

Child wellbeing and income inequality in rich societies: ecological cross sectional study

Kate E Pickett, senior lecturer in epidemiology,¹ Richard G Wilkinson, professor of social epidemiology²

¹Department of Health Sciences, University of York, Heslington, York YO10 5DD

²Division of Epidemiology and Public Health, University of Nottingham Medical School, Queens Medical Centre, Nottingham NG7 2UH

Correspondence to: R G Wilkinson
Richard.Wilkinson@nottingham.ac.uk

doi:10.1136/bmj.39377.580162.55

ABSTRACT

Objectives To examine associations between child wellbeing and material living standards (average income), the scale of differentiation in social status (income inequality), and social exclusion (children in relative poverty) in rich developed societies.

Design Ecological, cross sectional studies.

Setting Cross national comparisons of 23 rich countries; cross state comparisons within the United States.

Population Children and young people.

Main outcome measures The Unicef index of child wellbeing and its components for rich countries; eight comparable measures for the US states and District of Columbia (teenage births, juvenile homicides, infant mortality, low birth weight, educational performance, dropping out of high school, overweight, mental health problems).

Results The overall index of child wellbeing was negatively correlated with income inequality ($r=-0.64$, $P=0.001$) and percentage of children in relative poverty ($r=-0.67$, $P=0.001$) but not with average income ($r=0.15$, $P=0.50$). Many more indicators of child wellbeing were associated with income inequality or children in relative poverty, or both, than with average incomes. Among the US states and District of Columbia all indicators were significantly worse in more unequal states. Only teenage birth rates and the proportion of children dropping out of high school were lower in richer states.

Conclusions Improvements in child wellbeing in rich societies may depend more on reductions in inequality than on further economic growth.

INTRODUCTION

The wellbeing and behaviour of young people have recently attracted increasing attention from the media, policy, and law, with concern expressed over violence, drunkenness, antisocial behaviour, obesity, self harm, and pregnancy. A recent Unicef report, which assembled 40 indicators of child wellbeing in rich countries, concluded that children in Britain and the United States fared less well than in any of the other 21 countries included in its analysis.¹

Measures of child wellbeing are associated with socioeconomic status.² Ill health and social problems associated with low socioeconomic status tend to be more common in societies with bigger differences in income between rich and poor.^{3,4} In a recent study,

we found that it was those age and cause specific death rates with steeper social gradients that tended to be higher in more unequal societies.⁵

If, as Marmot has suggested,⁶ social gradients in health in rich countries reflect social position, and more unequal societies have worse health, then perhaps differences in social status are exacerbated in societies with wider differences in income.

The indicators of child wellbeing used in the Unicef report are ecological measures for whole countries. As the report does not attempt to explain the national differences in child wellbeing it described, we decided to see how they were related to three macro-economic measures: material living standards (average income, as measured by gross national income per capita), the scale of differentiation in social status (as measured by income inequality), and social exclusion among families with children (as measured by the proportion of children living in relative poverty). Although additional measures of material standards, differentiation in social status, and social exclusion might be desirable, none are so widely available as—or necessarily better than—gross national income per capita (converted according to local prices), income inequality, and percentage of children in relative poverty.

Having looked at the associations between these three macro-economic variables and the Unicef indicators internationally, we extended our analysis to indicators of child wellbeing among the 50 states of the US to see if the pattern of international associations was confirmed in an independent setting.

METHODS

International comparisons

In 2007 Unicef published an overview of child wellbeing in rich countries.¹ Data sources included sample surveys, such as the OECD (Organisation for Economic Cooperation and Development) programme for international student assessment and the World Health Organization's study of health behaviour in school age children, and routinely collected data, such as the OECD health database, the WHO mortality database, and the World Bank world development indicators.⁷ Reporting dates differ for different components of the index, ranging from 1998-2005.

The Unicef index was originally constructed in three tiers (table 1). Forty items were grouped into 18 subdimensions. These were then taken, three at a time, to form the six main dimensions (material wellbeing, health and safety, educational wellbeing, family and peer relationships, behaviours and risks, subjective wellbeing). Components were combined as averages of their z scores. Full descriptions of both the index and the underlying methods have been previously reported.¹⁷

The Unicef index contains measures both of child wellbeing and of factors conducive to wellbeing. As we wanted to see how wellbeing might be determined by the proportion of children living in relative poverty, it was necessary to remove the relative poverty item, leaving 39 items, and recalculate the index. Where necessary, we have reverse scored indicators so that low scores consistently indicate worse outcomes.

Selection of countries

Unicef published an overall ranking for child wellbeing for 21 OECD countries. Incomplete data were also reported for some other countries excluded from the overall ranking. We included only countries that had income inequality data and were among the richest 50 in the world and excluded those with populations of less than two million to avoid possible tax havens. This meant adding Australia (21 indicators), Japan (19 indicators), Israel (39 indicators), New Zealand (20 indicators), and Slovenia (25 indicators) to the Unicef set, and excluding the Czech Republic, Hungary, and Poland. The 23 countries included were Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the US.

Income inequality data came from the United Nations development programme human development indicators, 2003-6. As survey dates vary for different countries (from 1992 to 2001), and as the lag time for effects will vary for different components of the index, we took the average income inequality across the reporting years 2003-6.⁸ Income inequality was measured as the ratio of the total annual household income received by the richest 20% of the population to that received by the poorest 20%. This ratio ranged from 3.4 in Japan, the most equal country, to 8.55 in the US, the most unequal.

Child relative poverty was measured as the percentage of children aged 0-17 years in households with an income equivalent to less than 50% of the national median. This shows the impact of income inequality specifically on children. Data within the period 1999-2001 came from the OECD.⁷ As expected, income inequality and child relative poverty were positively correlated for our 23 countries ($r=0.72$, $P=0.0002$), indicating that they share about half (52%) of their variance.

Average income was measured as gross national income per capita at 2003 purchasing power parities

in US dollars and obtained from the World Bank world development indicators database.⁹

Statistical methods

We estimated Pearson's correlations to see how the index of child wellbeing and its six dimensions and 39 indicators were related to income inequality, children in relative poverty, and average income.

US comparisons

To provide independent tests of the international pattern of associations we tabulated associations among the 50 US states (and the District of Columbia) of eight indicators of child wellbeing. We examined previously published associations with teenage births, juvenile homicides, educational performance, and rates of high school drop out.^{4 10-12} We also conducted four new analyses: firstly, we replicated previous findings for infant mortality and low birth weight so that we could present them in a form consistent with the other outcomes, and then we analysed the proportion of children who are overweight and rates of child mental health problems.

As a measure of income inequality for the US, we use the Gini coefficient of the inequality of household incomes in 1999 provided by the US Census Bureau¹³ (the Gini coefficient varies between 1, indicating maximum inequality, and 0, indicating perfect equality). Average income, measured as per capita income in 1999, was also obtained from the US Census Bureau.¹⁴ Data on children in relative poverty are not available for all states, so our US comparisons are restricted to income inequality and average income.

Data on infant mortality¹⁵ and low birth weight¹⁶ for 2002 came from the US National Centre for Health Statistics. Data on the proportion of overweight children and the proportion of children with moderate or severe difficulties in the area of emotions, concentration, behaviour, or getting along with others were obtained from the 2003 US National Survey of Children's Health.¹⁷

RESULTS

The overall index of child wellbeing was closely and negatively correlated with income inequality ($r=-0.64$, $P=0.001$) (figure) and children in relative poverty ($r=-0.67$, $P=0.001$) but not with average income ($r=0.15$, $P=0.50$). Adjustment for income inequality or children in relative poverty did not change the lack of association between child wellbeing and average income in rich countries.

Table 1 shows the correlations between income inequality, children in relative poverty, and average income on one hand and the six dimensions and 39 items of the Unicef index on the other.

Associations with income inequality

Among the main dimensions of child wellbeing, health and safety and behaviours and risks were significantly

Table 1 | Structure of the Unicef index of child wellbeing and correlations of six main dimensions and 39 items with income inequality, child relative poverty, and average income*

	Income inequality		Child relative poverty		Average income	
	r	P value	r	P value	r	P value
Overall Unicef index	-0.64	0.001	-0.67	0.001	0.15	0.50
Material wellbeing						
Overall	-0.36	0.10	-0.37	0.10	0.40	0.06
Deprivation:						
Low affluence (child's own report)	-0.41	0.08	-0.40	0.11	0.80	<0.001
Few educational possessions (desk, computer, textbooks etc)	0.00	0.99	-0.26	0.25	0.29	0.19
Few books	-0.37	0.08	-0.34	0.14	-0.08	0.72
Work:						
No employed parent	-0.23	0.29	0.03	0.88	0.04	0.87
Health and safety						
Overall	-0.53	<0.01	-0.71	<0.001	0.16	0.45
Health at birth:						
Infant mortality	-0.76	<0.001	-0.66	<0.001	-0.13	0.55
Low birth weight	-0.42	0.048	-0.62	0.003	0.25	0.26
Immunisations:						
Measles	-0.11	0.60	-0.06	0.80	-0.26	0.22
Diphtheria-pertussis-tetanus (DPT)	-0.04	0.86	-0.32	0.16	-0.13	0.56
Polio	-0.05	0.82	-0.49	0.02	-0.06	0.79
Child mortality:						
Accident/injury mortality	-0.27	0.21	-0.40	0.08	0.38	0.08
Educational wellbeing						
Overall	-0.41	0.06	-0.55	0.01	0.48	0.02
Achievement:						
Maths scores	-0.50	0.03	-0.41	0.07	0.32	0.17
Reading scores	-0.25	0.28	-0.29	0.21	0.23	0.34
Science scores	-0.36	0.11	-0.13	0.57	0.09	0.69
Participation:						
Further education	-0.67	<0.001	-0.66	0.002	0.46	0.04
Aspirations:						
Aspiring to low skilled work	0.46	0.04	0.19	0.40	-0.14	0.55
Not in education, employment, or training	0.32	0.18	0.28	0.24	0.10	0.10
Peer and family relationships						
Overall	-0.37	0.08	-0.26	0.25	-0.19	0.39
Family structure:						
Single parent households	0.01	0.96	0.10	0.68	-0.68	<0.001
Step-parent households	0.08	0.73	0.23	0.35	-0.65	0.002
Family relations:						
Eat together regularly	-0.22	0.32	-0.22	0.34	0.35	0.11
Child talks to parents	0.10	0.68	0.00	0.99	0.01	0.97
Peer relations:						
"Peers are kind"	-0.50	0.02	-0.54	0.02	0.01	0.95
Behaviours and risk						
Overall	-0.58	0.004	-0.33	0.14	-0.10	0.69
Risk behaviour:						
Smoke cigarettes at least once a week	0.11	0.64	-0.10	0.72	-0.08	0.72
Been drunk twice or more	0.23	0.33	0.17	0.50	0.13	0.59
Cannabis in past year	-0.29	0.22	-0.36	0.15	0.41	0.08
Teenage birth rate	-0.74	<0.001	-0.65	0.001	0.03	0.89
Had sex by age 15 years	-0.04	0.88	0.06	0.84	0.19	0.49
Condoms used during last sexual intercourse	0.33	0.23	0.45	0.12	0.23	0.41
Experiences of violence:						
Involved in fighting	-0.20	0.39	-0.32	0.20	-0.21	0.36
Victim of bullying	-0.47	0.04	-0.28	0.27	0.09	0.69

Health behaviour:

Eat fruit daily	0.37	0.10	0.36	0.14	0.60	0.005
Eat breakfast on school days	-0.22	0.34	-0.42	0.08	-0.17	0.48
Average days physically active in past week	0.12	0.62	-0.45	0.06	-0.23	0.34
Overweight	-0.56	0.01	-0.72	<0.001	0.08	0.72

Subjective wellbeing

Overall	-0.04	0.84	-0.27	0.23	-0.31	0.15
---------	-------	------	-------	------	-------	------

Health:

Self rated fair/poor health	-0.32	0.19	-0.27	0.30	-0.38	0.11
-----------------------------	-------	------	-------	------	-------	------

Personal wellbeing:

Life satisfaction above median	-0.35	0.13	-0.32	0.20	-0.13	0.57
Feel like an outsider	-0.11	0.64	-0.04	0.85	-0.23	0.30
Feel awkward	0.28	0.22	0.01	0.94	-0.21	0.35
Feel lonely	0.45	0.04	-0.13	0.58	-0.17	0.46

School wellbeing:

"Likes school a lot"	0.07	0.77	0.04	0.87	0.00	0.99
----------------------	------	------	------	------	------	------

*Where necessary, items have been reverse scored so that lower scores indicate worse outcomes throughout table.

worse in more unequal countries. Infant mortality and rates of low birth weight were higher in countries with higher levels of income inequality, as were rates of teenage pregnancy, rates of overweight children, and the proportion of children who reported having been bullied. Items in other dimensions of wellbeing that were also related to income inequality included lower maths scores, a lower proportion of young people in further education, and a lower proportion of children who find that their "peers are kind."

There was a significant relation between lower levels of income inequality and a higher proportion of children feeling lonely. Children in countries with lower levels of income inequality were more likely to aspire to less skilled work.

Associations with percentage of children in relative poverty

Health and safety and educational wellbeing were the main Unicef dimensions of child wellbeing that were significantly worse in countries with higher levels of child relative poverty. Infant mortality and rates of low birth weight were higher in countries with more children in relative poverty, and rates of immunisation for polio were significantly lower. In such countries fewer young people participated in further education, fewer reported that "peers are kind," teenage birth rates were higher, and a higher proportion were overweight.

Associations with average income

Educational wellbeing (but not achievement) was better in countries with higher average incomes. In richer countries, fewer children reported low levels of family affluence, more young people participated in further education, and lower proportions of children were living in single parent or step-parent families. The only other significant association with average income was that children in richer countries were more likely to report eating fruit daily.

Results among states of the US

Table 2 summarises results for the US from previously published studies and our new analyses. Income inequality at the state level was significantly correlated with rates of teenage births, juvenile homicides, infant mortality, low birth weight, child overweight, mental health problems, and high school dropouts as well as with worse educational scores. States with higher average incomes had significantly fewer teenage births and fewer children dropping out of high school, but they did no better than poorer states on the other six measures of child wellbeing.

DISCUSSION

Income inequality and the proportion of children in relative poverty measure different aspects of inequality. We included both to distinguish the effects of living in a more unequal society from the effects of being brought up in families with low relative income. Inequality and child relative poverty, however, are almost equally closely related to the Unicef measures of child health and wellbeing. Average income was unrelated to the overall index.

Among the components of the Unicef index, higher levels of one or other of our inequality measures were significantly associated with worse outcomes for infant mortality, low birth weight, polio immunisation, average maths scores, the proportion of teenagers in further education, fewer children saying their peers are kind, teenage birth rates, experience of bullying, and childhood overweight. On the other hand, in more unequal countries fewer children reported feeling lonely, and fewer had low job aspirations. The first of these is entirely driven by Japan, an outlier, with a score more than 4 SD from the mean. The second is a more robust tendency for job aspirations to be lower in more equal countries. But rather than being realistic aspirations, this may simply reflect a stronger tendency for children in more unequal countries to aspire to unattainable money and fame. We found a non-significant tendency for aspirations to be highest

where educational achievements were lowest ($r=-0.36$; $P=0.12$). In addition, there is some evidence that social mobility is lower in more unequal countries.⁴

Our examination of indicators of child wellbeing among the US states largely confirmed these patterns. Outcomes on all of our indicators were significantly worse in more unequal states. In contrast, higher average income was significantly (and independently) related to lower teenage birth rates and to a lower proportion of children dropping out of high school.

Of the indicators of child wellbeing included in the Unicef index, the one most closely related to the overall index is the teenage birth rate, which has been called an “iconic” variable for this reason.¹⁸ It is also the indicator most closely related to inequality—internationally and among the US states.

Despite large differences in living standards, few measures of child wellbeing were related to average income in either the international or the US settings. Previous studies have shown that although health remains related to income within rich countries (as health inequalities testify), it is no longer related to average differences in income between them.^{19,20} This is consistent with the view that what matters within rich countries may no longer be absolute material standards, but income (or social position) relative to others in the same society. However, when international analyses include data for poorer countries, it is clear that among them, absolute material standards remain important for child wellbeing.¹⁸

Analyses of units as large as whole countries or states may seem too remote from the factors that affect individual health to be informative. But given that health inequalities are typically measured across the whole social class hierarchy, a clue to the extent of the same processes of social differentiation that mark people so deeply may be gained by measuring income distribution across whole societies. This may be why, in a review of 168 analyses, we found that studies of whole societies provided overwhelming evidence that income inequality and health were related, whereas results from studies measuring inequality in small areas were equivocal.³ Deprived neighbourhoods presumably have poor health because they are



Correlation between income inequality and the Unicef index of child wellbeing in 23 rich countries

deprived in relation to the wider society, not because of the inequality within them. Income distribution, as a societal variable, may be serving as a measure of the scale or importance of social stratification.

Associations, confounding, and causality

Although the associations between income inequality and child wellbeing may seem to fit well in this framework, that is not necessarily evidence of causality. Could there be confounding factors detrimental to child wellbeing that also tend to widen income differences? Consistent with the lack of association with average income, previous work suggests that relations between health and income inequality are not explained by poverty or by controlling—in multilevel models—for individual incomes.^{21,22}

We are sometimes asked about a possible confounding role of ethnic division or migration from poorer countries. Ram however, used international data to show that income inequality remained significantly related to health even after adjustment for an index of ethnic heterogeneity.²³ In addition, although levels of child wellbeing in Sweden and the US differ so dramatically, both countries have a similar proportion of the population (around 12%) who were born in other countries.^{24,25}

The provision of public services might also be a confounder. Healthcare expenditure, however, is not related to mortality in rich countries²⁶ and an analysis of US data found that expenditure on public services among the 50 states could account for only part of the relation between income inequality and mortality.²⁷ Among OECD countries we found that public social expenditure as a percentage of national income only slightly attenuated the relation between income inequality and the Unicef index (results not shown). For several other outcomes related to inequality—such as obesity, homicide, and levels of trust—it is much less plausible that services might be a powerful determinant.

The UK

As the figure shows, the UK has the lowest score for child wellbeing on the Unicef index and does worse

Table 2 | Correlations of measures of child wellbeing with income inequality, and average income across the 50 US states (including District of Columbia)

Measure of child wellbeing	Income inequality		Average income	
	r	P value	r	P value
Teenage births ¹²	0.72	<0.001	-0.55	<0.001
Juvenile homicides ¹²	0.31	0.03	0.00	0.99
Infant mortality*	0.55	<0.001	-0.20	0.15
Low birth weight*	0.65	<0.001	-0.01	0.99
Educational performance (combined maths and reading scores for 15 year olds)† ⁴	-0.69	<0.001	0.08	0.58
Dropping out of high school† ⁴	0.66	<0.001	-0.28	0.04
Overweight	0.64	<0.001	-0.07	0.63
Mental health problems	0.37	0.01	-0.14	0.33

*Similar findings have been reported elsewhere.^{11, 40}

†Similar findings have been reported elsewhere.¹¹

than expected—even given its high levels of inequality and child relative poverty. Its position reflects poor scores on most components of the index. Only on mortality from accidents and injury does the UK do conspicuously well. On the proportion of children who find their peers kind and helpful, the frequency of drunkenness, and the proportion of children who had sex by age 15, Britain does worse than expected from its levels of child relative poverty and inequality.

Three hypotheses

What are the social processes through which children might be affected by inequality and relative poverty? Three hypotheses seem plausible. Firstly, inequality might affect children through the effects of relative poverty on the level of material resources they are brought up with. Secondly, it might affect them through its impact on the quality of family life and relationships. Thirdly, children might be directly aware of increased status differentiation in the wider society and make invidious social comparisons themselves.

The data seem to provide little support for the first hypothesis. If absolute (as opposed to relative) material standards played a key role, we would have expected average income to be at least weakly related to the overall index of child wellbeing. We would also expect the Unicef index to be related to inequality through its more obviously material components, such as “educational possessions” (dictionary, books, desk, computer, etc) or levels of immunisation. Of the 39 index components, only the proportion of teenagers in further education was related to both inequality and average income. Lastly, if levels of material provision were crucial, the proportion of children living in relative poverty should have been a much stronger determinant of child wellbeing than societal inequality.

The second hypothesis fits well with the recognition that early childhood experience and the quality of family relationships are important for cognitive and emotional development as well as for later health. We are surprised, however, by the conspicuous lack of associations between either of our inequality variables and any of the measures of family structure and family relationships. These included single parenthood, families eating together, and children saying they talk

to their parents. These data, collected from children as old as 15, however, might be a poor reflection of family relationships in the important earlier years.

We have suggested elsewhere that greater inequality leads to increased competition and anxiety regarding social status.³²⁸ But are children sufficiently aware of differences in status to make the third hypothesis plausible? Research has found that before the end of primary school children are fully conscious of class differences: they can rank occupations hierarchically and are able to categorise people socially by outward indicators such as clothing, houses, and cars.²⁹³⁰ There is also evidence to show how children’s performance is affected by status differentiation. For example, although tests showed that 11-12 year old Indian children from high and low castes could solve mazes equally well before they knew each other’s caste, lower caste children did much less well as soon as caste was declared.³¹ Similar effects were apparent when black and white American high school students were given cognitive tests.³² When told the tests were to measure ability, the black students did much less well than when they were told they were not tests of ability. White students did equally well under both conditions. Other experiments have shown how the creation of artificial differences in status can lead to differences in behaviour and performance.³³

The Unicef data suggest that children’s responses to inequality are remarkably similar to those found in adult populations. The data on peer relations and violence among children runs parallel to those on social capital, trust, and violence among adults. Among both, the quality of social relations is poorer in more unequal societies.²⁸³⁴ When we computed a new measure of the quality of children’s relations with their peers by combining the Unicef data for involvement in fighting, experience of bullying, and the proportion of children not finding their peers kind and helpful, it correlated closely with both the inequality variables ($r=0.61$, $P<0.01$ for both). Similarly, it has been shown that juvenile homicides are, like adult homicides, correlated with inequality.¹² The most plausible explanation for the link between adult violence and inequality seems to be loss of face and people’s sensitivity to feeling disrespected and looked down on.³⁵³⁶ Accounts of school shootings in the US suggest similar patterns.³⁷³⁸ Lastly, the associations between inequality and the proportion of children who are overweight mirror relations between adult obesity and inequality.³⁹

Our finding that measures of child wellbeing are related to income inequality internationally among rich countries is supported by similar associations with child outcomes among the 50 states of the US. While our results have the usual limitations of cross sectional analyses, they cannot easily be attributed to confounding. Improvements in child wellbeing in rich countries might depend more on reductions in inequality than on further economic growth, and attempts to reduce the proportion of children in relative poverty are urgently required.

WHAT IS ALREADY KNOWN ON THIS TOPIC

A recent Unicef report measuring child wellbeing in rich countries puts the UK at the bottom

WHAT THIS STUDY ADDS

The Unicef index of wellbeing is strongly associated with income inequality and with the proportion of children living on less than half the median income in each country but not with gross national income per capita

Similar associations were found with eight indicators of child wellbeing in the 50 states of the US

Young people are aware of status differentiation

Attempts to reduce inequality and the proportion of children living in relative poverty are urgently required

We thank Jonathan Bradshaw for helpful comments and advice and Anna Goodman, who independently discovered the association between income inequality and child mental health in the US, for helpful discussions.

Contributors: Both authors participated in the design of the study, interpretation of the results and drafting of the article. KEP conducted the data analysis. Both authors are guarantors.

Funding: KEP is supported by a NIHR (National Institute of Health Research) Career Scientist Award.

Competing interests: None declared.

Ethical approval: Not required.

Provenance and peer review: Not commissioned; externally peer reviewed.

- 1 UNICEF Innocenti Research Centre. *Child poverty in perspective: an overview of child well-being in rich countries*. Florence: Innocenti Report Card, 2007.
- 2 Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annu Rev Psychol* 2002;53:371-99.
- 3 Wilkinson RG, Pickett KE. Income inequality and population health: a review and explanation of the evidence. *Soc Sci Med* 2006;62:1768-84.
- 4 Wilkinson RG, Pickett KE. The problems of relative deprivation: why some societies do better than others. *Soc Sci Med* 2007;65:1965-78.
- 5 Wilkinson RG, Pickett KE. Income inequality and social gradients in mortality. *Am J Public Health* 2007 doi: 10.2105/AJPH.2007.109637.
- 6 Marmot M. *Status syndrome: how your social standing directly affects your health and life expectancy*. London: Bloomsbury, 2004.
- 7 Bradshaw J, Hoelscher P, Richardson D. *Comparing child well-being in OECD countries: concepts and methods*. Florence: UNICEF Innocenti Research Centre, 2007 (working paper No 2006-03).
- 8 United Nations Development Program. *Human development report*. New York: Oxford University Press, 2003-6.
- 9 World Bank. *World development indicators (WDI)*. Manchester: ES DS International, (MIMAS), University of Manchester, 2006.
- 10 Gold R, Kawachi I, Kennedy BP, Lynch JW, Connell FA. Ecological analysis of teen birth rates: association with community income and income inequality. *Matern Child Health J* 2001;5:161-7.
- 11 Kaplan GA, Pamuk ER, Lynch JW, Cohen RD, Balfour JL. Inequality in income and mortality in the United States: analysis of mortality and potential pathways. *BMJ* 1996;312:999-1003.
- 12 Pickett KE, Mookherjee J, Wilkinson RG. Adolescent birth rates, total homicides, and income inequality in rich countries. *Am J Public Health* 2005;95:1181-3.
- 13 US Census Bureau. *Gini ratios by state, 1969, 1979, 1989, 1999*. Washington, DC: US Census Bureau, 1999 (table S4).
- 14 US Census Bureau. *Census 2000 summary file 3*. Washington, DC: US Census Bureau, 2005.
- 15 Kochanek KD, Murphy SL, Anderson RN, Scott C. Deaths: final data for 2002. *Natl Vital Stat Rep* 2004;53:1-115.
- 16 Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Munson ML. Births: final data for 2002. *Natl Vital Stat Rep* 2003;52:1-113.
- 17 Child and Adolescent Health Measurement Initiative. *National survey of children's health, data resource center on child and adolescent health*. 2005. www.childhealthdata.org.
- 18 Bradshaw J, Richardson D, Ritakallio V-M. Child poverty and child well-being in Europe. *J Child Serv* 2007;2:18-36.
- 19 Marmot M, Wilkinson RG. Psychosocial and material pathways in the relation between income and health: a response to Lynch et al. *BMJ* 2001;322:1233-6.
- 20 Wilkinson RG. Health inequalities: relative or absolute material standards? *BMJ* 1997;314:591-5.
- 21 Kennedy BP, Kawachi I, Glass R, Prothrow-Stith D. Income distribution, socioeconomic status, and self rated health in the United States: multilevel analysis. *BMJ* 1998;317:917-21.
- 22 Wolfson M, Kaplan G, Lynch J, Ross N, Backlund E. Relation between income inequality and mortality: empirical demonstration. *BMJ* 1999;319:953-5.
- 23 Ram R. Further examination of the cross-country association between income inequality and population health. *Soc Sci Med* 2006;62:779-91.
- 24 Larsen LJ. *The foreign-born population in the United States: 2003. Current population reports*. Washington, DC: US Census Bureau, 2004.
- 25 *Summary of population statistics 1960-2006*. Stockholm: Statistics Sweden, 2007.
- 26 Baily MN, Garber AM. *Health care productivity. Brooking papers on economic activity—microeconomics*. Washington, DC: Brookings Institution, 1997:143-215.
- 27 Dunn JR, Burgess B, Ross NA. Income distribution, public services expenditures, and all cause mortality in US States. *J Epidemiol Community Health* 2005;59:768-74.
- 28 Wilkinson RG. *The impact of inequality*. New York: New Press, 2005.
- 29 Simmons RG, Rosenberg M. Functions of children's perceptions of the stratification system. *Am Sociol Rev* 1971;36:235-49.
- 30 Tudor JF. The development of class awareness in children. *Social Forces* 1971;49:470-6.
- 31 Hoff K, Pandey P. *Belief systems and durable inequalities: an experimental investigation of Indian caste*. Washington, DC: World Bank, 2004 (research working paper).
- 32 Steele CM, Aronson J. Stereotype threat and the intellectual test performance of African-Americans. *J Pers Soc Psychol* 1995;69:797-811.
- 33 Peters W. *A class divided: then and now*. New Haven: Yale University Press, 1987.
- 34 Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. Social capital, income inequality, and mortality. *Am J Public Health* 1997;87:1491-8.
- 35 Gilligan J. *Preventing violence*. New York: Thames and Hudson, 2001.
- 36 Wilkinson R. Why is violence more common where inequality is greater? *Ann N Y Acad Sci* 2004;1036:1-12.
- 37 Anderson M, Kaufman J, Simon TR, Barrios L, Paulozzi L, Ryan G, et al. School-associated violent deaths in the United States, 1994-1999. *JAMA* 2001;286:2695-702.
- 38 Leary MR, Kowalski RM, Smith L, Phillips S. Teasing, rejection, and violence: case studies of the school shootings. *Aggress Behav* 2003;29:202-14.
- 39 Pickett KE, Kelly S, Brunner E, Lobstein T, Wilkinson RG. Wider income gaps, wider waistbands? An ecological study of obesity and income inequality. *J Epidemiol Community Health* 2005;59:670-4.
- 40 Kennedy BP, Kawachi I, Prothrow-Stith D. Income distribution and mortality: cross sectional ecological study of the Robin Hood index in the United States. *BMJ* 1996;312:1004-7.

Accepted: 26 September 2007