

**Are self-reported health inequalities widening by income? An analysis of British pseudo-birth cohorts born, 1920-1970**

Dr Stephen Jivraj

Research Department of Epidemiology and Public Health, University College London, 1-19  
Torrington Place, London, WC1E 6BT, UK  
Tel: +44 20 7679 1721

[stephen.jivraj@ucl.ac.uk](mailto:stephen.jivraj@ucl.ac.uk) is corresponding author

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## **Are self-reported health inequalities widening by income? An analysis of British pseudo-birth cohorts born, 1920-1970**

### **Abstract**

#### *Introduction*

The health of the British population has been shown to be worsening by self-reported health and improving by self-reported limiting illness for those born before and after 1945. Little is known about the inequality in health difference across British birth cohorts by income.

#### *Methods*

Repeated cross-sections from the British General Household Survey, 1979-2011 are used to create pseudo-birth cohorts born, 1920-1970 and their gender stratified, age-adjusted limiting illness and self-rated health are estimated by household income tertiles. Absolute and relative differences between the poorest and richest income groups are reported.

#### *Results*

Absolute inequalities in limiting illness between the richest and poorest households have doubled in women and increased by one and a half times in men for those born in 1920-22 compared with those born in 1968-70. Relative inequalities in limiting illness increased by a half in women and doubled in men. Absolute inequalities in self-rated health between the richest and poorest households increased by almost half in women and more than half in men and relative inequalities increased by 18% in women and 14% in men for those born in 1920-22 compared with those born in 1968-70.

#### *Conclusion*

Inequalities in self-reported health at the same age by household income have widened for successively later born British cohorts.

#### *What is already known on this subject?*

Health inequalities have been shown to be increasing in Britain since the 1970s by socioeconomic indicators including occupational social class, employment status and education. Less is known about health inequalities by income and whether these are increasing or decreasing across birth cohorts.

#### *What this study adds?*

Inequalities in self-reported health are increasing in later born British birth cohorts. This study suggests policies should act to reduce these inequalities to avoid greater demands in healthcare from those least able to manage their own health in later age.

## Introduction

This paper builds on earlier work showing later born English cohorts in the post war period have better or the same health in relation to limiting illness whereas worse or the same health in relation to general health [1]. The contribution here utilises a British dataset covering a longer time period than previously explored and focuses on whether generational trends in self-reported limiting illness and general health differ by income, thereby testing whether health inequalities are widening in later born cohorts. There is a body of contemporary work showing that health inequalities in Britain by socioeconomic status have widened since the 1970s [2–6]. Much of this literature looks at the difference between cross-sectional time points [5,6] or focuses on the difference between areas by level of deprivation [3,4]. Here an alternative approach is taken to most previous analyses by comparing differences in health by birth cohort of individuals after considering their age. This enables a test of whether later born cohorts had better or worse health compared with older born cohorts by income. The approach provides a clear steer to policy makers on where future demand for healthcare will be likely to come from and thereby for whom interventions could be prioritised. The purpose here is not to demonstrate whether income is or is not a determinant of health.

Surprisingly few UK studies analyse health inequalities by income. Education, occupational social class and employment status are much more commonly used. A study using nationally representative data from the General Household Survey (GHS) in England found an increase in absolute and relative educational health inequalities in women who were aged 30-79 between 1990 and 2010 [2]. Health inequalities were measured using age-standardised prevalence of *less than good* self-rated health and consider the changing size of educational categories over time. A similar study using nationally representative data from the Health Survey for England (HSE) during the period 1996-2009 also reported widening inequalities in self-reported health by occupational social class [5]. The HSE analysis shows how probabilities of reporting *bad* self-rated health remained constant in the highest social classes but increased in the lower classes among men and women aged 16 and over. A separate study using the GHS over the period 1978-2004 did not test for health inequalities per se although it did find increasing prevalence of *poor* self-rated health among the

working age population in Britain after adjustment for employment status, education, housing tenure and car ownership [7]. Another GHS study over a slightly shorter period of time (1979-2000) also found increases in *poor* self-rated health as well as increases in limiting long-term illness over time when controlling for education, housing tenure, social class, income and region [8]. A formal test of inequalities in self-reported health and limiting long term illness by employment status and occupational social class using the GHS found relative stability in the age-standardised prevalence of both self-assessed health measures at two time points (1986 and 1994) in working age men and women [6]. However, among working age men and women in retired or disabled status there were sharp increases in both health measures and sharp declines in female poor self-rated health among those unemployed and in manual occupations. These findings perhaps reflect the changing composition of those in manual occupations and who are unemployed over time. Two further studies take a different approach to the study of health inequalities by comparing employment activity rates by limiting long term illness, both studies find increased disparity for those in lower social class groups compared with higher social class groups [9,10].

This paper adds to the existing body of work demonstrating the health inequalities in Britain over birth cohorts born, 1920-1970. The main hypothesis is that later born cohorts will have greater inequality in self-reported measures of health by income.

## **Methods**

### *Data*

Repeated cross-sections from the GHS, 1979-2011 were used to create pseudo-birth cohorts. These secondary data are available via the UK Data Service and therefore ethical approval was not required for this study [11]. The birth cohorts do not follow the same people over time but provide nationally representative snapshots of people born in each year during the period 1979-2011. The GHS, which was renamed as the General Lifestyle Survey from 2008, was a representative survey of private households in England, Scotland, and Wales [11]. The sample size, excluding children and supplementary interviews conducted to boost the sample in Scotland in selected years, fell from 24,000 in 1979 to

15,000 in 2011. This partly reflects declining response rates over the study period (67-85%) due to refusal to participate among selected households as well as fewer interviews issued in later years [11]. Data was used in this study on individuals born between 1920 and 1970 for those aged 30-59. The selected age range ensured the sample included people of the same age in overlapping birth cohorts. Focusing on the working age population facilitated comparison to much of the existing work on temporal health inequalities.

### *Self-reported health status*

Two measures of self-reported health are used, limiting long-term illness (LLTI) and general health. The latter is referred to as self-rated health (SRH) henceforth. LLTI was measured using a question contained in the GHS that asks 'Do you have any long-standing illness, disability, or infirmity? By long-standing, I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time?'. A binary indicator of LLTI and no LLTI was used. LLTI was missing for 1.9% of the total sample size available during the period 1979-2011 (263,390).

SRH was measured using answers to the GHS question 'Over the last 12 months would you say your health has on the whole been good, fairly good, or not good. SRH, in this form, is only available up to and including the GHS 2007. After 2007 the response categories were altered making it difficult to make comparisons between GHS years. SRH was missing for 6.4% of the total sample size available during the period 1979-2007 (241,996).

Both health measures have been shown to be strongly related to other morbidities and to mortality in the working age population in Britain [2,12,13].

### *Pseudo-birth cohorts*

Sixteen, three-year pseudo-birth cohorts are defined using survey year and single year of age. The oldest cohort in the analysis was born between 1920 and 1922 and the youngest cohort was born between 1968 and 1970. The cohorts are referred to hereafter by their mid-point in the graphical analysis (e.g. the 1941-1943 cohort is referred to as 1942).

### *Household income*

Gross household weekly income was taken as the sum of all adults in the household, including proxy interviewees. The measure refers to income at the time of the interview, and is obtained by summing the components of earnings, benefits, pensions, dividends, interest and other regular payments [14]. The measure was equivalised at 2011 prices using the Retail Price Index [15] and categorised into tertiles using the resulting distribution across GHS years. The equivalisation was derived using the OECD scale [16]. Income was missing for 18.3% of the total sample size available during the period 1979-2011 (263,390).

### *Statistical analysis*

Logistic regression models were estimated for LLTI and ordered logistic regression models were estimated for SRH. Models were stratified by gender and fitted in two steps. The first model for each outcome included terms for age, age square and dummy variables for birth cohort, where the 1941-43 birth cohort was used as the reference category. Age was centred at its mean of 44. The quadratic age term takes account of the non-linear relationship between both LLTI and SRH, and age. The first model shows the descriptive pattern in LLTI and SRH over birth cohorts (see Figure 1). The second model for LLTI and SRH added household income tertiles, where the poorest tertile was the reference category, and an interaction between household income tertile and birth cohort. The interaction provides a test of the main research hypothesis that inequalities in self-reported health were wider in later born cohorts by income. The complete case sample excluded 19.4% and 22.5% of respondents with missing values on the health outcomes or income, or both for LLTI and SRH, respectively. It is important consider that trends over pseudo-birth cohorts may be due to period or cohort effects. There is no attempt here to disentangle these because of the additional assumptions and data that would be required which goes beyond the scope of this paper given its description intentions to demonstrate how the prevalence on self-reported health outcomes differs by birth cohort and income group.

All models were fitted taking into account clustering by GHS year and with robust standard errors. Survey weights were not used in the descriptive or statistical analysis given they were not available prior to 2000. The use of survey weights, when available, did not alter the substantive findings. The estimates from the second model were used to calculate gender specific absolute prevalence rate differences and relative prevalence rate ratios for both measures of health between those in the richest and poorest income tertiles.

## Results

Figure 1 shows the age-adjusted probability of LLTI and *not good* SRH over birth cohort (1920-1970) by gender. The percentage of women at mean age who reported a LLTI was constant over birth cohorts at around 20%. There was a statistically significant trend towards a lower percentage of men reporting a LLTI in later born cohorts at mean age, from 21% for those born in 1920-22 compared with 16% for those born in 1968-70. The percentage of women at mean age reporting *not good* SRH was constant at around 12% for those for those born between 1920 and 1970. The percentage of men at mean age reporting a *not good* SRH was constant over cohorts born between 1920 and 1970 at around 10%.

Figure 2 shows the predicted probability of LLTI over birth cohorts for women and men when taking into account tertiles of equivalised household income at 2011 prices. The proportion of women in the poorest tertile of household income had significantly greater LLTI when born later during the period 1920-70. The greater prevalence of LLTI in later born birth cohorts in the poorest tertiles can be seen in those born up to 1945, where there was an 8-percentage point increase between those born in 1920-22 compared with those born in 1944-46. The predicted probability for women in the middle and richest household income tertiles was constant across the analysed birth cohorts. There was a similar pattern in men, except the increase in the probability of LLTI for those in the poorest income tertile was steeper in those born after the war. Men in the middle and richest income tertiles were significantly less likely to report a LLTI (6 and 5 percentage point respectively) when born in 1968-70 compared with those born in 1920-22.

Figure 3 shows the age-adjusted predicted probability of *not good* SRH over birth cohorts for women and men when taking into account tertiles of equivalised household income at 2011 prices. Women in the poorest household income tertile had a marginally higher probability of not good SRH when born later after 1920. There was a 3-percentage point increase in the probability of *not good* SRH in the poorest income tertile between those born in 1920-22 compared with those born in 1926-27. The predicted probability of *not good* SRH was constant over birth cohorts born between 1920-1970 for those in the middle and richest household income tertiles. Men born after 1945 were significantly more likely to report not good SRH when born later up to 1970 in the poorest tertile of household income. There was a 6-percentage point increase in the predicted prevalence of not good SRH in those born in 1944-46 compared with those born in 1968-70 in poorest income tertile. Men in the middle and richest household income tertiles were marginally more likely to report *not good* SRH when born after 1945.

Table 1 shows the estimated absolute prevalence rate differences and estimated relative prevalence rate ratios for LLTI and *not good* SRH of those in the richest and poorest tertiles of household income by gender for those born in 1920-22 and those born in 1968-70. The absolute and relative inequalities in LLTI and SRH between those in the poorest and richest tertiles of household income for those born between 1920 and 1970 increased in both men and women. Absolute inequalities in LLTI between those in the richest and poorest household income tertiles in later born cohorts doubled in women and increased by more than one and half times in men from a prevalence rate difference of 0.10 and 0.09, respectively, for those born in 1920-22 compared with 0.19 and 0.24 for those born in 1968-70, respectively. The relative prevalence rate ratios in LLTI increased in later born cohorts by almost half in women and doubled in men from 1.76 in women and 1.57 in men to 2.54 in women and 3.15 in men. Absolute inequalities in *not good* SRH increased by 44% in women from 0.07 for those born in 1920-22 to 0.10 for those born in 1968-70 and increased by 58% in men from 0.09 for those born in 1920-22 to 0.14 for those born in 1968-70. The relative prevalence ratios in *not good* SRH increased by 18% in women and 14% in men from 1.84 and 2.40, respectively, for those born in 1920-22 to 2.17 and 2.73, respectively, for those born in 1968-70.

Table 1. Estimated prevalence rate and absolute and relative differences for richest and

poorest household income tertiles, 1921 and 1969 birth cohorts

Birth cohort	LLTI		Not good SRH	
	1921	1969	1921	1969
<i>Women</i>				
Poorest income tertile	0.23	0.32	0.15	0.19
Richest income tertile	0.13	0.12	0.08	0.09
Absolute prevalence rate difference	0.10	0.19	0.07	0.10
Relative prevalence rate ratio	1.76	2.54	1.84	2.17
<i>Men</i>				
Poorest income tertile	0.26	0.35	0.15	0.19
Richest income tertile	0.16	0.11	0.08	0.09
Absolute prevalence rate difference	0.09	0.24	0.09	0.14
Relative prevalence rate ratio	1.57	3.15	2.40	2.73

Notes: refer to Figures 2-3 for trend over all birth cohorts born 1920-70.

## Discussion

The results presented here show a widening in health inequalities by income in later born British birth cohorts, 1920-1970. They point to a greater future demand in health care from people in society who will be least capable of managing their health as they enter ages when morbidity becomes more common. The poorest among these later born cohorts are likely to require more health care sooner in life. In the absence of policy interventions there is likely to be a growing inequality by income in premature mortality given the strength of the relationship between LLTI and SRH and morbidity and mortality. This is doubly important because of the growing size of later born post war baby boom cohorts up to 1972 that will mean there is likely to be more people in poor health irrespective of relative declines in prevalence of LLTI in later born post-war cohorts. More effort is therefore required to assist the poorest in society from becoming increasingly dependent on healthcare as they become older.

The explanation for the increasing of inequalities in self-reported health is due to a multitude of factors explored in literature that is beyond the scope of the analysis in this paper. A notable association with the increase in health inequalities is greater income inequality at the age of peak income for those born later during the period 1920-70. The Gini coefficient rose

sharply from 1979 and has remained fairly constant since the early 1990s [17]. There is a suggestion that increased income inequality is responsible for increases in poor health in Britain in the latter quarter of the 20<sup>th</sup> Century [8]. This could be due to the increased marginalization of the poorest in society who have not shared equally in post war economic growth. A related explanation for increased inequalities in health by income evidenced in the literature is the increased level of economic inactivity in post-war born cohorts [7,9,10], in part, due to processes such as deindustrialisation [18]. The growth of spatial inequity in public and private investment is also likely to affect the health of those living in the more marginalised areas that have been affected by industrial decline [3,4]. Other factors strongly related to income might explain differences in the health of people born after 1945 compared with those born before, include smoking, which has increased in those in the poorest in society [19], and housing tenure, which has become increasingly polarised by social class and likely to become even more so in the future through housing inheritance [20]. A further explanation could be that those in lower income groups born earlier during the period 1920-70 have greater expectations of their own health. This might be due in part to the fact they would have experienced free at the point of use healthcare from an early age or birth, which itself might encourage people to self-define as having poorer health because they know they can expect treatment. Analysis of data using objective measures of health from datasets including the Health Survey for England or British Household Panel Study (and its successor, UK Household Longitudinal Study) could provide more fruitful investigation of this potential change in cultural norms of expectation of health by income.

The use of pseudo cohorts in the analysis in this paper means it is not possible to say anything about the trajectory of health of the same individuals over time or adjust for confounding variables that are likely to be on the causal pathway between income and health (e.g. smoking and housing tenure). Longitudinal cohort data would provide the opportunity to test the relative importance of income as a determinant of health and whether itself is responsible for greater inequalities in health in later born British birth cohorts. Currently, data is not available to test multiple cohorts from nationally representative data in Britain except for those born in selected birth cohorts: 1946, 1958, 1970 and 2001 [21]. The repeated cross-sectional survey data used here from the GHS enables comparison of people born in each year at ages available between 1972 and 2011 and should provide an accurate measure of

health in Britain through time, for the non-institutionalised population. The findings cannot be generalised to those in institutions, however given they represent less than 3% of the British population this limitation is unlikely to change the findings substantially. There is missing data in the GHS that has not been addressed in this study. The most important is the person non-response that was more common in later GHS years and is likely to be related to household income [22]. However, one would expect those disproportionately missing in lower income groups to have worse health and therefore the expectation would be an underestimation of health inequalities in later born cohorts [22]. There was also item non-response in the GHS data used that reduced the sample size of the final model for LLTI by 19% and the final model for SRH by 23%. The use of multiple imputation using variables included in the model as well as others known to be associated with missingness did not substantially alter the findings (analysis not shown here).

In summary, health inequalities by income have widen in those born later during the period, 1920-70

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## Figures

Figure 1. Age-adjusted estimated self-reported health prevalence by health outcome and gender, birth cohorts born 1920-1970

Figure 2. Age-adjusted estimated limiting long-term illness prevalence by gender for tertiles of household income, birth cohorts born 1920-1970

Figure 3. Age-adjusted estimated not good self-rated health prevalence by gender for tertiles of household income, birth cohorts born 1920-1970

