

# Income inequality and child mortality in wealthy nations

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## ABSTRACT

**Background** Relationships between income inequality and various health indicators have been the subject of much study and some controversy. We investigated associations between child mortality and income inequality amongst the wealthier OECD countries as well as changes in their relative child mortality rankings over time.

**Methods** Data were drawn from the 2003–2006 ‘State of the World’s Children’ reports published by UNICEF; Gini coefficients on income inequality were also used. Pearson correlation coefficients were calculated to investigate associations. Longitudinal child mortality data was used to compare rankings.

**Results** We discovered very strong associations between child mortality and income inequality. In contrast to earlier results, these associations persist when the USA is excluded from the analysis. The countries with the worst child mortality figures were previously singled out in a 1993 UNICEF study on child neglect in rich nations. We also report their worsening child mortality rankings, since 1960, relative to the other OECD countries.

**Conclusions** The results strengthen the existing evidence linking child mortality with income inequality in wealthy nations, and add to the evidence that sociopolitical factors are important in this regard.

## Introduction

There is considerable evidence and academic debate regarding relationships between income inequality and various health indicators including child mortality.<sup>1–6</sup> We show that there is a very strong association between income inequality and under-five child mortality amongst the wealthier OECD countries. It has previously been found<sup>4</sup> that this association largely disappeared when the USA, which has the highest figures within the group for both income inequality and child mortality, was excluded from a similar analysis. We demonstrate, analysing the most recent available data, that the association persists whether or not the USA is included in the analysis.

The wealthy countries which recorded the worst child mortality figures included the USA, UK, Australia, Canada and New Zealand, which were all singled out for criticism in a UNICEF study on child neglect in 1993<sup>7</sup> and each of these countries has seen a marked worsening of their child mortality rankings since 1960.

all of which were drawn from UNICEF’s annual ‘State of the World’s Children’ Reports<sup>8–11</sup> for the years 2003–2006 inclusive, which typically document data two years in arrears. In addition, we calculated correlation coefficients for associations between the Gini coefficient of income inequality and the UNICEF child mortality data.

The U5MR (under-five mortality rate) is defined by UNICEF as the ‘probability of dying between birth and exactly five years of age expressed per 1000 live births’. An ‘income inequality ratio’ (IIR) has been calculated for the purposes of this analysis using data provided in the UNICEF reports. These record the percentage share of national household income received by the 20% of households with the highest, and by the 40% of households with the lowest, incomes. The IIR is the former figure divided by the latter: thus a larger ratio indicates greater inequality. These figures are described by UNICEF as being reported

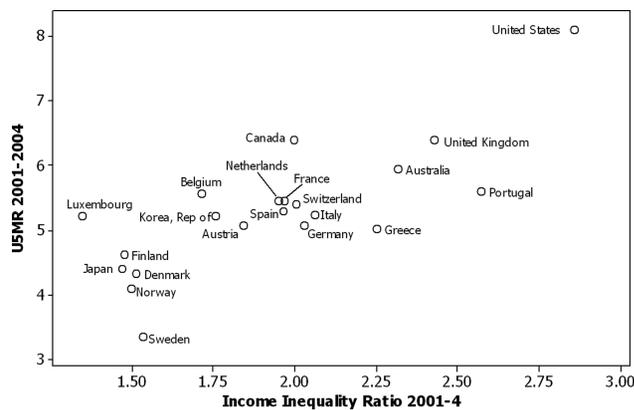
## Data and methods

We calculated Pearson correlation coefficients for associations between income inequality and child mortality data,

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for the most recent year available for any given country within a specified period. For example, for the most recent (2006) Report, the specified time period is 1993–2003. Therefore, like the Gini coefficients, they typically are not provided for a common base year. It has been noted that the Gini coefficient is losing popularity as an inequality measure and that there is no clear consensus about an alternative.<sup>12</sup> Where Gini coefficients have been used they have been drawn from the UN Human Development Report 2005, in which survey years for the countries in question range from 1993 to 2000.

Arithmetic means of the annual data taken from each UNICEF report (U5MR and IIR) have been calculated for the period 2001–2004 to help smooth any short-term variations. Nine OECD countries have been excluded from the correlation analysis: of these, Iceland, Ireland and New Zealand were excluded because of incomplete data relating to the IIR; the others, Czech Republic, Hungary, Mexico, Poland, Slovakia and Turkey, were excluded because their income levels are considerably lower than those of the other countries. While the cut-off point chosen is somewhat arbitrary, it does represent a point below which there is a significant gap in levels of gross national income per capita. This cut-off allows a more ‘like with like’ comparison based on income, although a comparatively wide variation in levels of national wealth is still a feature of the remaining countries. The 21 countries subjected to the statistical analysis appear in Figure 1 and were, in ascending order of their mean U5MR (which is shown in parentheses): Sweden (3.25); Norway (4); Denmark (4.25); Japan (4.5); Finland (4.75); Austria, Germany, Greece (5); Italy, Luxembourg, Republic of Korea, Spain (5.25); Belgium, France, Netherlands, Portugal, Switzerland (5.5); Australia (6); United Kingdom (6.5); Canada (6.5); United States (8).



**Fig 1.** Mean income inequality ratio and under-five mortality rate, for the years 2001–4, for those of the wealthier OECD countries for which full data were available.

## Results

For the 21 countries with available data, the Pearson correlation coefficient showed a strong association ( $p < 0.001$ ,  $r = 0.76$ ) between the IIR and the U5MR. Very similar results were generated when the Gini coefficient was used instead of the IIR ( $p < 0.001$ ,  $r = 0.77$ ). Comparable associations of U5MR and IIR were found for each individual year from 2001 to 2004:  $p$  values for each year were all significant at the 0.1% level while values for  $r$  ranged from 0.62 to 0.78 (and from 0.67 to 0.75 when the Gini coefficients were used).

An earlier investigation<sup>4</sup> of these phenomena amongst a very similar group of wealthy OECD nations noted that associations between infant and early life mortality and income inequality (as measured using the Gini coefficient) ‘largely disappeared when the USA was excluded from analyses ... but an association with low birthweight remained due to high levels of both income inequality and low birthweight in the UK’. The potential of the USA figures to distort such associations has also been emphasised in a review of the literature relating to developed countries.<sup>13</sup>

When the USA was removed from the aggregated 2001–2004 data presented here, a very strong ( $p < 0.001$ ,  $r = 0.63$ ) association was still apparent amongst the remaining 20 countries. A strong association ( $p = 0.005$ ,  $r = 0.57$ ) was also evident when both the US and UK were removed. When, in addition, Canada and Australia were removed, the correlation still showed marked statistical significance ( $p = 0.011$ , and  $r = 0.55$ ).

Some longitudinal data appears in the UNICEF reports, including the U5MR figures for 1960. A striking feature of this data is the relative worsening of the position of the countries highlighted in the UNICEF report cited above, when countries are ranked in ascending order of U5MR (see Table 1). Relative to all the ‘wealthy’ OECD countries (24 in total) these changes in ranking from 1960 to 2001–2004 are as follows (current rankings appear first followed by the 1960 ranking in parentheses): USA 24th (11th); UK 22nd equal (8th equal); Canada 22nd equal (12th); Australia 19th equal (5th); New Zealand 19th equal (7th).

## Discussion

### Main finding of this study

There is a very strong association between income inequality and under-five child mortality amongst the wealthier OECD countries. Within this group the highest child mortality figures are to be found in those “Anglo-American” countries which attracted criticism in 1993 in a UNICEF study on child neglect. Furthermore, since 1960, the relative ranking,

**Table 1** Changing rankings of U5MR amongst the wealthier OECD countries (and income ranking for 2003)

Country	Mean U5MR 2001–2004	Mean 2001–2004 rank	U5MR 1990	1990 rank	U5MR 1960	1960 rank	GNI/cap 2003, \$	GNI rank
Sweden	3.25	1	7	2 =	20	1	28 840	8
Iceland	3.75	2	7	2 =	22	2 =	30 810	7
Norway	4.00	3	9	6 =	23	4	43 350	2
Denmark	4.25	4	9	6 =	25	6	33 750	5
Japan	4.50	5	6	1	40	16 =	33 750	6
Finland	4.75	6	7	2 =	28	10	27 020	10
Austria	5.00	7 =	10	15 =	43	19	26 720	12
Germany	5.00	7 =	9	6 =	40	16 =	25 250	15
Greece	5.00	7 =	11	21 =	64	22	13 720	22
Italy	5.25	10 =	9	6 =	50	20	21 560	19
Korea, Rep of	5.25	10 =	9	6 =	127	24	12 030	24
Luxembourg	5.25	10 =	10	15 =	41	18	43 940	1
Spain	5.25	10 =	9	6 =	57	21	16 990	20
Belgium	5.50	14 =	10	15 =	35	14	25 820	14
France	5.50	14 =	9	6 =	34	13	24 770	16
Netherlands	5.50	14 =	9	6 =	22	2 =	26 310	13
Portugal	5.50	14 =	14	24	112	23	12 130	23
Switzerland	5.50	14 =	9	6 =	27	8 =	39 880	3
Australia	6.00	19 =	10	15 =	24	5	21 650	18
Ireland	6.00	19 =	10	15 =	36	15	26 960	11
New Zealand	6.00	19 =	11	21 =	26	7	15 870	21
Canada	6.50	22 =	8	5	33	12	23 930	17
UK	6.50	22 =	10	15 =	27	8 =	28 350	9
United States	8.00	24	12	23	30	11	37 610	4

based on increasing under-five mortality, of these countries has markedly worsened relative to the others.

### What is already known on this topic

A number of studies have related income distribution to a range of health outcomes within developed countries. These have included inter-country and intra-country analyses: the latter, such as comparisons between states<sup>14,15</sup> in the USA, would arguably help to allay concerns about international variations in data collection and definitions. A systematic review<sup>13</sup> of the literature dealing with the effect of income inequality and macro-level social policy on infant mortality and low birthweight was undertaken by Spencer in 2004. The findings of that review, which drew on a number of studies, were that there was evidence to suggest a statistically significant association between infant mortality and income inequality. However it was also emphasised that this effect may have been because of the disproportionate influence of the USA which has 'exceptionally high income inequality

and poor child health'. While the combination of countries in the cross-national studies varied, the USA was included in all of them and it was suggested that the removal of the USA from the analysis would be likely to lead to the disappearance of the association.

### What this study adds

We have shown that very strong associations between income inequality and child mortality persist when the USA is excluded from the analysis, and, further, that strong associations persist when other countries with relatively high levels of child mortality are also excluded. In addition we have reported two particularly striking features of the data which relate to the countries criticised in the earlier UNICEF report: firstly, as a group, they have the highest child mortality figures amongst the countries whose data have been analysed, and secondly their ranking, when judged by this measure relative to the other countries, has markedly declined over recent decades.

## Limitations of this study

Our tests of association were restricted, due to data availability, to 21 of the 24 countries which we classified as the wealthier OECD countries. The data came mainly from UN reports and we are reliant on their procedures regarding comparability and consistency of the data. The study was limited in terms of scope in that we did not attempt to consider explanations for the differing child mortality figures: but we have acknowledged the growing literature which does address these questions, and which, in particular, acknowledges the relevance of social and economic policies for population health.

## Conclusion

The relationship between health and income inequality has been described as having been 'independently discovered several times'.<sup>16</sup> We approached the area in the context of an exploration of differences in social outcomes for countries with differing approaches to socioeconomic organisation.

Our findings add to existing evidence which suggests that sociopolitical factors are important in determining infant mortality rates.<sup>17–19</sup> In particular, our evidence raises the possibility of a systemic factor relating to those countries identified as having the worst rates of child mortality.

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