

Title Are income support policies effective in improving health?: do we have the tools to answer the question?

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Abstract

The association between low income and poor health in Western economies is well established. There is less evidence about causality or that policies aimed at providing income support or poverty eradication have any measurable impact on health, although they may be justified on other grounds. This paper reviews the limited experimental evidence in this area and then considers studies that have investigated this issue by exploiting longitudinal or cross sectional data sets.

The existing literature is critically reviewed and some of the difficulties in using existing data bases to explore policy impact are discussed using as an example the British Household Panel Survey. The BHPS is a longitudinal data base (currently 10 years) covering a wide range of socio-economic data and is a useful tool in addressing many policy questions but the health measures included may weaken its relevance in this particular area. The few studies that have used BHPS data in this context have used mortality data or the GHQ-12 as outcome measures. A more recognised health measure, SF-36, has been included in only one wave of data collection to date. This limits its direct use to cross-sectional analysis.

The paper concludes by indicating issues for further research in this area.

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1 Introduction

Over the past decade, there has been a shift in health policy towards placing a greater emphasis on the role of lifestyle and life circumstances in improving health. Evans and Stoddart (1990) identified a gap between the developing research on the wider determinants of health and the focus of health policy, at that time, primarily on issues related to the provision of health care. They argued that this was, at least in part, due to an absence of appropriate models to conceptualise the problems and they set out a comprehensive framework of the determinants of health. However, conceptualising the problems is only the starting point; identifying what to do about them poses even greater challenges.

Although there is evidence of the factors that are associated with poor health status, less is known about the comparative effectiveness of specific policy interventions in improving health and reducing inequalities in health. A recent compilation of the evidence from systematic reviews of research relevant to the 'wider public health' agenda reveals the extent of the gaps in current knowledge (Contributors to the Cochrane Collaboration and the Campbell Collaboration 2000). In respect of interventions to reduce health inequalities, the Acheson Report (Department of Health 1998) and the work of its associated evaluation group (Macintyre et al 2001) have highlighted the paucity of the evidence base.

This paper addresses some of the issues that arise in identifying evidence relating to one factor in health inequalities; poverty or low income. Although the association between low income and poor health is widely accepted, there is little evidence to support the effectiveness of interventions. Evidence reviewed for the Acheson Report identified only one trial relating to income support and the health outcome employed was relatively short-term; effect on low birth weight (Kehrer and Wolin 1979). However, the review adopted fairly restrictive criteria, in terms of study design. Case-control studies, observational studies and modelling of secondary data offer alternative approaches that may provide sufficiently robust evidence for policy purposes.

The current study, which is work in progress, is undertaking a less restrictive systematic search of the literature to identify studies relating income change to health, regardless of design. At this stage, studies that simply relate income and health and the literature on the separate role of income inequality are not being considered. The preliminary findings are discussed in the following sections and a brief overview of some of the literature is given. This separates the studies into those that evaluate a specific intervention and those that examine income change in general. Whilst there is some evidence that income change is associated with health change, the

available literature does not provide robust evidence for the effectiveness of income support, targeted at the least well off, in improving poor health.

As it seems reasonable to assume that a large scale intervention study is unlikely to be mounted in the UK, the use of secondary data sets may be essential in exploring the effect of income support policies. However, these data sets will in themselves present problems. In section 5, the paper moves on to discuss some of the data problems and the underlying issues in the context of the British Household Panel Survey (BHPS). The final section of the paper returns to the question posed in the title. If the evidence of effectiveness does not currently exist, are the tools (methods and data) available to provide a satisfactory answer. Some proposals for developing the research are offered for discussion.

2 Literature review

Search strategy

The scope of the search was kept broad to include all research into the relationship between health and income. This broad search enables studies to be divided into three groups: group 1 studies measure the relationship between income and health; group 2 studies seek to establish the relationship between a change in income to a change in health status; and group 3 studies also look at the relationship between a change in income to a change in health status, but with the change in income due to an intervention. The broad search minimises the risk of missing potentially relevant studies. The eventual aim is to provide a complete overview of the research in this area and emphasise the lack of research into specific policy interventions with regard income. Figure 1 provides an overview of the break down of studies with the terms on the right-hand side being the main factors to be used in extracting and summarising information from the studies. The overview of the literature here focuses only on those studies, which appear to fall into the group 2 and 3 categories.

Only the computerised databases of Medline (1980-2002) and Social Science Citation Index (1980-2002) have been searched at present. The search terms included health status, health disparities, social class, income, poverty, income support, public policy and social support. The search strategy is shown in Appendix 1. The search was restricted to English language studies and excluded developing countries. The reference lists of identified studies are also being searched.

Search results / categorisation

Eight studies have been identified from the computerised databases as belonging potentially to Group 3. The primary studies, one systematic review and one model are: Abbott and Hobby (2000); Danziger et al. (2001); Ensminger and Juon (2001); Johnson et al. (1999); Kneipp (2000), Wolfson et al. (1993), Connor et al. (1999) and Bhatia (2001). This categorisation is based on the study abstracts.

In addition, a report into the evaluation of welfare policy in the U.S. (Moffitt and Ver Ploeg 2000) reviews 14 funded studies that were conducted after a call by the Office of the Assistant Secretary for Planning and Evaluation for changes in policy to be evaluated. The Personal Responsibility and Work Opportunity Act of 1996 introduced the Temporary Assistance for Needy Families (TANF) program and eliminated the open-ended entitlement under the Aid to Families with Dependent Children program. This has been called the most drastic change in the welfare system since its inception (Moffitt and Ver Ploeg, 2000; Kneipp, 2000). One aim of TANF was to reduce the number of welfare recipients by 50% by 2002. In order to achieve this major shift from welfare into work, the onus was on individual states to decide which intervention policies to adopt to achieve this target. This report provides the potential for identifying studies that could be included in group 3. Unfortunately, the report was identified too late for a review of the studies. However, the reform programme identifies transferring from welfare to work as an alternative policy to income support initiatives. In evaluating wider welfare policies, the health benefits from any increase in income need to be distinguished from the health benefit from a change in the source of income.

In group 2 seven potential studies were identified from the computerised search, but only four studies and the model were available for inclusion here. These are Benzeval and Judge (2001); Blakey et al. (2000); Duncan (1996); Lynch et al. (1997), Thiede and Traub (1997) and Cairney et al (1998). Further studies have been identified from the literature review undertaken by Benzeval and Judge (2001), but are not reviewed here.

Within the literature identified by the search were studies that had modelled the expected health benefits from increasing income, based on income / health relationships. These models were also classified according to their use of an intervention. The models attempt to identify the effects of income change but have to be treated with caution because the underlying assumption is that providing the higher income will produce the same level of health as currently enjoyed by persons with that income level.

3 Intervention studies

The study by Kneipp (2000) is the only primary study retrieved for review. Using data taken from 1988 and 1989 of the longitudinal Washington State Family Income Study, Kneipp examined the effect on psychosocial health of women leaving welfare for employment compared with those remaining on the Aid to Families with Dependent Children (AFDC). The analysis aimed to answer two questions: was there any difference in the psychosocial health of women that received welfare for varying amounts of time in a year and was there any difference in the psychosocial health of women that moved from welfare to work? Income was measured by the number of months in a year a woman received welfare in 1988. Three health measures were used: Gecas Self-Evaluation Scale, which is based on self-worth, self-esteem and self-efficacy; Pearlin's Depressive Symptomology Scale, which conceptualises depression as a global indicator of stress and one question specific to perceived emotional support from any source. Confounding was controlled with the use of propensity score matching. Age, income, race, education, job-training status, self-esteem scores, depression scores, number of months Medicaid was received, perceived emotional support and the age of the youngest child were the variables used in determining the propensity score.

Women employed for all 12 months had statistically significant better measures of psychosocial health than those receiving welfare for 7-12 months out of the year. There was no significant difference in depression, self-esteem, self-efficacy or perceived emotional support for those that received welfare for both year one and two compared to those leaving welfare for work in year two.

Reviewing this study revealed that income was not used as an explanatory variable, nor was a change in income measured. The receipt of welfare was being used as a measure of poverty and was being compared with moving into employment. These are not income measures and whilst moving from welfare to work may increase income, the effect on health may also be due to the change in source of income. The inclusion of income change would have made this study more useful in terms of the evidence it might provide for welfare to work policies.

There was no reference to whether the women leaving welfare for work achieved this through a specific intervention, such as subsidies for child-care or job-training programmes. From 1988 the AFDC programme did provide some support to assist with the transition from welfare to work (Moffitt and Ver Ploeg, 2000; Kneipp, 2000). As public assistance history was collected for respondents this information was available, but unfortunately not used in the analysis. Therefore, this does not qualify as a group 3 study. As it is, the study highlights some of the problems associated with conducting a literature review in this area.

Connor et al. (1999) conducted a systematic review of the literature concerned with randomised studies of augmented income and resultant health. They also searched for studies of winners and losers of lotteries. The argument for including such studies was that since these are games of chance, these studies are actually randomised trials of increased income.

Searching computerised databases, contacting relevant authors and searching relevant reports identified ten studies. Of these, five were North American income maintenance experiments. These studies had the potential to be highly informative, but health outcome data were not collected and there were shortcomings in the design and analysis of the studies. A further four studies, two looking at financial assistance for ex-prisoners, one at housing allowance and one lottery study also did not include a measure of health outcome. Only one Canadian study was primarily designed to assess the link between raising people with mental illness above the poverty line and changes to health. Of the 54 participants, 26 were randomised to receive allowances and forgivable loans. All were assigned a sponsor and an advisor from supporting agencies. Health improvements were found for both groups but the small sample size meant that the additional effect of the allowances and loans could not be established.

Bhatia (2001) constructed a model to assess the health improvement of a proposed \$11.00 hourly wage for San Francisco city contractors and property leaseholders. San Francisco State University had already established the number of full-time and part-time workers affected by this policy change, but the characteristics of the employees still had to be ascertained. To ascertain the characteristics of the affected population, data from the Bureau of Labour Statistics for three years were analysed. Specifically workers aged 18-64 years who earned \$5.75 to \$11 per hour and were currently in occupational or industry categories were considered. Income data were then adjusted to current dollars using the urban consumer index and estimated proportions pooled across the three years.

The introduction of such a policy would have implications for the children of affected subjects as well as individuals themselves. To assess the impact of such a policy on the affected population's mortality, preventable hospitalisation, emergency room visits and their children's development a literature search was conducted. Effect measures and their standard errors were taken from the two studies identified.

Expected gain in income and current income of subjects was adjusted to the year of income reported in the study using the consumer price index. Current estimated family income and expected income were then added to the model and the expected changes in health outcomes for full-time and part-time workers as well as their children were estimated.

4 Non-intervention studies

Using data taken from the first six waves of the BHPS, Benzeval and Judge (2001) sought to answer four questions: what effect does including a time dimension have on the association between income and health; is long-term income more important than income measured at one point in time; are persistent episodes of poverty more harmful to health than occasional ones and what effect does income change have on health after income level has been controlled for? When analysing the relationship between income levels and health, income from the first five waves was associated with health in wave six, but when answering questions relating to changes in income over time, all six waves were used. Income was measured by taking the net income of the household available from the BHPS, deflated by the retail price index and then equalised using the McClements scale. These two adjustments take inflation and the differences in the size and composition of households into account. Health was measured by four variables in the BHPS: limiting illness; health problems; General Health Questionnaire 12 and the subjective assessment of health. More details of these health measures are discussed in section 5. Problems with clustering, stratification of the sample selection methods, longitudinal probability selection and attrition weightings were taken into account and logistic regression performed.

Including a time dimension suggests that the main direction of causation runs from income to health. Current income and average income were both significant for health problems but only current income was significant for GHQ 12. People who experienced persistent periods of poverty had the worst health and the greater the increase in income over the six year period the less likely an individual was to report poor health. Further issues are discussed in more detail in section 5.

Data from the German Socioeconomic Panel were used by Thiede and Traub (1997) to examine two hypotheses: income determines life style and living circumstances, which significantly influence health status; and health status determines living circumstances and subsequently income. Income was defined as equalised total net monthly income of a household. Poverty was defined as half the size adjusted median income of the population. Health was defined as need of care, loneliness, optimism, health satisfaction and chronic diseases. Whether a respondent was handicapped and the degree of handicap was also taken into consideration. Mutual influences of the health dimensions were investigated.

The results showed that income changes did influence the health variable the need of care, but health status explains little of the determination of income change. They conclude that their

results provide evidence of both hypotheses and that both lines of effect should be taken into account in a general hypothesis.

A sample of respondents from the Alameda County Study was the basis for Lynch et al's. (1997) research into the cumulative effect of economic hardship on respondents. Data were collected in 1965, 1974, 1983 and 1994. Economic hardship was defined as total household income of less than 200% of the federal poverty level. The number of times net household income from all sources adjusted for household size was less than 200% of the federal poverty level during 1965, 1974 and 1983 was calculated for subjects. This study had the potential to measure income change directly because information was collected on gross household income from all sources for all periods. Health was measured on the basis of physical functioning, psychological functioning and cognitive functioning in 1994. Age, sex, smoking history, consumption of beer, wine and spirits, physical activity and body-mass index were all controlled for.

When subjects reported economic hardship and good or excellent health in 1965, economic hardship was found to be a significant predictor of reduced physical, psychological and cognitive functioning in 1994. This result is supported further by the main result that sustained economic hardship for all periods was strongly associated with reduced physical, psychological, and cognitive functioning in 1994.

The study by Blakey et al. (2000) was found to be outwith the criteria for the study, however, it is included because the results have implications for the use of longitudinal data. The authors used data for 213,695 people taken from the 1995 and 1997 Current Population Survey in the U.S. to discern the potential lag time with which income inequality affects the intermediate factors that affect health. Income inequality was measured by the Gini coefficient. State income inequality and median household income was calculated from 50 states for five different time periods from Current Population Survey data. Health was measured by a self-rated measure of either fair/poor or good/very good/excellent. Age, sex, race and equivalised income were all controlled for. Results showed that income inequality 15 years previously was more strongly associated with self rated health status than the current level of income inequality within a state for people aged 45 years and older.

Cairney et al (1998) developed a number of hypothetical models to ascertain the improved health outcomes of reducing economic disparities of the elderly in Canada. Using data on respondents aged 65 and over from the 1991 General Social Survey on Health conducted by Statistics Canada, six measures of health outcomes were regressed on three indicators of social class (occupation, education and income adequacy). Sex, age, French ethnic origin, marital status, smoking,

drinking, weight, physical activity and church attendance were all controlled for. Only self-rated health, heart disease, respiratory disease and sleeping problems were significantly related between income and health. Income adequacy was significantly predictive across all four measures of health. The measure of income adequacy was created by Statistics Canada and is a five-category variable based upon total household income and the number of individuals living in the household at the time of the survey with the criterion for categories based upon low income cut-offs. Income adequacy for the lowest income group was coded 1 up to the highest group coded 5.

This model was then used to test three hypothetical shifts in income adequacy. The health benefits associated with: moving everyone in the sample to the highest income adequacy group; moving those in the lowest and low income adequacy groups into the middle income group and shifting those in the lowest group into the low income adequacy group.

5 Issues in using secondary data sets

Measurement of health outcomes

One of the most important issues to address is the health outcome measure used in the analysis of income change and health. Different measures may give different results and the choice is restricted by the availability of measures within secondary data sets. The measure chosen needs to be valid and reliable. Whilst mortality data are frequently used in studies of income and health, and provide an unambiguous measure of outcome, there are problems. As far as the population under 65 is concerned, death is a relatively rare occurrence. Large differences in mortality rates between different social groups are based on small differences in absolute numbers and provide little insight into the more general health of the population. The effect of income changes on mortality outcomes is also likely to be very long term.

A number of other health measures are available in secondary data sets. The BHPS is a longitudinal panel that has reported data for 10 years, so far, on a wide range of social and economic variables. Each annual wave has included the following health measures:

- Self assessed health:- 5 categories of excellent, very good, good, fair or poor;
- General Health Questionnaire (GHQ 12): a measure of psychological well-being, originally developed to screen for psychiatric disorders;
- Health problems: - a list of 12 specific problems, as diverse as skin conditions/allergies or chest problems or difficulty in hearing or migraine/frequent headaches, and a category for other problems;

- Limitation on activities due to illness: includes work, housework and activities such as climbing stairs or walking. The form of the questions is different in wave 9, where the same topics are covered by items in the SF-36 health profile.

In one wave (wave 9) the SF-36 health profile was included. This is arguably a better validated measure of general health.

The choice of health measure would be simplified if there were agreement between them or if they produced similar results in relation to income change. One study, which has used the BHPS data from the first 6 waves (Benzeval and Judge 2001), included all four of the measures then available (i.e. not SF-36). Self assessed health and limitation on activity were found to be more strongly associated with the various income and income change measures than either GHQ-12 or health problems. This difference in results may be unsurprising, as it would appear that each of the measures of poor health employed in the study was identifying a different sample. Tables 1 to 3 show the relationship between 3 of the measures, using data from wave 9 of the BHPS and dividing the distribution into binary categories of good and poor health as employed by Benzeval and Judge. In each case, the agreement about good health is better than the agreement about poor health. Thus, for those who self assess their health as fair or poor, more than half are defined as having good health on GHQ-12 (57% Table 1) or by number of health problems (58% Table 3). Similarly, for those defined as having poor health on GHQ-12 (score of more than 3), 61% self assessed their health as excellent, very good or good (Table 1) and 57% had at most 1 health problem.

Limitation on activity was not included in this analysis, as the questions are asked in a different format in wave 9, through the inclusion of the SF-36 health profile. The SF-36 has eight dimensions covering aspects of physical and mental health:

- *Physical functioning* relating to limitations on specific activities due to health (SF36PF);
- *Role limitations* in the past 4 weeks due to *physical* health problems and relating to work or other regular daily activities (SF36RP);
- *Bodily pain* experienced in the past 4 weeks and its impact on work or housework (SF36P);
- *Social functioning* based on the extent to which physical or emotional health has interfered with normal social activities in the past 4 weeks (SF36SF); *General mental health* in the past 4 weeks (SF36MH);
- *Role limitations* in the past 4 weeks due to *emotional* problems and relating to work or other regular daily activities (SF36RE);
- *Vitality, energy or fatigue* in the past 4 weeks (SF36EV); and
- *General health perceptions* (SF36GHP).

The SF-36 data from wave 9 have been analysed in comparison with GHQ-12 scores and self assessed health. The level of agreement between these variables might help to interpret the different results in the Benzeval and Judge (2001) study, if it is accepted that SF-36 is a robust and valid indicator of general health. Also, the fact that SF-36 is only included in one wave to date precludes its use for longitudinal analysis unless one of these other indicators can be used to control for baseline state of health.

Table 4 shows the correlation between each of the SF-36 components and the 2 forms of GHQ-12 scores reported in BHPS. (The first scores each item 0,1,2 or 3 to produce a scale of 0-36 and the second system condenses the item scores into 0 and 1 to produce a scale of 0-12. It is this second form of the variable that is used in Benzeval and Judge). The variables are shown not to be independent but the degree of correlation between them is not particularly high. Unsurprisingly, the best correlation is with the mental health component of the SF-36 profile.

Table 1 Comparison of GHQ-12 and Self Assessed Health

Self assessed health	Good health		Poor health		Row total
	GHQ2<=3	Row %	GHQ2>3	Row %	
Excellent / very good / good	8101	85	1428	15	9529
Column %	87		61		
Fair / poor	1214	57	903	43	2117
Column %	13		39		
Column total	9315		2331		11646

Pearson chi2(1) = 828.3285 Pr = 0.000
 likelihood-ratio chi2(1) = 720.1257 Pr = 0.000
 Cramer's V = -0.2667
 gamma = -0.6168 ASE = 0.016
 Kendall's tau-b = -0.2667 ASE = 0.011

Table 2 Comparison of GHQ-12 and Health Problems

	Good health		Poor health		Row total
	GHQ2<=3	Row %	GHQ2>3	Row %	
Health problems <=1	7508	85	1336	15	8844
Column %	81		57		
Health problems >2	1807	65	994	35	2801
Column %	19		43		
Column total	9315		2330		11645

Pearson chi2(1) = 552.0968 Pr = 0.000
 likelihood-ratio chi2(1) = 504.1298 Pr = 0.000
 Cramer's V = 0.2177
 gamma = 0.5112 ASE = 0.018
 Kendall's tau-b = 0.2177 ASE = 0.010

Table 3 Comparison of Self Assessed Health and Health Problems

	Excellent / very good / good	Row %	Fair / poor	Row %	Row total
	Health problems <=1	8136	90	921	10
Column %	84		42		
Health problems >2	1607	56	1264	44	2871
Column %	16		58		
Column total	9743		2185		11928

Pearson chi2(1) = 1670.1362 Pr = 0.000
 likelihood-ratio chi2(1) = 1465.3924 Pr = 0.000
 Cramer's V = -0.3742
 gamma = -0.7484 ASE = 0.011
 Kendall's tau-b = -0.3742 ASE = 0.010

Table 4 Correlations Between SF-36 Component Scores and GHQ 12

	HLGHQ1 (scale 0-36)		
	ρ^1	Prob > t ²	Number of observations
SF36PF	-0.2237	0.000	11934
SF36RP	-0.2554	0.000	11934
SF36P	-0.2536	0.000	11934
SF36SF	-0.3887	0.000	11934
SF36MH	-0.5825	0.000	11934
SF36RE	-0.3470	0.000	11934
SF36EV	-0.4731	0.000	11934
SF36GHP	-0.3512	0.000	11934
	HLGHQ2 (scale 0-12)		
	ρ	Prob > t	Number of observations
SF36PF	-0.2081	0.000	11934
SF36RP	-0.2786	0.000	11934
SF36P	-0.2488	0.000	11934
SF36SF	-0.4075	0.000	11934
SF36MH	-0.5280	0.000	11934
SF36RE	-0.3756	0.000	11934
SF36EV	-0.4424	0.000	11934
SF36GHP	-0.3198	0.000	11934

Table 5 Mean SF-36 Component Scores by Self Assessed Health State

	Self Assessed Health State				
	Excellent	Very good	Good	Fair	Poor
SF36PF	98	96	93	77	45
SF36RP	97	94	90	67	33
SF36P	93	88	82	64	36
SF36SF	97	95	92	76	42
SF36MH	87	83	79	69	55
SF36RE	98	96	93	80	55
SF36EV	75	68	62	46	28
SF36GHP	93	83	71	46	22

¹ Spearman rank correlation coefficient

² Testing independence of the two variables

The lowest correlations are with physical dimensions of the profile, suggesting that GHQ-12 is limited in scope as a health outcome.

Table 5 reports the mean SF-36 component scores by category of self assessed health. The data are again from wave 9 and relate to individuals aged 18-65. These results lend some support to the grouping used in the binary variable good health / poor health, with distinct differences between the groups self assessed as good and fair. However, it also appears that the category of excellent, very good or good may be more homogeneous than the category of fair or poor, with marked differences in average scores between these groups.

The distribution of SF-36 scores within categories demonstrates this further. Tables 6 and 7 (and figures 2 and 3) provide examples for two of the eight components for SF-36. There are a number of points to note. The component scores are discrete variables, although they are frequently analysed as continuous, and the number of possible values varies between components. In this example, SF-36RP has only 5 possible values, whereas SF-36PF has 21. In both cases, the distribution of total scores is skewed towards the higher end of the distribution and this is also the case with most of the other components. Five of the eight component scores show very high numbers reporting maximum scores. Comparing the distributions for those with 'good' health and 'poor' health, shown in figure 2 and 3, illustrates the similarity in the 3 categories which comprise 'good' health and the difference in the distribution between fair and poor.

Income measures.

Income measures form the other important aspect of the potential of secondary data sets to inform policy analysis. The definition of income, per se, is less problematic apart from the consistency of comparisons across studies using different data. However, there are issues relating to the comprehensiveness of the income data, treatment of taxation and adjustment for household size and composition (household equivalence income). The BHPS contains a full range of income variables and methods of adjusting for taxation and other deductions and for household size have been developed.

The definition of low income or poverty also varies between studies. This is partly a matter of choice relating to the question the study is addressing. Some studies divide the income distribution into groups (deciles or quintiles), whilst others concentrate on low income versus high income. Different low income or poverty thresholds are applied in different countries and at different times, although the standard being adopted across the EU is 60% of median household equivalent income before housing costs. The inclusion or exclusion of housing costs has been a

Table 6**Distribution of SF-36 role limitations due to physical health.**

SF36RP	Self assessed state of health					
	Excellent	Very good	Good	Fair	Poor	Total
0	30	101	189	245	200	765
25	18	42	91	138	43	332
50	13	61	89	91	24	278
75	26	87	158	107	19	397
100	1513	2831	2571	711	84	7710
Total	1600	3122	3098	1292	370	9482

Table 7**Distribution of SF-36 physical functioning**

SF36PF	Self assessed state of health					
	Excellent	Very good	Good	Fair	Poor	Total
0	2	2	0	8	36	48
5	0	2	1	10	18	31
10	1	0	1	8	12	22
15	0	2	3	14	18	37
20	0	0	7	16	28	51
25	1	1	12	19	20	53
30	1	2	10	28	22	63
35	0	2	8	21	16	47
40	0	2	6	34	16	58
45	4	3	17	35	26	85
50	2	4	14	31	19	70
55	1	5	27	46	13	92
60	3	9	31	34	13	90
65	3	11	39	44	12	109
70	3	19	38	65	16	141
75	5	38	56	66	11	176
80	10	35	112	73	22	252
85	18	105	145	97	10	375
90	41	175	296	117	11	640
95	146	483	581	177	14	1401
100	1358	2215	1690	345	17	5625
Total	1599	3115	3094	1288	370	9466

point of some controversy, in terms of whether it acts as a proxy for regional cost of living differences. The BHPS data allow income to be calculated both with and without housing costs.

The relationship between income and health

The relationship between income, income change and health, in terms of the shape of the curve and the effect sizes that may be expected, has an important influence on the interpretation of available evidence and the design of future studies. Benzeval and Judge (2001) demonstrate that the relationship between income and health is nonlinear, with a particularly big increase in the odds of reporting poor health for the bottom 40% of the income distribution. However, they analyse the impact of income change across the whole income distribution. They find a significant negative association between income change and the probability of reporting poor health but for all measures except GHQ-12, the effect is weaker than the effect of initial income. It is possible that small effects elsewhere in the income distribution are diluting a stronger effect of income change on those with the lowest incomes.

The interpretation of the results on income change is further complicated by the finding that, whilst large reductions in income (more than 30%) are significantly associated with poor health, the relationship between large increases in income and health is not significant. Again, there is a problem in not knowing where the impact of these large increases is being felt. Another issue to take into account is the time period over which income change takes place. The effect on health may depend both on the length of time between income increasing and the health outcome being measured and the accumulated period over which the income change takes place.

Finally, there is need to distinguish between movements along the income / health curve and shifts in the curve. It is not sufficient to use an association between income and health to infer that the health state of low income persons would be the same as higher income persons if they were provided with the same income. Longitudinal studies of the impact of income change are the appropriate method for exploring the effect of income support but the analysis needs to be focussed on the low income group.

Conclusions and further research

The literature search and critical review are only at the initial stages but the papers identified to date do not suggest that the intervention literature will be substantial. Studies of income change and health may be slightly greater in number but their relevance to the main question of interest may be limited. Most, if not all, of the best of these studies have considered the relationship

between income change and health across the whole range of income and not specifically for the least well off. Therefore, even robust and positive findings for the effect of income change on health do not provide direct evidence that, by itself, income support for the least well off improves the health of this group.

The focus on income change as the indicator of interest is based on the view that more robust evidence can be derived from the examination of shifts in the income and health curve rather than movements along the income and health curve. This necessarily implies that the analysis is restricted to evaluating marginal changes in income rather than the effect of total income support. This may be reasonable, as it is more likely that policy decisions will be concerned with marginal shifts in income support.

The BHPS data set does offer some potential for exploring the effect of income support policies on health but the consequence of focusing on income change in those on low incomes may result in insufficient numbers for the analysis to be conclusive. This is an empirical question that remains to be explored. The accumulation of further years of the panel will allow data to be analysed over longer periods than the six years included by Benzeval and Judge (2001), which may be important in the context of the time lags that may exist between income change and health improvement. However, a key issue in using the BHPS data set for longitudinal analysis remains the choice of health measure.

If the analysis of longitudinal data on income change and health gain affecting those on low income should fail to provide robust evidence to support welfare policy, then an alternative approach to unravelling the evidence might be to adopt a quasi-medical model and consider the stages or mechanisms by which an income increase will result in health change. In this approach, other lifestyle and life circumstances influences would be treated as mediating factors rather than confounders. This may be an appropriate model, as income can clearly act as a proxy for several other factors. The stages to be investigated would be:

the effect of the income support or welfare policy on income;
the impact of income change on consumption patterns and life circumstances; and
the effect of changes in consumption patterns and life circumstances on health.

This approach might exploit different data sets in the exploration of the various stages between income change and health gain.

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Appendix 1 Search strategies

MEDLINE (Ovid)(1980- ; limited to English language)	MEDLINE (Ovid)
Search Strategy for 'Health and Income'	Search Strategy for Interventions (for income and health)
1. *health status/	1. health status/
2. *health status indicators/	2. health status indicators/
3. (health adj3 inequal\$).tw	3. (health adj3 inequal\$).tw
4. (health adj3 disparit\$).tw	4. (health disparit\$).tw
5. or/1-4	5. or/1-4
6. exp *income/	6. exp income/
7. *Poverty/	7. income tax/
8. *poverty areas/	8. Poverty/
9. *Socioeconomic Factors/	9. poverty areas/
10. or/6-9	10. social class/
11. 5 and 10	11. or/6-10
12. news.pt	12. public policy/
13. letter.pt	13. exp public assistance
14. 12 or 13	14. exp social welfare
15. 11 not 14	15. social support/
16. developing countries/	16. social justice/
17. developed countries/	17. "SUPPORT, NON-U.S. GOV'T"/ or "SUPPORT, U.S. GOV'T, NON-P.H.S."/ or "SUPPORT, U.S. GOV'T, P.H.S."/
18. 16 not (16 and 17)	18. income maintenance.tw
19. 11 not 18	19. (income adj3 maintenance).tw
	20. (income adj3 subsid\$).tw
	21. (income adj3 support\$).tw
	22. (poverty adj3 eradicat\$).tw
	23. (poverty adj3 reduc\$).tw
	24. (poverty adj3 lower\$).tw
	25. or/12-24
	26. 5 and 11 and 25
	27. news.pt
	28. letter.pt
	29. 27 or 28
	30. 26 not 29
	31. developing countries/
	32. developed countries/
	33. 31 not (31 and 32)
	34. 30 not 33

Social Science Citation Index (Web of Science)(1981- ; limited to English language)

(health status or health inequalit* or health disparit*) and (income or poverty or socioeconomic status) and (maintenance or subsid* or support or assist* or benefits or social welfare or social security or policy or intervention* or initiative* or program*)

Figure 1



