

EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

Does an increase of low income families affect child health inequalities? A Swedish case study

S Bremberg

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Study objective: Reduction of health inequalities is a primary public health target in many countries. A change of proportion of low income families might affect child health inequalities. Yet, the importance of family incomes in high income welfare states is not well established. The aim of this study was to investigate the effect of increased percentage of low income families on child health inequalities during an economic recession in Sweden, 1991–1996.

Design: Health inequalities for six health indicators were assessed during the period 1991–1996 and during adjacent periods. Relative inequality indices were estimated according to Pamuk and Mackenback. Appraisal of a child's socioeconomic situation was based on social data for the child's residency area.

Setting: The total population of children and adolescents 0–<19 years old living in Stockholm County, Sweden, was studied. Each one year cohort comprised 20 470–25 420 people.

Main outcome measures: Mortality; rate of low birth weight; days of hospital care for infections, asthma/allergic disorders, and unintentional injuries; and rate of abortions.

Main results: Mortality decreased annually by 6.9%. The average relative inequality index for mortality before the recession was 1.40 and was lower during the recession, 1.14. The remaining five health indicators, and the relative inequality index for these indicators, did not differ significantly between the recession years (1991–1996) and adjacent periods.

Conclusions: Relative health inequalities did not change, or decreased, during the recession years. The findings indicate that the connection was weak between child health inequalities and family incomes, within the frame of time and the range of income changes that occurred during the study period.

Correspondence to:
Dr S Bremberg, National
Institute of Public Health,
Olof Palmes gata 17,
SE-103 52 Stockholm,
Sweden;
sven.bremberg@telia.com

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The social distribution of health has been highlighted during the past decades.¹ This interest has a moral underpinning because large social differences in health are not considered justified. The WHO has established reduction of health inequalities as a primary public health target for Europe.²

Research in this field tries to disentangle the relative importance of income, occupational status, educational level, cultural resources, health behaviours, environmental exposures, etc. The influence of incomes on health is especially important to clarify because income levels might be affected by taxes and transfers. Globally, at an aggregated national level, there is an evident relation between average income and health outcomes, for example, mortality.³ A relation between

income and health has also been demonstrated at the individual level, for example, in the US.^{4,5} Yet, there is a curvilinear relation between income and health.⁶ Thus, the health benefit of an income increase diminishes by increasing incomes. Generally, income seems to be of less significance in high income countries as compared with low income countries.⁷ From a public policy perspective, the strength of the relation between income and health has to be assessed because the potential health gains of transfers have to be balanced by the political and economical costs.

There are four reasons for focusing on children in studies of income and health. Firstly, children are not responsible for their own financial situation. Thus, economical inequalities

Table 1 Gross national product and economical conditions in families with children, Sweden 1991–1999*

Year	GNP per capita growth in real prices (%)	Median annual disposable income per unit of consumption in families with two adults and children 0–17 years (SEK×1000)	Proportion low income families with children (living with disposable incomes below a pre-set norm)	
			Child 0–6 years (%)	Child 7–17 years (%)
1991	–1.1	94.7	7.5	6.3
1992	–1.7		9.2	6.8
1993	–1.8		11	9.6
1994	5.1		11.3	8.2
1995	3.7	85.2	14.9	13.4
1996	0.8		20.0	15.3
1997	2.0		16.3	14.8
1998	3.9		16.2	13.5
1999	3.8	93.7	15.0	8.4

*Statistics Sweden¹² except for proportion of low income families.¹⁴

Table 2 Health indicators studied

Outcome	Age of child	Source	Years covered	Average drop out rate (%)
Mortality	0–<19 years	National Death Registry	1988–1995	10.1
Low birth weight (<2500 g) per 1000 infants	Live born	National Birth Registry	1987–1996	3
Infections* days in hospital care per 1000 children	0–<7 years	National Hospital Discharge Registry	1987–1998	5.4
Asthma and allergic disorders days in hospital care per 1000 children†	0–<7 years	National Hospital Discharge Registry	1987–1998	2.6
Accidental injuries‡ days in hospital care per 1000 children	0–<19 years	National Hospital Discharge Registry	1987–1998	3.6
Abortions per 1000 girls/women	15–<20 years	County Procedures Registry	1993–1998	4.5

*ICD-9: 8–9, 31–41, 47–63, 72–79, 320–324, 372A, 382–383, 421, 460–465, 480–490, 510, 528, 590, 595, 599A, 680–686, 730, after 1997 ICD-10: A08–A09, A37–A49, A84–A87, B00–B09, B25–B34, G00–G07, H10, H66–H67, H70, I33, J00–J22, J39–J40, J85–86, K12, L00–L08, M86, N10–N12, N30, N39.0. †ICD-9: 466, 493, 691, 708, 995A–B, 995D, after 1997 ICD-10: J30, J45–46, L20–L23, L50, T78. ‡ICD-9: E800–E999, after 1997 ICD-10: V00–Y36.

are often considered less fair for children than for adults.⁸ Accordingly, income transfers might be more justified.

Secondly, the level of income seems to be more significant for the health of children than that of adults⁹ and elderly people.¹⁰ Global data are available at a national aggregated level for 1999. In that year, an increase in per capita income from US\$1000 to US\$25 000 (PPP adjusted) was combined with roughly a 95% reduction of infant mortality. In adults (15–59 years), this increase of per capita income reduced mortality by 80%, and at age 60 the expectancy of healthy years (DALE) was reduced by 50%.¹¹ Thus, children seem to be more sensitive than adults to the level of economical resources.

Thirdly, in adults it is possible that individual health will affect income, and not only the reverse. Thus, the direction of a causal relation is not obvious. For children, however, a causal relation is more apparent because family income is less affected by the health of their children than the reverse.

Fourthly, exposures to risk factors during an entire life span affects health.¹² Children have lived a shorter time than adults. An exposure, for example, a certain level of income, will therefore affect child health more directly than health during adulthood.

To investigate the strength of the relation between income and health at the individual level, it is necessary to consider the influence of determinants that are connected with family income, for example, parental education and parental occupational status. This is difficult because most of these determinants are closely connected. Commonly, multiple regression models are used to check for these connected social determinants. The outcome of an analysis is dependent upon the precision of the assessment of the connected variables. The importance of income will be inflated if the precision of the income assessments is high and the precision of the other assessments is low, and vice versa. Moreover, structured relations between the determinants will affect the outcome of the analysis.¹³ Thus, it is apt to also use other study designs.

A period of marked change in distribution income in a nation enables analysis of the health effects of income. Thus, the economical recession in Sweden in the 1990s presents an opportunity to study health effects of varying incomes. During the 1980s, the Swedish gross national product (GNP) grew each year in real prices. During the period 1987–1990 the growth averaged 2.4% (range 1.1%–3.3%). During the period 1990–1993, however, the Swedish GNP diminished 5%,¹⁴ see table 1. After 1993 the economy recovered. The unemployment rate approximately followed the GNP growth rate and peaked in 1993 at the height of the recession. The effects on the economy of families with children peaked three years later, in 1996. The delay was attributable to state credits that in part financed income transfers and subsidised services. During these years, the fraction of low income families almost tripled in families with children 0–6 years old and doubled in families with children 7–17 years old.¹⁵ Yet, most other major socioeconomic characteristics of families with children did not change

much during this decade, for example, proportion of families with different occupations, educational levels, and access to cultural resources.¹⁵ Thus, the period 1991–1996 presents an opportunity to study the effects of an increasing number of low income families, while most other socioeconomic characteristics of families were stable.

During this period, health inequalities in Sweden by socioeconomic status remained broadly unchanged in adults.^{16, 17} This was also true in Finland, which experienced a similar economic recession during the same period.^{17, 18} Considering the weaker effects of income that are expected in adults than in children, it is justified to analyse the effect of this recession on children's health.

The aim of this study was to investigate the effect of increased percentage of low income families on child health inequalities during the period 1991–1996 in Sweden. To assess health during this period, routinely collected data had to be used. Mortality data are useful. Yet, mortality only partially reflects child health in high income countries. Thus, other sources of information have also to be used. Surveys of self reported health are often used in studies of adults.¹⁷ Time series of such data, however, are scarce in childhood. Registers of chronic disorders are also less useful in children as such disorders are uncommon. Thus, less perfect information, like hospital admission rates for selected conditions, have to be used.

METHODS

The *population* that was studied consisted of 12 overlapping sets. Each set contained all children aged 0–<19 years residing in the county of Stockholm during one year. The sets covered the period 1987 to 1998. The total population of the county was about 1.8 million. A one year set embodied on average 23 000 individuals (range 20 470–25 420).

Table 3 Development of mortality and relative inequality index for mortality of children 0–<19 years in Stockholm County 1988–1995. Years with increasing number of low income families with children are shown in bold type

Year	Mortality per 100000 (95% confidence intervals)	Relative Inequality Index
1988	56.3 (48.4 to 64.3)	1.44
1989	62.3 (54.0 to 70.6)	1.46
1990	67.0 (58.4 to 75.5)	1.29
1991	58.3 (50.4 to 66.3)	1.27
1992	52.9 (45.4 to 60.4)	1.21
1993	50.4 (43.3 to 57.7)	1.32
1994	40.2 (33.7 to 46.7)	0.97
1995	33.6 (27.8 to 39.5)	0.95

Key points

- In the period 1991–1996 the proportion of low income families with children in Sweden doubled.
- During this period child mortality decreased while no consistent trend was found for five other health indicators.
- Relative health inequality indices were not consistently affected during this period. The findings indicate that the connection was weak between family incomes and child health inequalities.

Mortality, and five other health indicators from a set of local *health indicators* were studied, see table 2. The set had been developed to support local public health practitioners. Five indicators were available for more than five years. These were included in the study.

Social health inequalities were analysed ecologically at the level of primary health care districts (PHCD). In 1993, the population in the county had been geographically divided into 129 PHCDs, each with an average total population of 14 000. Linking all children's national registration numbers with the population residency register, where enumeration district residency was available, derived information on PHCD residency of all children. Each PHCD was on average made up of five enumeration districts. The linking failed in 1.8%–10.1%, resulting in the drop outs that are presented in table 2. The geographical composition of the PHCDs changed slightly before and after 1993. These changes were not considered.

The method used for analysis of social health inequalities was developed by Pamuk¹⁹ and applied by Mackenbach.²⁰ Each PHCD was given a social rank value. The calculation of rank was done in three steps. In a first step, three socioeconomic

indicators were obtained from Statistics Sweden for each PHCD: the fractions of manual workers in 1990, social welfare recipients in 1993, and immigrants in 1994. All three indicators correlated. A composite socioeconomic indicator was calculated for each PHCD by adding z scores for the three indicators. The PHCDs were then ranked according to this composite socioeconomic indicator. These ranks were transformed into values between 0 and 1; a rank =0 represented the PHCD with the highest rank—that is, the lowest social score—and a rank =1.0 represented the PHCD with lowest rank. In a second step, two variate regression lines were calculated for one year at a time, based on each PHCD's social rank, and the health outcomes that were studied. Adjustments were done for the varying size of the child population in the PHCDs, as described by Mackenbach.²⁰ In a third step, the slope of each regression line was expressed as a relative inequality index (RII). RII was calculated as a ratio according to the formula

$$RII = \text{outcome}_{\text{rank}=1.0} / \text{outcome}_{\text{rank}=0.0}$$

During the period 1991–1996 the median disposable income in families with children decreased and the proportion of low income families increased. This period has been named the recession years for short, and was set apart from the preceding and following years. Differences of the health indicators, the RII of these indicators, and changes of both were tested with Student's *t* test. The *t* tests were performed two tailed. A *p* value <0.05 was considered to be significant.

RESULTS

The mortality rate decreased annually in average by 6.9% during the study period, see table 3. The average RII for mortality before

Table 4 Health indicators: development of outcomes*

Health indicator	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Mean for recession years	Mean for other years	Difference
Low birth weight per 1000 infants	47	48	43	40	46	47	41	45	42	43	–	–	44.0	44.4	<i>p</i> =0.85
Infections: days in hospital care per 1000 children	83	85	76	72	82	84	76	67	60	47	46	38	69.4	66.6	<i>p</i> =0.79
Asthma and allergic disorders: days in hospital care per 1000 children	18	16	11	12	12	13	17	15	14	11	6	6	13.4	11.5	<i>p</i> =0.39
Accidental injuries: days in hospital care per 1000 children	38	30	36	34	29	27	26	26	20	17	15	16	24.4	28.1	<i>p</i> =0.42
Abortions per 1000 girls/women	–	–	–	–	–	–	23	22	21	21	21	20	21.7	20.1	<i>p</i> =0.16

*Recession years are shown in bold type.

Table 5 Health indicators: development of relative inequality indices*

Health indicator	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Mean for recession years	Mean for other years	Difference
Low birth weight per 1000 infants	1.50	1.34	1.28	1.26	1.35	1.07	1.23	1.06	1.50	1.57	–	–	1.30	1.35	<i>p</i> =0.70
Infections: days in hospital care per 1000 children	2.14	1.96	1.55	1.76	1.51	1.81	1.24	1.30	1.34	1.28	1.13	1.68	1.41	1.70	<i>p</i> =0.11
Asthma and allergic disorders: days in hospital care per 1000 children	2.24	1.59	0.76	1.42	1.84	1.45	1.55	1.67	1.38	1.36	1.50	1.60	1.54	1.52	<i>p</i> =0.91
Accidental injuries: days in hospital care per 1000 children	1.27	1.3	1.53	1.45	1.32	1.40	1.20	1.20	1.63	1.08	1.80	1.56	1.30	1.49	<i>p</i> =0.13
Abortions per 1000 girls/women	–	–	–	–	–	–	1.14	1.58	1.59	1.60	1.83	1.32	1.48	1.57	<i>p</i> =0.70

*Recession years are shown in bold type.

the recession (1988–1990), was 1.40. During the recession (1991–1996) the average RII was somewhat lower, 1.14, although not significantly, $p=0.059$.

Aggregations into two year groups, 1988–89, 1990–91, etc, permitted separate analyses of infants, aged 0 years, and children aged 1–<19 years. For infants, the RII in 1988–89, 1990–91, 1992–93, and 1994–95, were 1.51, 1.15, 1.42, and 1.06, respectively, and for children 1–<19 years of age 1.43, 1.51, 1.09, and 0.90, respectively. The average RII during the first two periods (1988–89 and 1990–91)—that is, mainly before the recession was 1.40 and during the recession (1992–93 and 1994–95) somewhat lower, 1.12, although not significantly, $p=0.085$.

The remaining five health indicators varied moderately over the years, see table 4. There were no statistically significant differences for these indicators between the mean values for the recession years and the combined years before and after the recession (1987–1990 and 1997–1998).

The RII for these five indicators also varied moderately, see table 5. There were no statistically significant differences between the mean values for the recession years and the combined years before and after the recession (1987–1990 and 1997–1998). The mean values during the recession years were generally slightly lower than during the remaining years for four of the five indicators.

DISCUSSION

No consistent trend for the development of RII was found during the recession years when the proportion of low income families with children more than doubled. This finding indicates that the connection between child health and family income was weak within the limited frame of time, the limited number of observations, and range of income changes that occurred during the study period.

The social gradient for mortality in 0–<19 year old children in this study, assessed as RII at the beginning of the study period in 1988, was 1.44. A previous Swedish study of infant mortality in 1983–1986 demonstrated an odds ratio of 1.4 for infants of mothers with <10 years compared with >12 years of education.²¹ In another Swedish study of mortality in 1–19 year old children in 1981–1986, an odds ratio of 1.5 was found in children of unskilled workers, as compared with higher non-manual employees.

Most studies of socioeconomic health differences in the Nordic countries concern infant mortality. Increasing socioeconomic health differences, from the 1970s to the 1980s, have been reported in Sweden^{22–23} and Norway.²⁴ During this period, sudden infant death syndrome (SIDS) constituted a significant part of all infant deaths. The social gradient for SIDS is steeper than for most other causes of infant mortality.²¹ In the Nordic countries, the SIDS rate peaked around 1990.²⁵ Thus, the increase of socioeconomic health differences for infant mortality up until 1990 might be explained by the increase of SIDS during this period.²⁶ Consequently, a decreasing social gradient would be expected afterwards. The result in this study is consistent with this expectation.

Only one Nordic study of socioeconomic mortality differences includes children older than 1 year. In 1981–86 the total mortality in Swedish children aged 1–19 years in 1981–86 was found to be 1.5 times higher in children of parents who were unskilled workers compared with children of professionals, higher managerial, and intermediate non-manual employees.²⁷ A similar social gradient was found in this study for the period 1988–91, when the RII averaged 1.47. Yet, a decrease of the RII during the 1990s has not previously been reported.

Limitations and strengths

The fraction of low income families increased during the recession years, as did the rate of unemployment. Although

Policy implications

In a high income country without large inequalities, increase of income transfers might not be effective for short-term reduction of health inequalities in children.

the peak of low income families occurred three years later than the peak of unemployment, it is hard to disentangle their health effects. It is probable that low income and unemployment acted in concert. Yet, no consistent trend was found. An increase of educational level, social support, or access to other resources might have cancelled out a negative effect of decreasing income. Such changes, however, do not take place within a few years' time.

The investigation was based on routinely collected data. The validity of mortality and low birthweight data are probably satisfactory as these registers, the National Death Registry and the National Birth Registry, are carefully corrected. The data in the National Hospital Discharge Registry are less well scrutinised. Yet, no major trends were found for indicators that were derived from this registry.

Change of maternal health care routines might affect the rate of low birth weight. Yet, this rate has been stable in Sweden since the National Birth Registry was established in the 1970s.²⁸ Thus, new medical routines probably have not affected this rate.

In Sweden hospitalisation of children is free of charge and no referral is needed. For children there is only one public system of hospitals and no private sector hospitals. Thus, access to hospital admissions is equal for all socioeconomic groups. Changes of medical practice might evidently affect the overall rate of hospital admissions. In the Swedish system, however, such changes will affect different socioeconomic groups equally. Hospital admission data might therefore be used for the study of socioeconomic gradients in health, although this measure is imperfect for the study of the prevalence of these disorders. A number of previous studies of socioeconomic gradients in children of infections,²⁹ asthma,³⁰ and injuries,^{31–32} have used the Swedish National Hospital Discharge Registry. The influence of varying hospital admission routines on the socioeconomic gradient was considered negligible in these studies. The County Procedures Registry has not previously been used for the study of socioeconomic gradients of abortions. Access abortions is equal in the system. Therefore, this outcome might also be used for the study of changes of the socioeconomic gradient.

An ecological method was used for assessing social gradients of health outcomes. Thus, characteristics of the neighbourhood were used for assigning a social position to a child. This approach is problematic for conclusions of health effects of the social exposure.³³ In this study, however, the ecological classifications were not used for causal inferences. In a residentially segregated area, like Stockholm County, an ecological method might be as sensitive for detection of social health differences as a method that uses parental characteristics, for example, occupation.

The social classification was conducted in the middle of the study period in 1990, 1993, or 1994, while health outcomes were assessed annually. Thus, some social misclassifications might have occurred over the study years. Social misclassifications might be expected to be more common at the start and near the end of the study period and result in a lowered social gradient. Thus, a pattern with a peaking social gradient around 1992 would be expected if misclassifications had been common. Yet, this was not found. Moreover, the social classification did not include assessments of unemployment rates and family incomes. Yet, on aggregated area level, unemployment rates, the rates of low incomes, fractions of manual workers, social welfare recipients, and immigrants all correlate (data not shown). Thus, a socioeconomic effect on health might be expected to be reflected in the RII assessments.

The assessment of economical resources in families with children were based on national data while the child health inequalities were studied in one county only. It was assumed that the economical development for families with children followed the national trend. No data on the economics of families with children were available at county level. Yet, important indicators of the economical crisis followed the same trend in Stockholm County as in Sweden as a whole.¹⁴ Thus, the lack of increase in health inequalities could not be explained by differences in economical development in the study area, as compared with Sweden as a whole.

The study concerned all children aged 0–<19 years. Yet, four indicators only cover parts of this age span. These indicators covered different age groups. Thus, although all indicators did not cover 0–<19 years, the indicators combined ought to reflect this span of ages.

A decrease in family income might affect health after some latency period. The period after 1996 is incompletely described. Thus, such an effect cannot be excluded. Some effects might be immediate. Thus, the rate of accidental injuries might be expected to respond to short-term income changes. This might also be true of income effects on the rates of low birth weight and infections. Socioeconomic conditions, however, also affects development of social and intellectual competencies. These competencies will in turn affect health during the life course.^{34–35} Such latency effects of low income cannot be excluded in this study.

One of the strengths of the study is the use of multiple health indicators, and the study of a total population—that is, no sampling was required.

Interpretation

Investments in social institutions, such as education and social insurance systems, possibly influence the level of health inequalities more than individual incomes.^{7–36} These institutions were quite unaffected during the study period.³⁷ These circumstances might explain why no increase in health inequalities was observed.

Author's affiliations

S Bremberg, Department of Public Health Sciences, Karolinska Institute, Stockholm, Sweden

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