

# The global impact of income inequality on health by age: an observational study

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## EDITORIAL by Tumwine

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## ABSTRACT

**Objectives** To explore whether the apparent impact of income inequality on health, which has been shown for wealthier nations, is replicated worldwide, and whether the impact varies by age.

**Design** Observational study.

**Setting** 126 countries of the world for which complete data on income inequality and mortality by age and sex were available around the year 2002 (including 94.4% of world human population).

**Data sources** Data on mortality were from the World Health Organization and income data were taken from the annual reports of the United Nations Development Programme.

**Main outcome measures** Mortality in 5-year age bands for each sex by income inequality and income level.

**Results** At ages 15-29 and 25-39 variations in income inequality seem more closely correlated with mortality worldwide than do variations in material wealth. This relation is especially strong among the poorest countries in Africa. Mortality is higher for a given level of overall income in more unequal nations.

**Conclusions** Income inequality seems to have an influence worldwide, especially for younger adults. Social inequality seems to have a universal negative impact on health.

## INTRODUCTION

Recent evidence has pointed towards the apparent association between greater income inequality in a nation with higher mortality as being a real effect.<sup>1</sup> In rich nations, the prominent hypothesis is that the psychosocial stress of being in a relatively low position within a social and economic hierarchy leads to physiological harm.<sup>2</sup> It has recently been suggested that the effect of social inequalities on health is important worldwide, not just in affluent nations.<sup>1</sup>

If psychosocial stress is a key mechanism we should expect the impact of inequality to vary over the life course,<sup>3</sup> since how we are viewed by our peers is thought to matter more at some ages than others. One study found that the effect of income inequality was strong among infants but decreased with age and reversed for those older than 65.<sup>4</sup> Similarly, a study of 13 countries in the Organisation for Economic Cooperation and Development (OECD), using data from the 1970s to the early 1990s, found the association between income inequality and mortality weakened after the age of 25.<sup>5</sup>

The weight of evidence from studies in the United States suggests that income inequality is a significant predictor of mortality among infants, but this relation is weaker or disappears among people older than about 65. In all age-specific studies, income inequality

exerted the greatest influence on mortality at some point between the ages of 15 and 64 years. Thus, inequalities seem to be most damaging to health during working adult ages.

In this study we have examined variation by age in the relation between income inequality and mortality and have extended such analyses to countries not included in previous studies. This has been made possible through the use of recently released (and independently validated) secondary data which cover nations other than the richest that are members of the OECD.

## METHODS AND DATA

We report results based on 126 countries for which complete data on income inequality and mortality by age and sex were available around the year 2002, and which include 94.4% of the world's population. We obtained the mortality data from the World Health Organization.<sup>6</sup> These data enable us to calculate mortality by age group and sex (see [bmj.com](http://bmj.com) for details). We used a consistent measure of wealth—the log of gross domestic product (GDP) per capita adjusted to ensure purchasing power parity.<sup>7</sup> We also used a widely published measure of inequality from the same United Nations Development Programme source—the Gini coefficient.<sup>7</sup> The mean and median (range) values for these two measures respectively are \$9348 and \$4955 (\$521-\$68 000), and 40.1 and 38.0 (24.4-70.7).

We treated whole countries as units in a natural experiment. All countries were thus weighted equally in the results shown here.

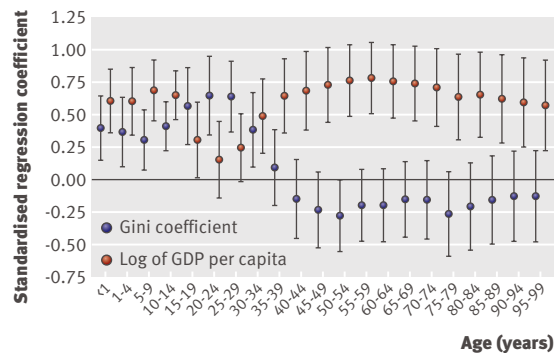
## Statistical analysis

We modelled the extent to which relations between health and income, and between health and income inequality seemed to vary across each of the age bands. We used linear regression to measure the association between mortality as the dependent variable and log of adjusted gross domestic product per capita as the independent predictor. We took a similar approach for the Gini coefficient. See [bmj.com](http://bmj.com) for details of modelling and sensitivity analyses.

## RESULTS

Figures 1 and 2 show the strength of the relation between each variable and age-specific mortality for both sexes combined (a larger coefficient indicates a stronger relation). A statistical test that the coefficients varied with age suggested that the correlation with the standardised Gini coefficient was  $-0.559$  ( $P < 0.01$ ), but the relation between age and log of income coefficients was not significant ( $0.334$ ,  $P > 0.05$ ). We found that income inequality had the greatest influence on mortality between the ages of 15 and 29 in OECD countries (fig 1), and between the

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**Fig 1 | Association of income inequality and affluence with mortality in the 30 countries of the OECD (income inequality measured as the Gini coefficient, and affluence as the log of gross domestic product (GDP) per capita adjusted to ensure purchasing power parity)**

ages of 25 and 39 worldwide (fig 2). The strength of the worldwide relation was reduced when we omitted countries in Africa (results not shown). The worldwide result is thus partly a product of processes operating most strongly in this continent, not simply a reflection of those operating within OECD countries.

The figures suggest that the strength of the association of inequality with mortality varies inversely with that for the association of affluence with mortality—that is, as inequality reaches its maximum influence, affluence reaches its minimum. This is a new finding which may have important implications for debates on the likely causal mechanisms.

**Secondary analyses**

We obtained similar results when we studied the two sexes separately. Inequality seemed to matter slightly more for males than females, but the shape and nature of the associations with age were not fundamentally altered. Similarly, the factors included in our sensitivity analyses had little impact on the results.

**DISCUSSION**

Our results prompt a series of hypotheses. Firstly, that the much disputed impact of income inequality on health is real, but that, because the impact varies with age, studies that have not accounted for this can show wide variation in the association of inequality with population health. Future studies should consider outcomes for different age groups.

Secondly, there is an age related mechanism that results in higher mortality being experienced in societies where there is greater social competition, all else being equal. Higher rates of income inequality tend to reflect more competitive rather than more cooperative societies. Whatever the mechanism, it has its strongest effects in early to middle adulthood.

Thirdly, in the nations with the lowest child and infant mortality, the importance of income inequalities will often be most obvious. This might be why the influence

of income inequalities has been found most strongly in studies of all age mortality in OECD countries.

Fourth, given the importance of African countries in providing evidence of a relation between inequality and mortality worldwide, high mortality from AIDS, armed conflict, and other causes common in more unequal and very poor countries might be a factor in explaining the observed relation.

Lastly, social inequalities as reflected through unequal incomes are damaging to health for those living in both rich and poor nations, and the direct mechanisms for such damage are likely to vary by area. The underlying mechanism may be similar—that, because humans are social animals, human health is best protected when people cooperate.

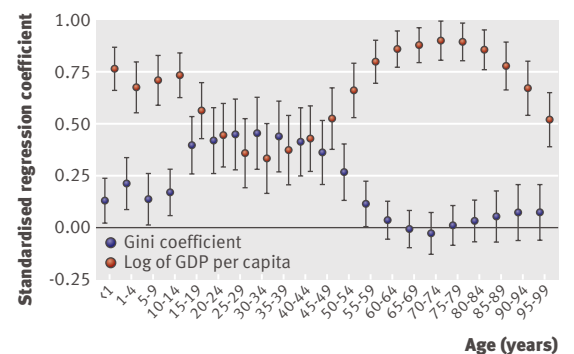
Our finding that, as inequality reaches its maximum influence on mortality, affluence reaches its minimum influence may have important implications for debates on the likely causal mechanisms. Greater equality may mitigate the need for overall affluence to grow for health to improve overall.

**Future research**

More detailed studies are needed to consider mortality and psychological morbidity by age and sex in relation to social inequalities between people. Time trends should be studied where possible. Patterns in the prevalence of mortality by cause, age, and sex should be studied to infer the possible biological processes at play and the extent to which external injuries and accidents are important. Lastly, the possible protective effects of old age and of young age need to be studied.

**Conclusion**

Income inequality is associated with higher mortality levels in all nations worldwide, not just affluent ones, but the effects are more pronounced at different ages. Although the direct mechanisms that operate are likely to be different between different countries, there does not seem to be a beneficial impact of social inequality on health anywhere.



**Fig 2 | Association of income inequality and affluence with mortality in all countries worldwide (income inequality measured as the Gini coefficient, and affluence as the log of gross domestic product (GDP) per capita adjusted to ensure purchasing power parity)**

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

Mortality falls as incomes rise, and this relation holds both between and within countries

Among affluent nations, this relation is tempered as income inequalities increase: the health gains from increases in income are less in more unequal nations

There is some evidence that these effects are more pronounced at different ages

**WHAT THIS STUDY ADDS**

High inequalities in income are closely associated with higher mortality in both poor and rich nations of the world  
This is particularly apparent when the effects are studied by age: worldwide, income inequality is most strongly detrimental to health in young adulthood

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**Competing interests:** All authors are in their 30s and are currently seeking the "bubble reputation" (*As You Like It* 2.7.139-65). However, all have their feet on the ground, having trained in medical geography.

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## Impact of insurance and supply of health professionals on coverage of treatment for hypertension in Mexico: population based study

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### ABSTRACT

**Objective** To examine the independent and combined contributions of insurance status and supply of health professionals on coverage of antihypertensive treatment among adults in Mexico.

**Design** Population based study.

**Setting** Mexico.

**Participants** 4032 hypertensive adults (2967 uninsured and 1065 insured): 1065 uninsured adults matched with 1065 adults insured through Seguro Popular, a programme to expand health insurance coverage to uninsured people in Mexico.

**Main outcome measures** Coverage of antihypertensive treatment and coverage of antihypertensive treatment with control of blood pressure.

**Results** Rates of treatment for hypertension varied by insurance status and supply of health professionals. Hypertensive adults insured through Seguro Popular had a significantly higher probability of receiving antihypertensive treatment (odds ratio 1.50, 95% confidence interval 1.27 to 1.78) and receiving antihypertensive treatment with control of blood pressure (1.35, 1.00 to 1.82). Greater supply of health professionals in areas with coverage through Seguro Popular was a significant predictor of antihypertensive treatment after adjusting for covariates (1.49, 1.00 to 2.20).

**Conclusions** Expansion of healthcare coverage to uninsured people in Mexico was associated with greater use of antihypertensive treatment and blood pressure control, particularly in areas with a greater supply of health professionals.

### INTRODUCTION

Lack of health insurance is a key obstacle to antihypertensive treatment.<sup>1-5</sup> Mexico's Seguro Popular programme to extend health insurance to all uninsured people by 2010 has the potential to increase access to treatment for hypertension. The law stipulates that priority for affiliation is to be given to poor households in areas of high deprivation, and to rural areas and indigenous groups.<sup>6</sup> In addition Seguro Popular was designed to start in communities with health facilities sufficiently equipped to provide the relevant services.<sup>6</sup>

We examined the association between Seguro Popular and coverage of antihypertensive treatment and control of blood pressure among adults. We also explored whether the supply of health professionals (numbers of doctors and nurses per 1000 population) was a mediating or moderating factor between Seguro Popular and antihypertensive treatment and blood pressure control. We hypothesised that Seguro Popular would be a significant predictor of coverage for both, and that the programme would affect the care