. Kaplan GA, Pamuk E, Lynch JW, Cohen RD, Balfour JL. Income inequality and mortality in the United States. (Forthcoming)
- ¹¹. Kennedy BP, Kawachi I, Prothrow-Stith D. Income distribution and mortality: test of the Robin Hood Index in the United States. (Forthcoming)

-
- ¹². Fritzell J. Income inequality trends in the 1980s: a five country comparison. *Acta Sociologica*. 1993; 36: 47-62..
 - ¹³. Buhmann B, Rainwater L, Schmaus G, Smeeding TM. Poverty: sensitivity estimates across ten countries using the Luxembourg Income Study (LIS) database. *Review of Income and Wealth*. 1988; 34: 115-142.
 - ¹⁴. Romeder JM, McWhinnie JR. Potential years of life lost between ages 1 and 70: an indicator of premature mortality for health planning. *International Journal of Epidemiology* 1977; 6: 143-51.
 - ¹⁵. Redpath B. Family Expenditure Survey: a second study of differential response, comparing census characteristics of FES respondents and non-respondents. *Statistical News*, 1986; 72: 13-16.
 - ¹⁶. Meager N, Court C, Moralee J. *Self-employment and the income distribution*. Institute of Manpower Studies 1994
 - ¹⁷. Wolf W. Verzerrungen durch Antwortausfälle in der Konsumerhebung 1984. *Statistische Nachrichten*; (OSTAT, Vienna) 1988; 43 (11): 861-7.
 - ¹⁸. Goyder J. *The silent minority: non-respondents on sample surveys*. Westview Press, Boulder, Colorado 1987
 - ¹⁹. Platt S, Kreitman N. Trends in parasuicide and unemployment among men in Edinburgh, 1968-82. *British Medical Journal* 1984; 289: 1029-32.
 - ²⁰. Charlton J, Kelly S, Dunnell K, Evans B, Jenkins R. Suicide deaths in England and Wales: trends in factors associated with suicide deaths. *Population Trends* 1993; 71: 34-42.
 - ²¹. Durkheim E. *Suicide*. Edited by G. Simpson, Routledge, London. 1952
 - ²². van Doorslaer E, Wagstaff A, Bleichrodt H, et al. Socioeconomic inequalities in health: some international comparisons. *Journal of Health Economics*, Forthcoming.
 - ²³. Kunst A, Mackenbach J. International comparisons of socio-economic inequalities in mortality. Paper presented to the European Population Conference, Milan, Italy, 1995.
 - ²⁴. Leclerc A, Lert F, Fabien C. Differential mortality: some comparisons between England and Wales, Finland and France, based on inequality measures. *International Journal of Epidemiology*. 1990; 19: 1001-1010..
 - ²⁵. McCord C, Freeman HP. Excess mortality in Harlem New England Journal of Medicine 1990; 322: 173-7.
 - ²⁶. Krahn H, Hartnagel TF, Gartrell JW. Income inequality and homicide rates: cross-national data and criminological theories. *Criminology* 1986; 24: 269-295.

-
- ²⁷. James O. *Juvenile violence in a winner-looser culture*. Free Association Books, 1995
- ²⁸. Sapolsky RM. Endocrinology alfresco: psychoendocrine studies of wild baboons. *Recent Progress in Hormone Research* 1993; 48: 437-68.
- ²⁹. Siegrist J, Peter R, Junge A, Cremer P, Seidel D. Low status control, high effort at work and ischaemic heart disease: prospective evidence from blue-collar men. *Social Science and Medicine*. 1990; 31: 1127-34.
- ³⁰. Kennedy S, Kiecolt-Glaser JK, Glaser R. Immunological consequences of acute and chronic stressors: mediating role of interpersonal relationships. *British Journal of Medical Psychology* 1988; 61: 77-85.

Table 1 Countries, years and response rates for income distribution surveys: Luxembourg Income Study.

COUNTRY	YEAR	RESPONSE RATE %
Canada	1971	76
	1975	76
	1981	77
	1987	76
	1991	76
USA	1974	95
	1979	95
	1986	95
Belgium	1985	92
	1988	44
France	1979	82
	1981	82
	1984	82
Finland	1987	N/A
	1991	N/A
Ireland	1987	64
Italy	1986	61
Netherlands	1983	56
	1987	60
Norway	1979	75
	1986	78
Sweden	1967	N/A
	1975	N/A
	1981	86
	1987	86
Switzerland	1982	98
United Kingdom	1969	70
	1974	68
	1979	67
	1986	69
Australia	1981	93
	1985	94
	1989	93

Table 2 Causes of death for which Potential Years of Life Lost
1-65 years were calculated. (ICD 9 Basic List)

All Causes

Infectious and parasitic diseases (01- 07)

Malignant neoplasms (08 - 14)

Malignant neoplasm of stomach (091)

Malignant neoplasm of trachea, bronchus and lung (101)

Malignant neoplasm of female breast (113)

Diseases of the circulatory system (25 - 30)

Ischaemic heart disease (27)

Cerebrovascular disease (29)

Diseases of the respiratory system (31 - 32)

Bronchitis, emphysema and asthma (323)

Diseases of the digestive system (33 - 34)

Chronic liver disease and cirrhosis (347)

Injury and poisoning (E47 - E56)

Motor vehicle traffic accidents (E471)

Suicide and self-inflicted injury (E54)

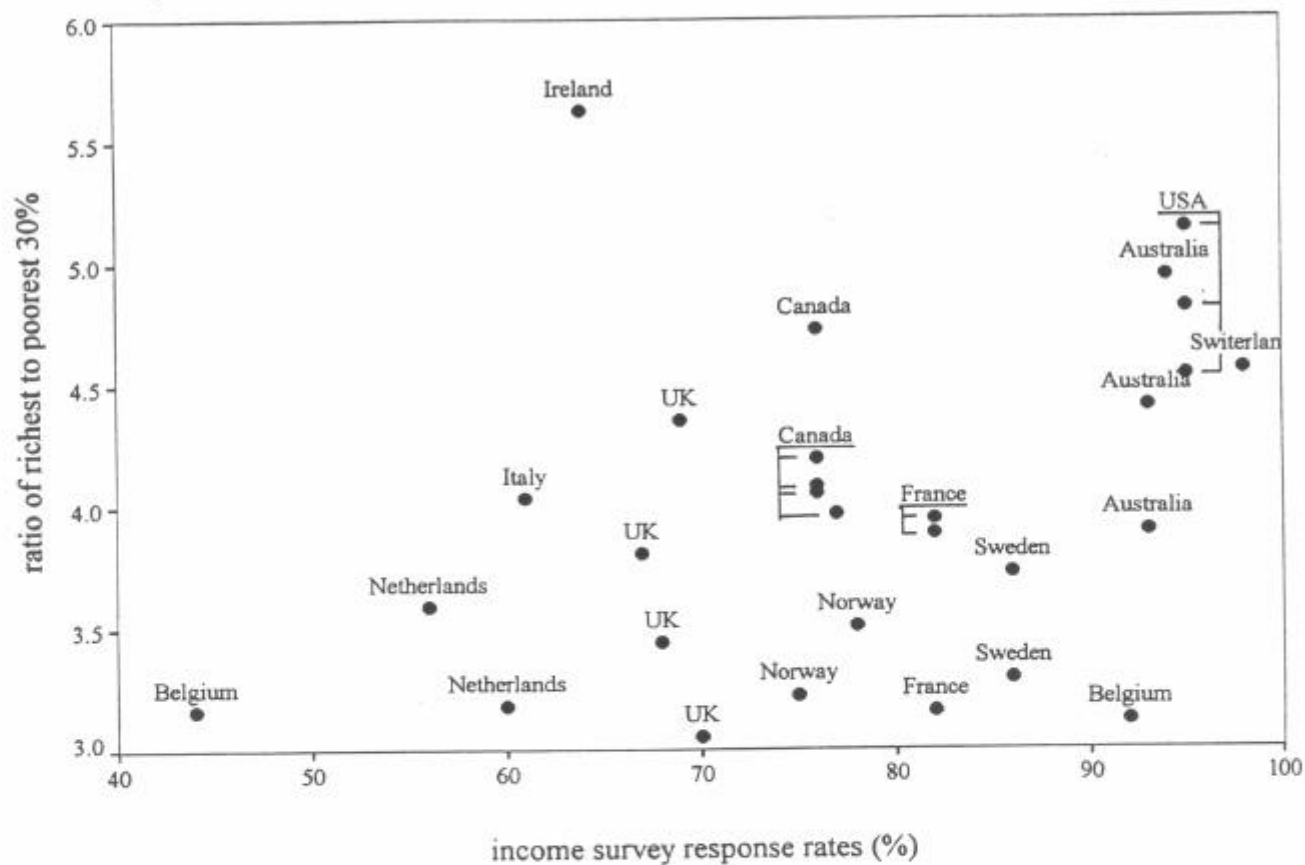
Table 3 Partial correlation coefficients (controlling for year) between mortality measures and the proportion of income received by the poorest 30% in two population categories.

Income distribution among:-	households where head is less than 65 years old		households with children
	unweighted	weighted	unweighted
male PYLL 1 - 65 yrs	-0.19 P=0.159	-0.68 P=0.000	-0.45 P=0.005
female PYLL 1 - 65 yrs	-0.39 P=0.014	-0.71 P=0.000	-0.62 P=0.000
child SMR M&F 1-19 yrs	-0.44 P=0.007	-0.73 P=0.000	-0.67 P=0.000
infant mortality	-0.32 P=0.039	-0.50 P=0.004	-0.53 P=0.001

TABLE 4 Maximum partial correlations (controlling for year) found between causes of death (PYLL) and the income shares received by various deciles. The range of deciles shows which part of the income distribution was most closely associated with mortality from each cause.

PYLL by cause:-	Incomes among:-	Males		Females	
		Deciles	Correlation	Deciles	Correlation
All causes	CHILDHSE	0-3	-0.45	0-3	-0.62
	HHLT65	0-3	-0.68	0-3	-0.71
Infections	CHILDHSE	0-6	-0.35	0-3	-0.36
	HHLT65	0-6	-0.41	0-4	-0.47
Neoplasms	CHILDHSE	0-9	-0.62	0-4	-0.33
	HHLT65	0-9	-0.47	---	n.s.
<i>of which:</i> stomach	CHILDHSE	0-1	+0.36	0-2	+0.67
	HHLT65	0-1	+0.56	0-2	+0.66
lung	CHILDHSE	0-7	-0.48	0-2	-0.49
	HHLT65	0-8	-0.39	0-2	-0.48
breast	CHILDHSE	---	---	0-6	-0.40
	HHLT65	---	---	---	n.s.
Circulatory diseases	CHILDHSE	---	n.s.	0-3	-0.39
	HHLT65	0-2	-0.43	0-3	-0.50
<i>of which:</i> IHD	CHILDHSE	---	n.s.	0-2	-0.40
	HHLT65	0-2	-0.32	0-2	-0.53
CVD	CHILDHSE	---	n.s.	---	n.s.
	HHLT65	---	n.s.	---	n.s.
Respiratory diseases	CHILDHSE	---	n.s.	---	n.s.
	HHLT65	---	n.s.	---	n.s.
Digestive diseases	CHILDHSE	0-5	-0.32	0-5	-0.49
	HHLT65	0-5	-0.40	0-7	-0.44
<i>of which:</i> liver dis. & cirrhosis	CHILDHSE	0-5	-0.36	0-5	-0.42
	HHLT65	0-5	-0.40	0-8	-0.36
Traffic accidents	CHILDHSE	0-2	-0.72	0-2	-0.68
	HHLT65	0-3	-0.68	0-2	-0.73
Suicide	CHILDHSE	0-6	+0.37	0-3	+0.55
	HHLT65	---	n.s.	0-3	+0.35
Other injury	CHILDHSE	---	n.s.	---	n.s.
	HHLT65	0-1	-0.63	0-1	-0.43

Figure 1 Relation between income survey response rate and ratio of incomes of richest to poorest 30%



TITLE FOR FIGs. 2 a-d.

FIG 2(a-d) -- Partial correlations (controlling for year) between PYLL from all causes and shares of income received by each decile separately (a & b) and cumulated across deciles from the poorest upwards (c & d).

Note:-

_____ $P < 0.05$
----- $P < 0.01$

FIG 2a separate deciles, CHILDHSE

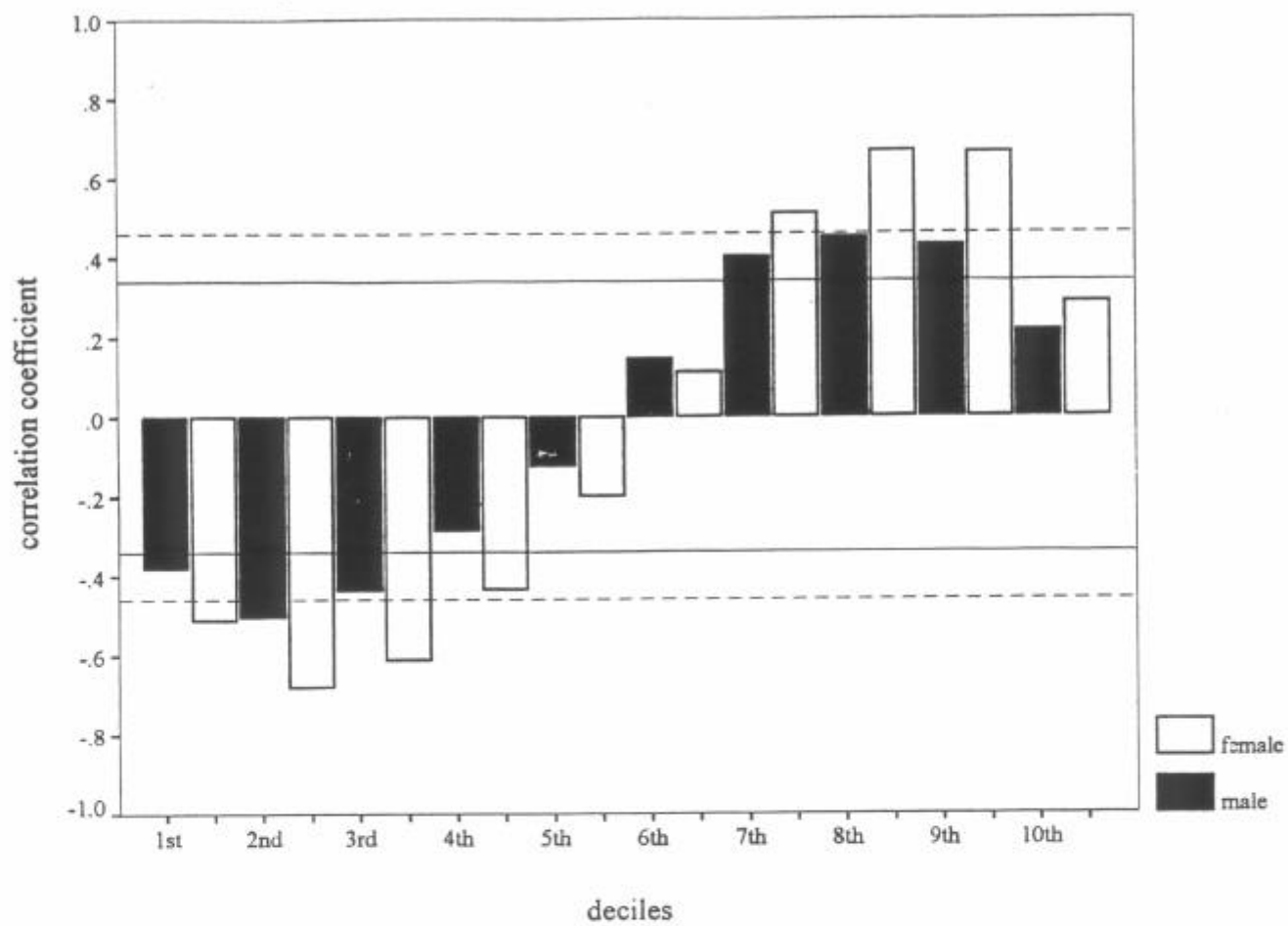


FIG 2b Separate deciles, HHLT65

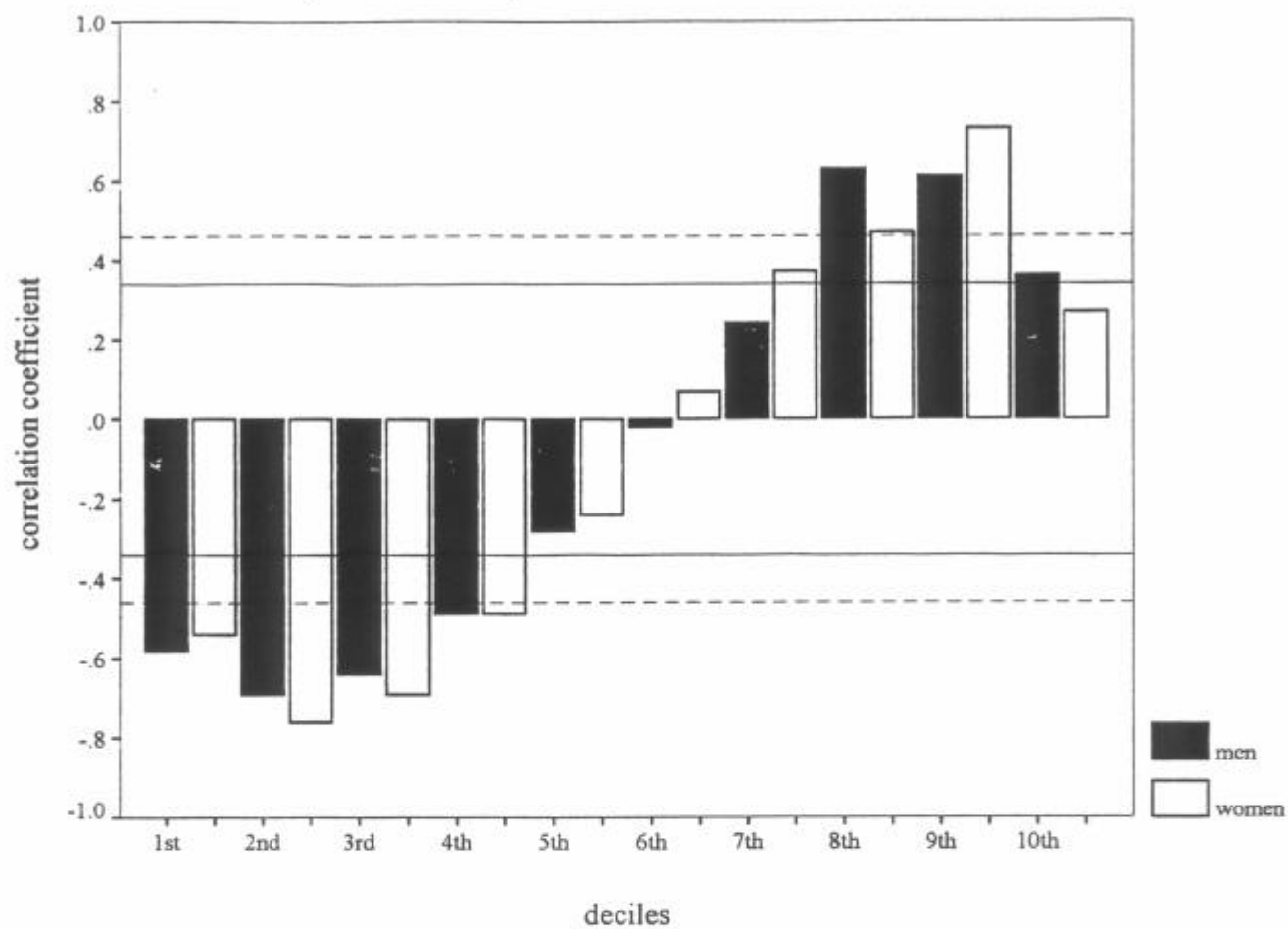


FIG 2c cumulative deciles, CHILDHSE

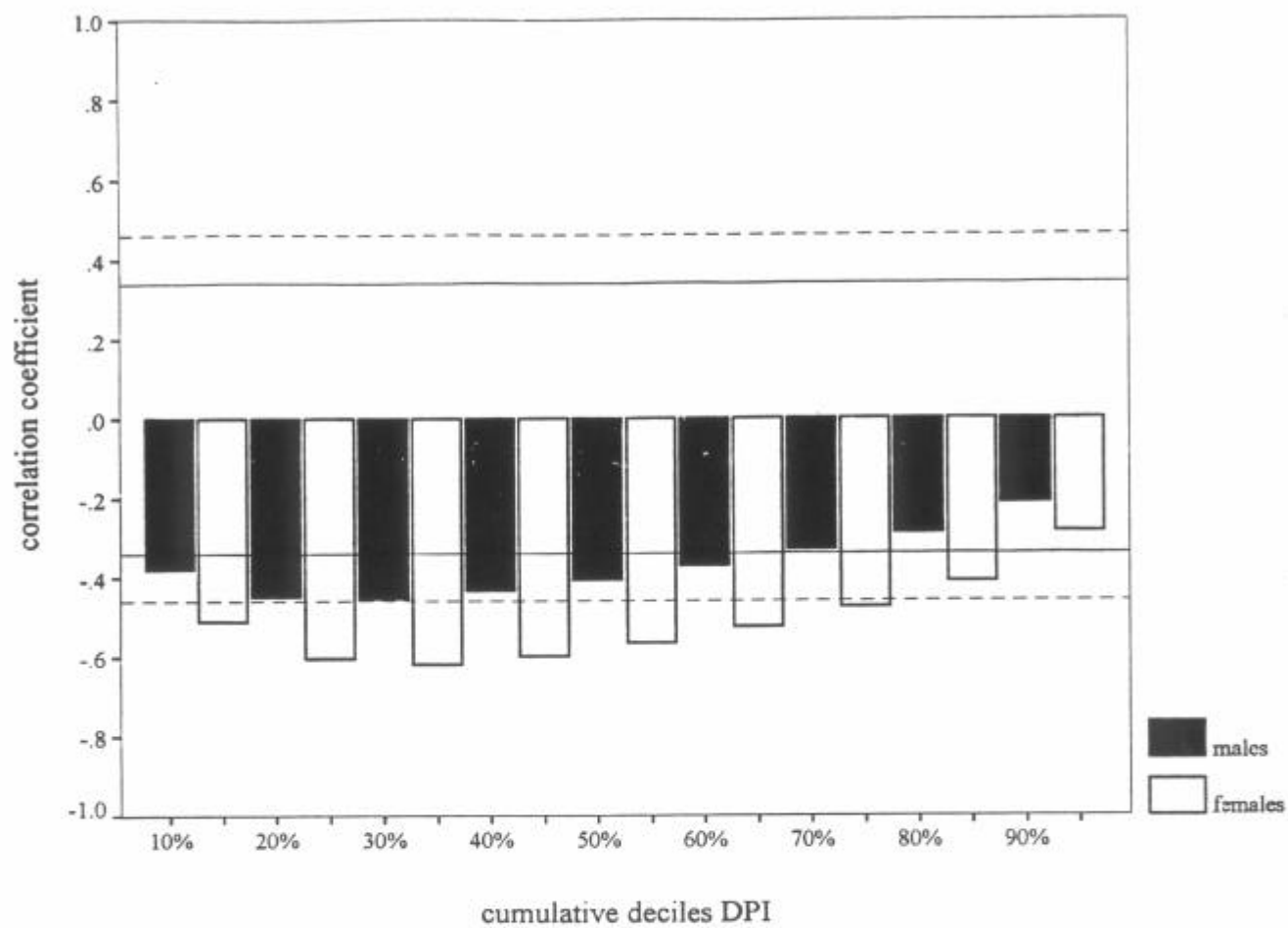


FIG 2d cumulative deciles, HHLT65

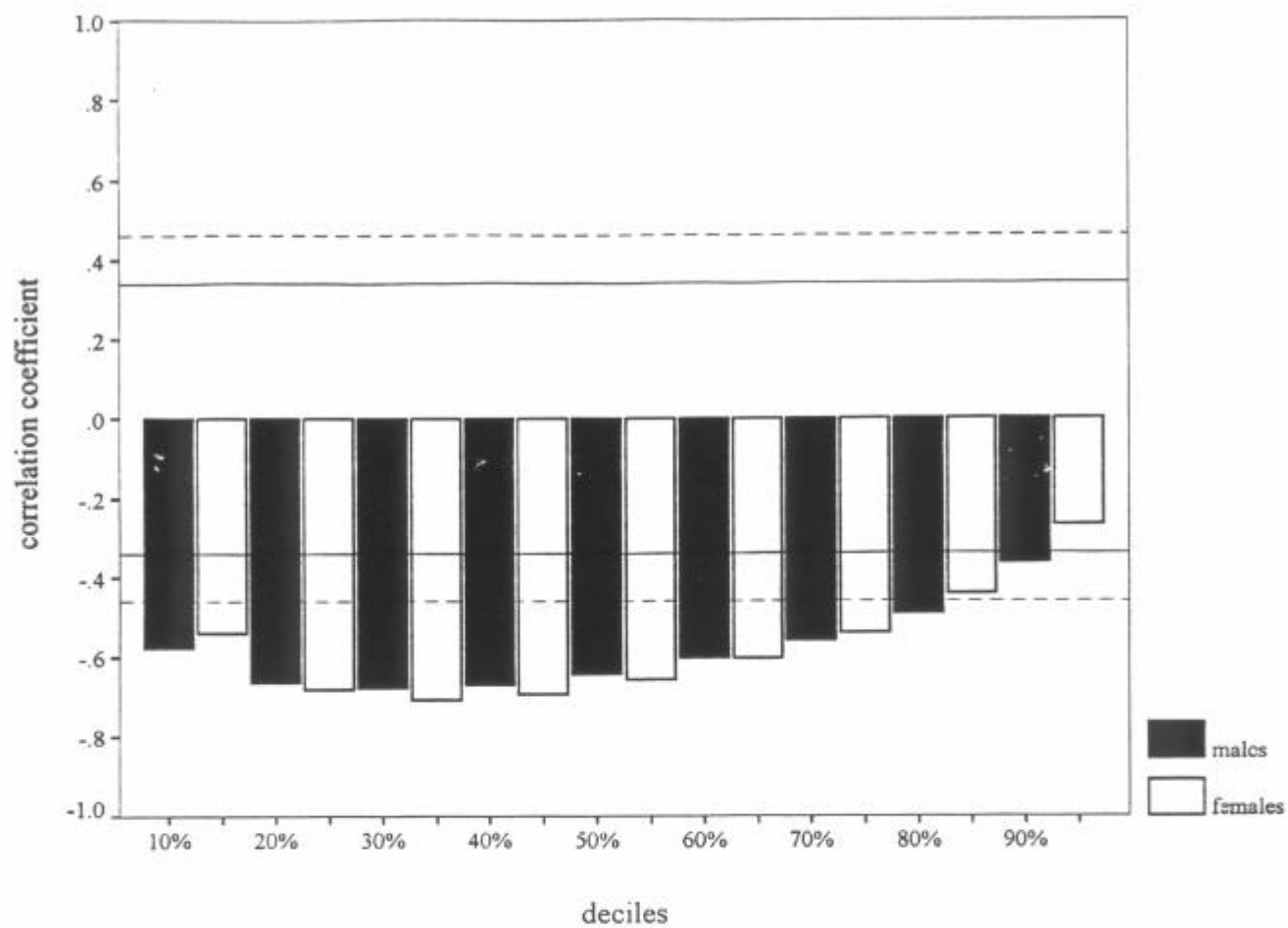


FIG 3 Partial correlations (controlling for year) between age-specific death rates and income share received by poorest 30%

FIG a CHILDHSE

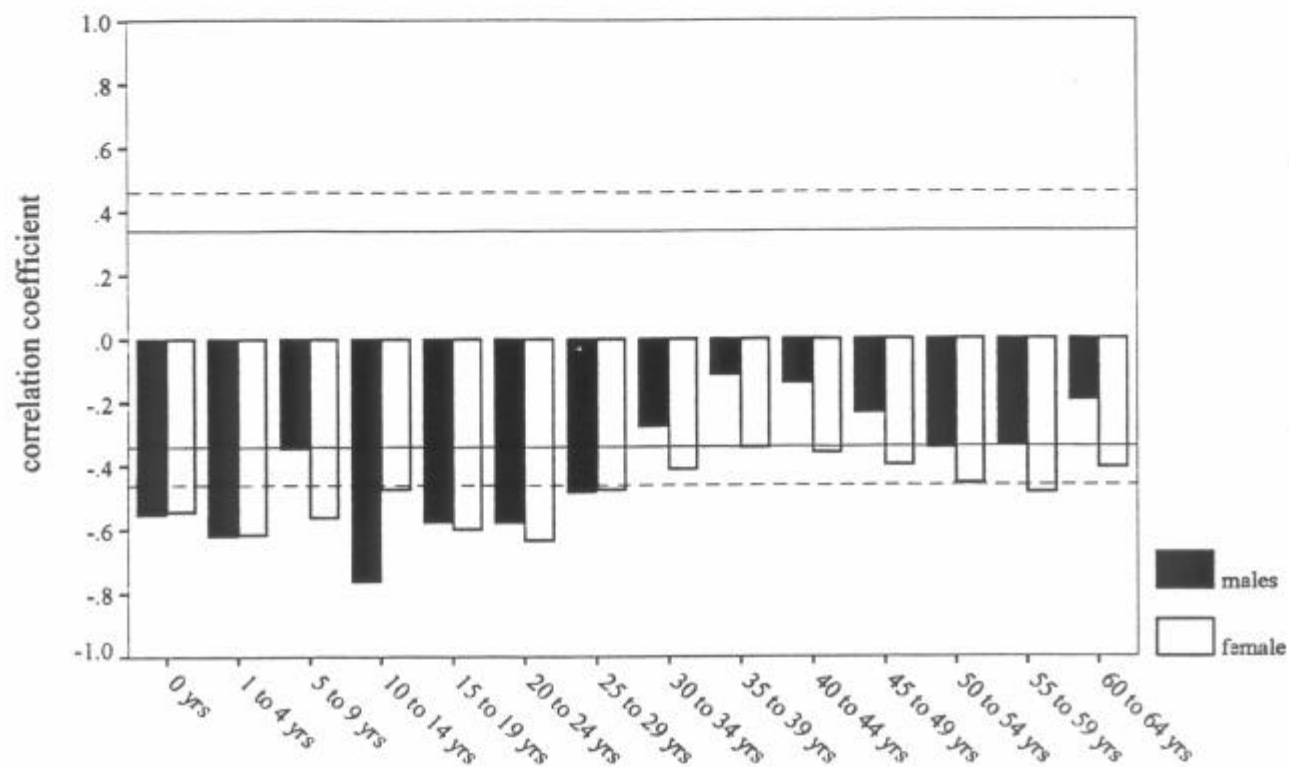
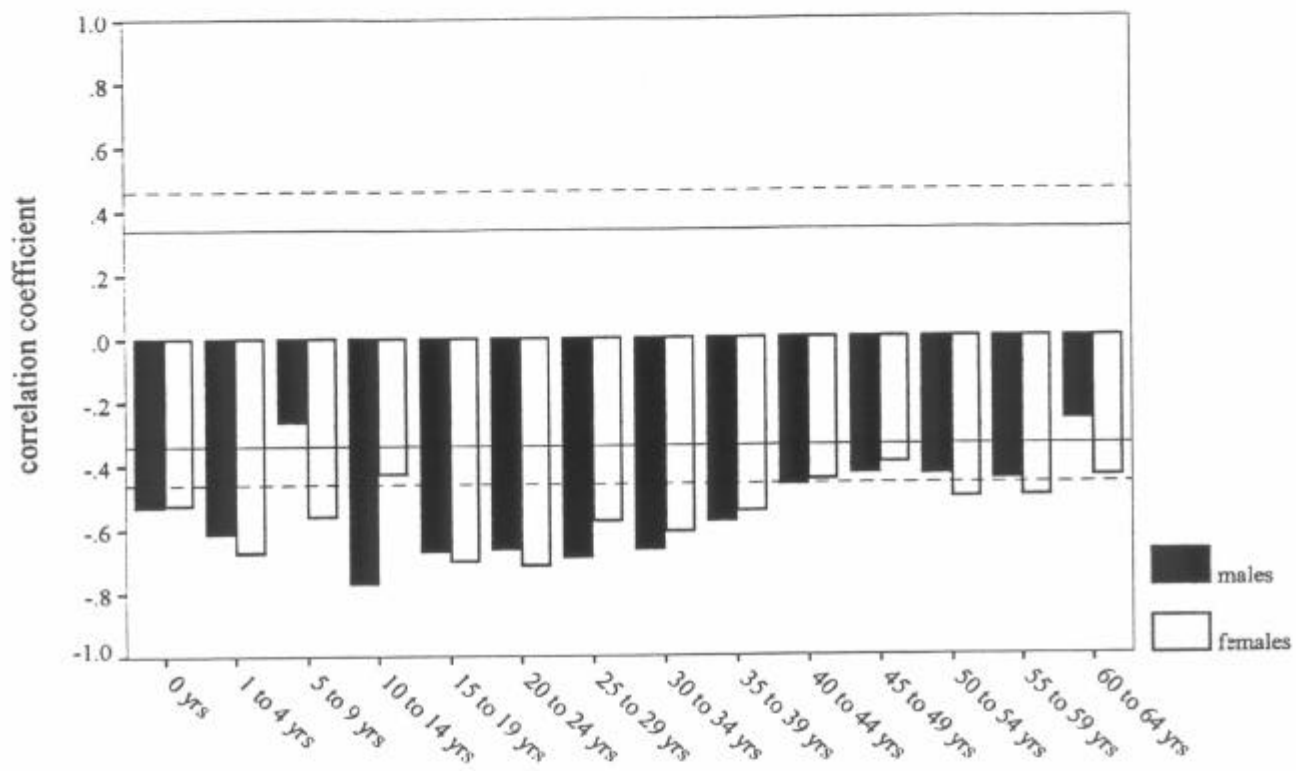


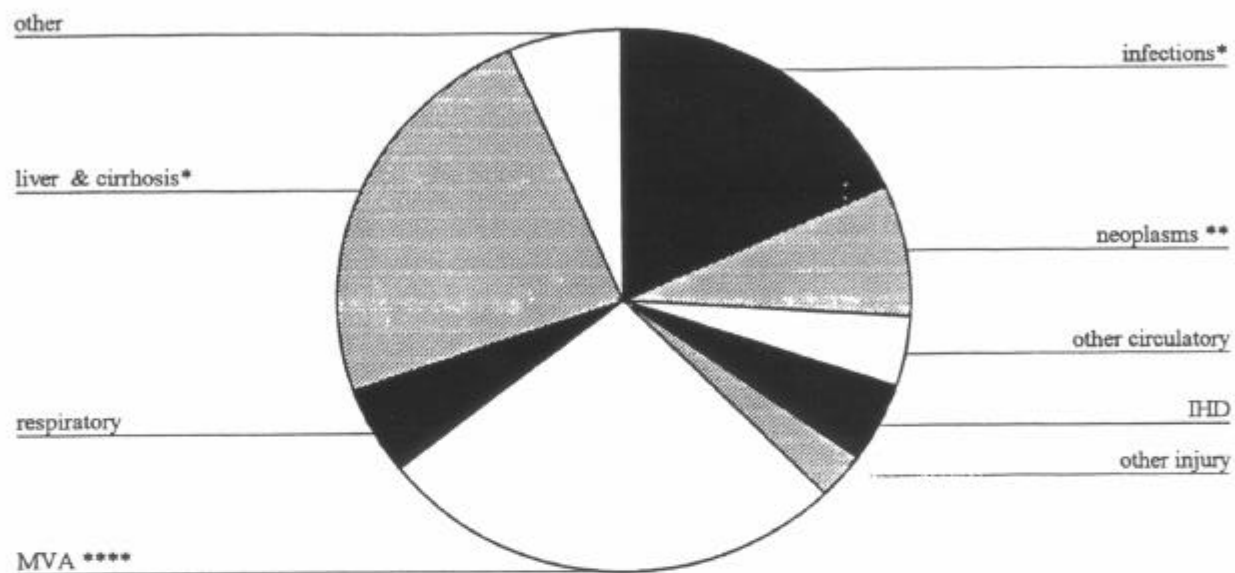
FIG 3b HHLT65



Title for Figs. 4 (a-d)

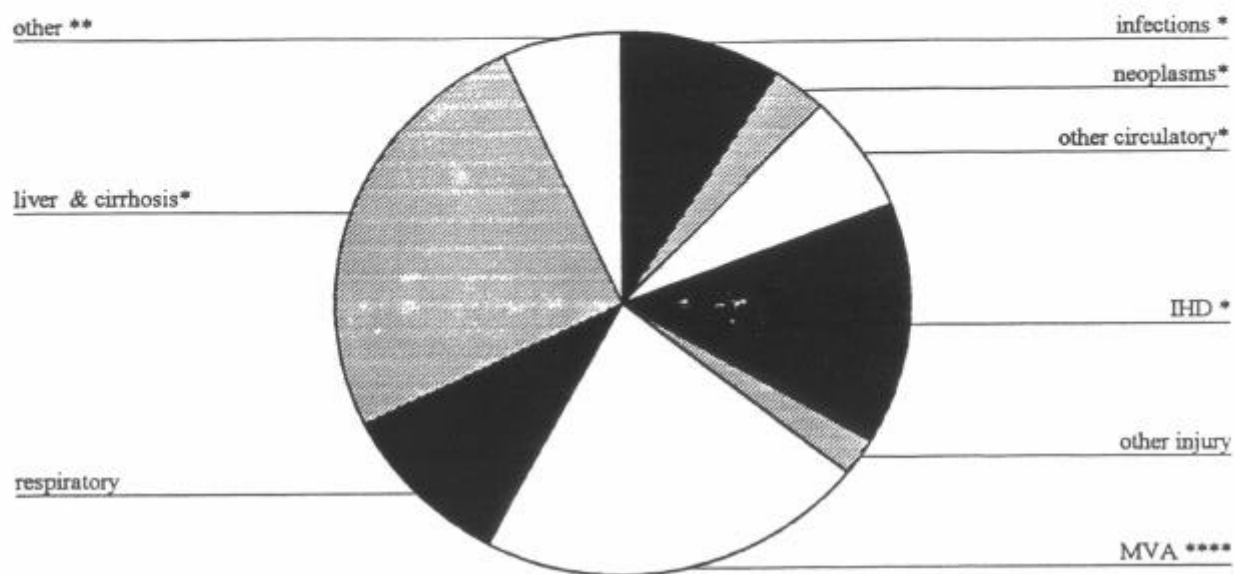
FIG 4(a-d) Contribution of different causes of death to the association between PYLL from all causes and the proportion of income received by the poorest 30 percent.

FIG 4a Males, CHLDHSE



* $p < 0.05$ ** $p < 0.01$
 *** $p < 0.001$ **** $p < 0.0001$

FIG 4b · Females, CHLDHSE



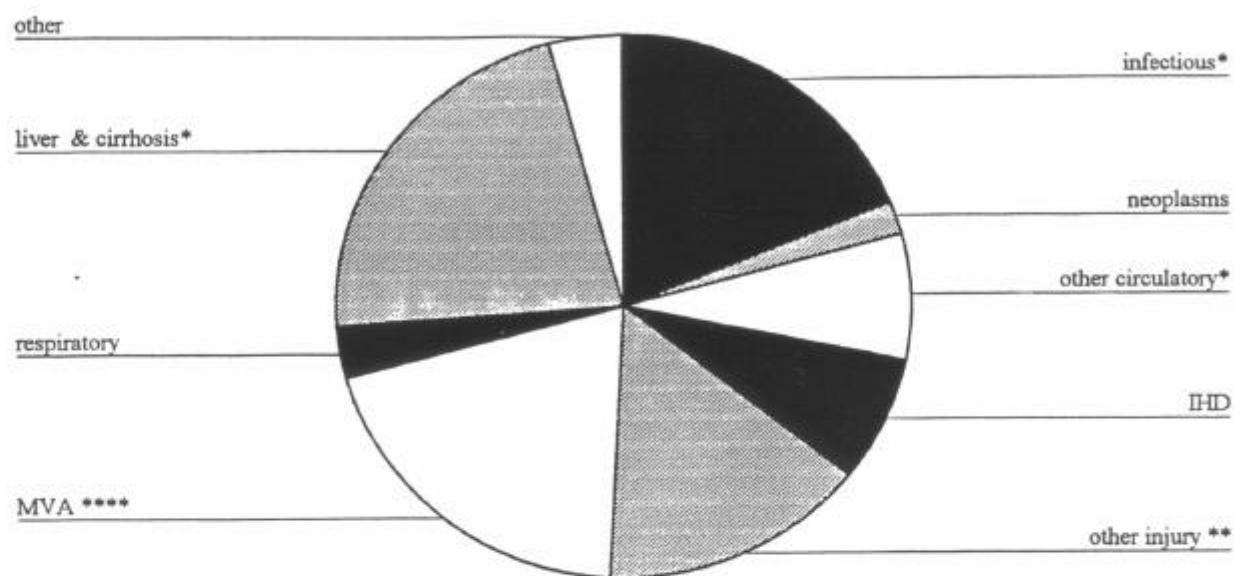
* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

**** $p < 0.0001$

FIG 4c Males, HHLT65



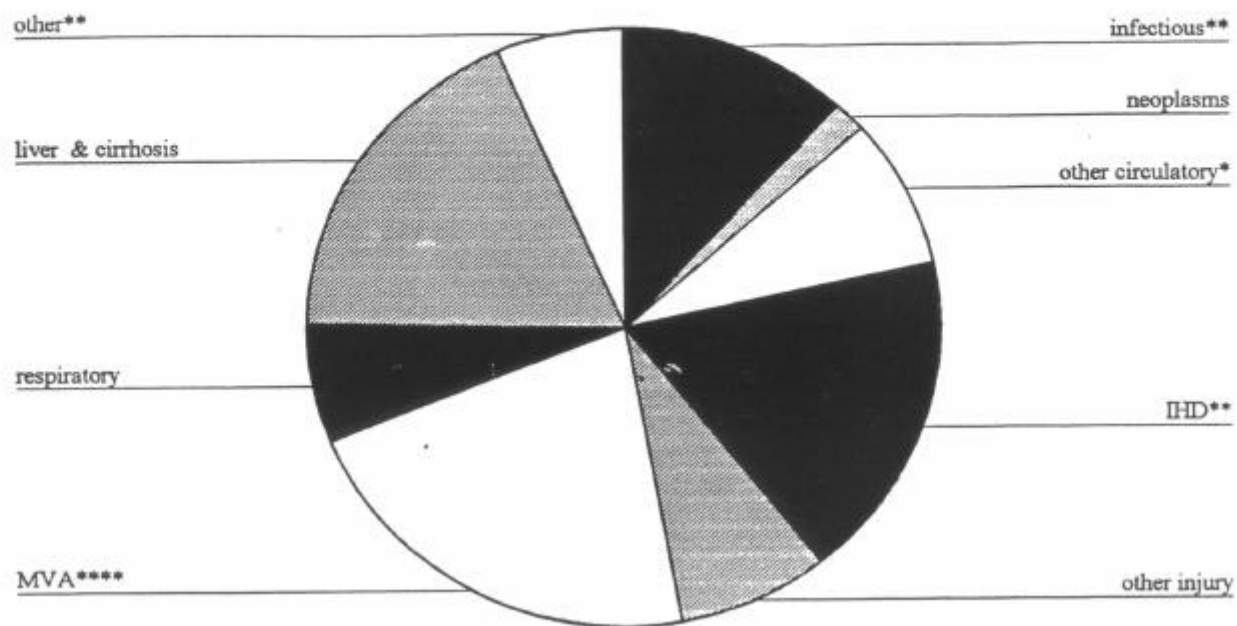
* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

**** $p < 0.0001$

FIG 4d - Females, HHLT65



* $p < 0.05$ ** $p < 0.01$

*** $p < 0.001$ **** $p < 0.0001$

FIG 5 % reduction in PYLL from each cause associated
with a 5% increase in income share received by poorest 30%

FIG 5a CHLDHSE

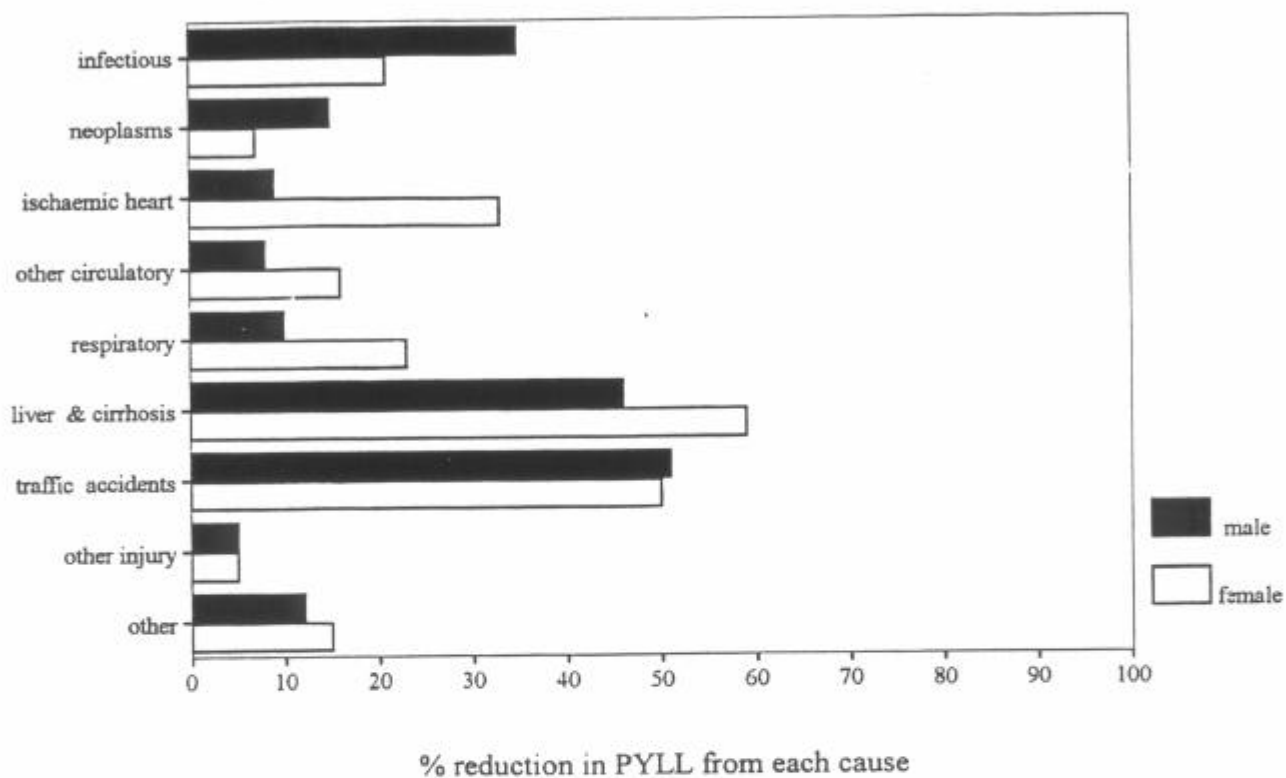


FIG 5b HHLT65

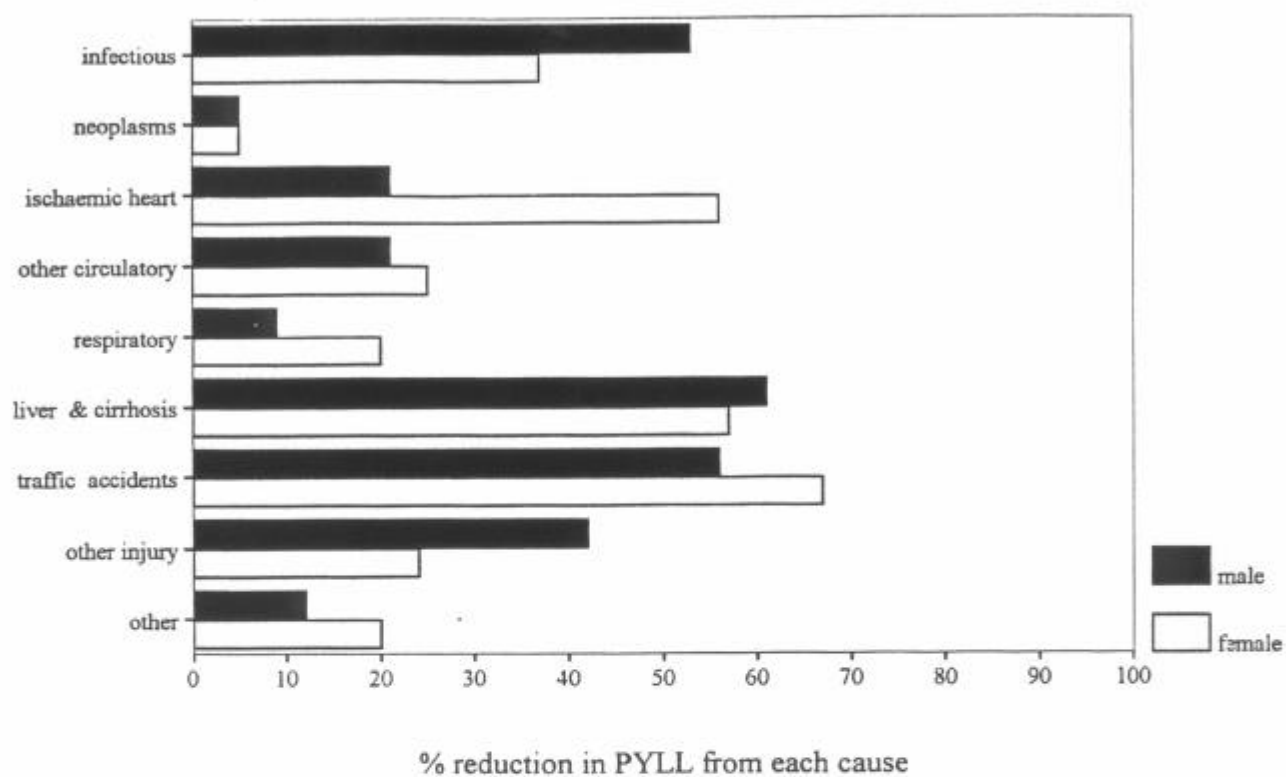


FIG 6 Relation between child SMR (1-19yrs) and income share received by poorest 30% (controlling for year).

