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Published: 08/08/2018

*Document Version*  
Peer reviewed version

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*Citation for published version (APA):*

Yagnik, A., McCartney, G., Robinson, M., Hearty, W., Armour, G., & Collins, C. (2018, Aug 8). The health impacts of changes in individual or household income: a systematic review.

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*Published in:*  
SSRN Electronic Journal

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*Document Version*  
Early version, also known as pre-print

[Link to publication on the UWS Academic Portal](#)

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Manuscript Number: THELANCET-D-18-04153

Title: The health impacts of changes in individual or household income: a systematic review

Article Type: Article

Corresponding Author: Dr. Gerry McCartney, MD

Corresponding Author's Institution: NHS Health Scotland

First Author: Anmol Yagnik

Order of Authors: Anmol Yagnik; Gerry McCartney, MD; Mark Robinson, PhD; Wendy Hearty, MPH; Gillian Armour; Chik Collins, PhD

Abstract: Background

Income is a centrally important determinant of population health, yet the health impacts of changes to income are unknown. This study aimed to systematically review the available literature to clarify the health impact of changes to individual or household income.

Methods

We undertook a systematic review, critical appraisal and narrative synthesis. We searched seven databases and the grey literature. The exposure of interest was any change in individual or household income and we included studies with any general health or mortality outcome. We limited the review to longitudinal studies with a non-unexposed comparison group and excluded studies considering only specific health outcomes. There were no restrictions to the time period or populations of interest.

Findings

We screened 7,283 citations and identified 19 high quality studies for inclusion. Fourteen examined the impact of secular changes in income and generally found that increased income led to increased self-assessed health. The impact of inheritances or lottery wins was uncertain but generally positive. Changes in income in the context of social security changes had mixed impacts on health.

Interpretation

Increased income over time is associated with increased self-assessed health but there is an absence of evidence of the impact on mortality. There is a need for studies of the impacts of changes in individual income on mortality and for evaluations of changes in policy that affect incomes.

# The health impacts of changes in individual or household income: a systematic review

Anmol Yagnik<sup>1,2</sup>, Gerry McCartney\*<sup>3</sup>, Mark Robinson<sup>3</sup>, Wendy Hearty<sup>3</sup>, Gillian Armour<sup>3</sup>, Chik Collins<sup>2</sup>

\* Corresponding author: Gerry McCartney, Meridian Court, 5 Cadogan Street, Glasgow, G2 6QQ, [gmccartney@nhs.net](mailto:gmccartney@nhs.net), +44 141 414 2750.

<sup>1</sup> Faculty of Health, York University, 4700 Keele Street, Toronto, Canada.

<sup>2</sup> School of Media, Culture and Society, University of the West of Scotland, High Street, Paisley, Scotland.

<sup>3</sup> Public Health Science Directorate, NHS Health Scotland, Meridian Court, 5 Cadogan Street, Glasgow, Scotland.

## **Abstract**

### **Background**

Income is a centrally important determinant of population health, yet the health impacts of changes to income are unknown. This study aimed to systematically review the available literature to clarify the health impact of changes to individual or household income.

### **Methods**

We undertook a systematic review, critical appraisal and narrative synthesis. We searched seven databases and the grey literature. The exposure of interest was any change in individual or household income and we included studies with any general health or mortality outcome. We limited the review to longitudinal studies with a non-unexposed comparison group and excluded studies considering only specific health outcomes. There were no restrictions to the time period or populations of interest.

### **Findings**

We screened 7,283 citations and identified 19 high quality studies for inclusion. Fourteen examined the impact of secular changes in income and generally found that increased income led to increased self-assessed health. The impact of inheritances or lottery wins was uncertain but generally positive. Changes in income in the context of social security changes had mixed impacts on health.

### **Interpretation**

Increased income over time is associated with increased self-assessed health but there is an absence of evidence of the impact on mortality. There is a need for studies of the impacts of changes in individual income on mortality and for evaluations of changes in policy that affect incomes.

### **Funding**

AY was granted a Global Health Travel Award by York University of \$4,000 (CAD) to travel to Scotland and work on this project.

### **Keywords**

Systematic review, income, health, mortality, self-assessed health.

## **Research into context**

### **Evidence before this study**

Income and poverty are recognised determinants of health and operate at individual and social level, with greater income associated with better health within and between populations. There is some evidence that income transfers in low and middle-income countries positively influence some health outcomes but the evidence is sparse and at risk of bias.

### **Added value of this study**

This systematic review synthesises the available evidence on the health impacts of changes in individual or household incomes. There is high quality evidence that secular increases in income lead to increases in self-assessed health. The impact of inheritances and lottery wins is uncertain and the impact of changes in income associated with social security changes is mixed.

### **Implications of all the available evidence**

Income is a fundamental determinant of health and increasing income is an important means of improving health for those in poverty. Reducing income inequalities is important in reducing health inequalities.

## Introduction

Income is an important determinant of health.<sup>1,2</sup> The absolute level of income available to individuals and families, and how this compares to others such that it facilitates or hinders participation in society (relative poverty),<sup>3</sup> impacts on health through a range of material, social and psychological mechanisms. The level of income at national level also matters. Countries with higher average incomes have longer life expectancies, although the relationship is non-linear such that the impact is much greater at lower levels of income.<sup>4</sup> It has also been shown that a more unequal distribution of income within countries is associated with lower mean life expectancy and a range of other negative social outcomes.<sup>5</sup>

In addition to the impact of income on mean population outcomes, inequalities in income (and power and wealth) are important determinants of health inequalities within countries.<sup>2,6-9</sup> On the available measures, inequalities in mortality have tracked trends in income inequalities in both Great Britain and the USA, providing evidence that narrowing income inequality could be an effective means of reducing health inequalities.<sup>7,10,11</sup>

There are many studies which examine the association between income and health cross-sectionally. Health outcomes are almost always better amongst those with higher incomes and those living in the least deprived circumstances, with a stepwise gradient across the population.<sup>6,12,13</sup> The causal nature of the income-health relationship has been studied extensively, with other explanations such as reverse causality and confounding by health behaviours being discounted.<sup>14-16</sup> However, it is not clear how substantial changes in health may be for a given change in income, or the extent to which any change is dependent on *how* incomes change (e.g. due to a change in employment, due to secular trends in pay, as an unconditional income supplement, etc.). Nor is it clear how dependent change may be on contextual political economy or lifecourse stage.

The best existing reviews consider the health impacts of income supplements in low and middle-income countries and of in-work tax credits (IWTCs).<sup>17-19</sup> These found: that unconditional cash transfers (UCTs) may improve some health outcomes but findings were uncertain;<sup>17</sup> that UCTs in the context of disasters may be effective but again was uncertain;<sup>19</sup> and that the evidence for the impact of IWTC on health was sparse and at high risk of bias.<sup>19</sup>

Recent attempts to quantify the likely impact of policy changes that would impact directly on incomes have suggested that increasing the minimum wage to a higher level, increasing the value of social security benefits, and providing more employment, would be substantially more effective at reducing mortality inequalities and reducing mean population mortality than interventions targeting individual behaviours.<sup>20</sup> Attempts to compare the impact of exposures across the social determinants of health, and in particular the impact of changes to income, have been limited by an absence of synthesised evidence.<sup>21</sup>

This study seeks to address this gap by systematically reviewing the literature to synthesise all relevant work which considers the impact of changes to individual or household income on subsequent health outcomes.

## Methods

We report this review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA).<sup>22</sup> The protocol for the review was agreed in advance of the searches

undertaken and was published on the PROSPERO register (see [https://www.crd.york.ac.uk/prospero/display\\_record.php?RecordID=86115](https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=86115), PROSPERO 2018 CRD42018086115). No changes were made to the protocol during the study.

The following databases were searched with the aid of an experienced librarian: Web of Science, ASSIA and Proquest Public Health (PPH) databases, Social Services Abstracts and Sociological Abstracts, Medline, Cochrane library and psychINFO. In addition, information was retrieved from the following grey literature domains using Google advanced search: Academic Institutions, Public Health England, Scottish Government and local authorities, and third sector organizations. No restrictions were placed on the publication period and all searches were undertaken in English. The full search strategies are provided in the appendix.

The exposure of interest was a change to individual or household income, with no restriction placed on the cause of the change in income. All aspects of general health were included as an outcome measure including search terms such as “well-being” and “mortality”. Studies including only specific measures of health (e.g. cause-specific mortality, hospital admissions or specific diseases or illnesses) were excluded to keep the size of the review manageable. Studies measuring “well-being” and “life satisfaction” as proxies for happiness were also excluded, as we were only interested in general health outcomes. Eligible study types were longitudinal studies (i.e. randomized controlled trials, controlled trials, cohort/panel studies with repeated exposure measures). Reviews that included relevant studies were used to identify individual studies of interest, but were not themselves included. Repeat cross-sectional studies or ecological studies in which individuals cannot be followed over time were excluded. It was required that studies had a comparator group for whom the change in income had been different, in order to differentiate the impact of changes in income from other exposures. There were no restrictions placed on the time or populations of interest.

All references from research databases were uploaded into the Covidence software package and independently screened by two reviewers. Conflicts over inclusion were resolved through discussion. Narrative and quantitative data were extracted in summarized form by one reviewer and checked by another. The quality of individual randomized and cluster randomized trials was assessed using the Cochrane risk of bias tool,<sup>23</sup> whereas the critical appraisal tool outlined in Appendix 3 of Joyce (2010)<sup>24</sup> was used for non-randomized studies. The full list of questions for each tool can be found in the protocol. The data were synthesized categorically by the category of increased income and greater weight was given to higher quality studies.

## Results

A total of 7,283 references were screened, with 19 studies included in the final synthesis (Figure 1). Almost all studies were panel or cohort studies with only one randomised controlled trial. Most studies were from high income countries (8 from Europe, 9 in USA, 1 in Canada and 1 in Malawi) and dated from the late 20<sup>th</sup> Century onwards. Most studies used self-assessed health as an outcome measure, three used parent reports of child general health, two used all-cause mortality and one used the standardized index of ill-health (SIDH), which was constructed using information from health systems and morbidity measures. The quality of the included studies was generally very high with most studies meeting nearly all of the critical appraisal criteria thresholds. The diversity in the exposure data precluded any statistical synthesis of the results.



Fourteen of the included studies considered secular changes in household or individual income which were unrelated to specific policy interventions or events, and which used others in the population for whom incomes did not change as the comparison group (Table 1). Ten of these found that changes in income and either self-assessed or parental-assessed health moved in the same direction.<sup>25-34</sup> Two studies did not show any association between change in income and self-assessed health.<sup>35,36</sup> Two other studies yielded contradictory findings: one found that people who experienced the greatest changes in income (positive or negative) experienced relatively high mortality rates compared to those who did not;<sup>37</sup> whilst the other found that people moving into poverty and people moving out of poverty both had a relative improvement in their self-assessed health.<sup>38</sup> In the latter study, the improvements in health for those moving out of poverty was restricted to African-Americans, better educated and younger people.<sup>38</sup> Although there is consistent and high quality evidence that a secular increase in income leads to better health, the size of the effect is not easily synthesised as there is a wide range of measures for the exposure data, in addition to the potential influence of differences in the impact across contexts and population strata.

Three studies looked at the health impacts of income arising from lottery wins or inheritances (Table 2). All three were high quality studies, but none found changes in self-assessed health, life expectancy or mortality that were large enough or precise enough to be measured (although in two of the three studies the direction of effect was in favour of health improving).<sup>30,39,40</sup>

There were four studies which looked at the health impacts resulting from changes in income in the context of a change in the benefits system (Table 3). The general quality of the studies was high although two may be subject to biases in the estimated effects between the intervention and comparison groups.<sup>41,42</sup> Two studies looked at the impact of increases in the Earned Income Tax Credit in the USA, finding that it generally improved self-assessed health for mothers<sup>41</sup> but with a smaller and imprecise effect on low income adults more generally.<sup>36</sup> As part of a study of a wide range of outcomes following increased child benefits in Canada, no change in general child health was found, but for boys only parental-assessed health worsened.<sup>42</sup> There was one high quality randomised controlled trial which compared two social security policies. For those randomised to the new programme, there was increased income and employment but no change in mortality.<sup>43</sup>

**Table 1 - Studies considering secular changes in household or individual income**

Study	Critical appraisal <sup>a</sup>	Context	Outcome <sup>c</sup>	Effect of increased income <sup>b</sup>	Summary of findings
Bævre 2014 <sup>37</sup>	1 2 3 4 5 6 7* 8 9	Norway 1968-1990 (income) & 1990-2002 (mortality) Men aged 50-69y	Mortality	0	Groups with the most variation in income had higher mortality. Mortality increased by just as much regardless of whether the income variation was dominated by falls or increases.
Binder 2010 <sup>35</sup>	1 3 4 5 6 7 8 9	Britain 1991-2005 Adults aged 16+y	SAH	↔	No significant association was observed between change in log income and change in SAH over the subsequent 3 years.
Chin 2010 <sup>25</sup>	1 2 3 4 5 6 7 8 9	Malawi 2004-8 Adults aged 15-49y	SAH	↑	A 10% increase in income (as approximated by expenditure) was associated with a 0.4 or 0.8 unit increase in self-assessed health (on a scale of 1-5).
Coley 2014 <sup>26</sup>	1 2 3 4 5 6 7 8 9	USA 1999-2005 Low income mothers	SAH	↑	Increased wages were associated with greater income and SAH with a 0.41 standard deviation income increase associated with a 0.39 standard deviation SAH increase.
Frijters 2005 <sup>27</sup>	1 2 3* 4 5 6 7 8 9	Germany (E) 1990-2004, (W) 1982-2002) Adults 18+y	SAH	↑	A 1 log point increase in income led to a 0.083, 0.067 and 0.088 point improvements in health satisfaction for East German men, West German men and West German women respectively, with no impact for East German women.
Haliday 2017 <sup>28</sup>	1 2 3 4 5 6 7 8 9	USA 1984-1993 Married adults 25-60y	SAH	↑	A \$10,000 increase in income led to a 0.46 and 2.61 percentage point increase in the probability of being in good health in men and women respectively; with the impacts greatest amongst low income men and high income women.
Jones 2011 <sup>29</sup>	1 3 4 5 6 7 8 9	Germany 1984-2005 Adults 16+y	SAH	↑	A €5,000 increase in income increases the likelihood of better than bad health by 22 percentage points. The effects are bigger amongst older adults and those with lower incomes.
Larrimore 2011 <sup>36</sup>	1 2* 3 4 5 6 7 8 9	USA 1992-2005 Low income adults 22-62y	SAH	↔	Increased income of \$1,000 is associated with an average marginal effect of 0.154 percentage point increase in the likelihood of being in excellent health and 0.025 percentage point decline in the probability of being in poor health, but these could have been due to chance.
Lindahl 2002 <sup>30</sup>	1 2 3 4 5 6 7 8 9	Sweden 1968-1981 15-75y	STDH & LE	↑	An increase in income by 10% increases a standardised index of ill-health (the STDH) by 0.01-0.2 standard deviations, and life expectancy by 5-8 weeks.
McDonough 2005 <sup>38</sup>	1 2 3 4 5 6 7 8 9	USA 1968-1996 (income) & 1984-1996 (health) Adults	SAH	0	Health declined as the population aged, and most quickly for those with any history of poverty. Those who became poor or who moved out of poverty had a slower decline in health. There were interactions with other population characteristics such that leaving poverty improved health only for African-Americans, better educated and younger members of the sample.
McKenna 2017 <sup>31</sup>	1 2 3 5* 6 7 8 9	UK 2008-2012 Children aged 6-	Parent reported	↑	The relative risk of a fair/poor score was 1.62 (95% CI 0.98 to 2.70) for children in households that became income poor compared to those who did not become income

		12y			poor. The relative risk was 1.44 (95% CI 0.79 to 2.62 after adjustment for ethnicity, new lone parenthood, maternal education and parental age).
Meer 2003 <sup>32</sup>	1 3 4 5 6 7 8 9	USA 1984-1999 Adults	SAH	↑	For each US\$1m wealth increase over a 5 year period, the probability of being healthy increased by 9.5 percentage points.
Van Ourti 2009 <sup>33</sup>	1 2* 3 4 5 6 7 8 9	13 EU states 1994-2001 Adults aged 16+y	SAH	↑	The marginal effect of income on health was positive and greatest for those on the lowest incomes.
Wolf 2017 <sup>34</sup>	1 2 3 4 5 6 7 8 9	USA 2008-2011 Children aged 3-5y	Parent reported	↑	Reduced income was associated with worse parentally-assessed child health on a 5 point scale (b = -0.016, p< 0.05) with greater negative effects for mothers with less education. Other changes in income were not clearly related to health outcomes.

<sup>a</sup> The critical appraisal was coded as follows: presence of a representative sample = 1; appropriate control group used = 2; baseline response greater than 60% = 3; follow-up response greater than 80% = 4; non-response and drop-out adjusted for = 5; conclusions substantiated by date presented = 6; majority of confounders adjusted for = 7; evidence of protection from contamination = 8; appropriate statistical tests used = 9 (\*denotes that a criterion was partially met).

<sup>b</sup> ↑ = change in income associated with change in health in same direction (i.e. increase or decrease in both); ↔ = change in income associated with no change in health or the change was insignificant at p=0.05; ↓ = change in income associated with change in health in opposite direction; O = other income-health relationship.

<sup>c</sup> SAH = self-assessed health, STDH = Standardised Index of Bad Health; LE = life expectancy.

**Table 2 - Studies considering changes due to lottery winnings and inheritances**

Study	Critical appraisal <sup>a</sup>	Context	Outcome <sup>c</sup>	Effect of increased income <sup>b</sup>	Summary of findings
Apouey & Clark, 2015 <sup>39</sup>	1 2 3 4 5 6 7 8 9	Britain 1996-2008 Adults 16+y	SAH	↔	There was no evidence of a correlation between lottery wins and health.
Kim & Ruhm, 2009 <sup>40</sup>	1 2 3 4 5 6* 7 8 9	USA 1992-2006 Adults aged 51-61y and their spouses	SAH and mortality	↔	There was no evidence that inheritances >\$10,000 reduce mortality. There was some evidence of an associated improvement in SAH but the estimates were imprecise.
Lindahl, 2002 <sup>30</sup>	1 2 3 4 5 6 7 8 9	Sweden 1968-1981 Adults 15-74y	STDH and LE	↔	The impact of increased income from lottery wins and STDH and life expectancy was positive but uncertain.

<sup>a</sup>The critical appraisal was coded as follows: presence of a representative sample = 1; appropriate control group used = 2; baseline response greater than 60% = 3; follow-up response greater than 80% = 4; non-response and drop-out adjusted for = 5; conclusions substantiated by date presented = 6; majority of confounders adjusted for = 7; evidence of protection from contamination = 8; appropriate statistical tests used = 9 (\*denotes that a criterion was partially met).

<sup>b</sup> ↔ = change in income associated with no change in health or the change was insignificant at p=0.05.

<sup>c</sup> SAH = self-assessed health, STDH = Standardised Index of Bad Health; LE = life expectancy.

**Table 3 – Studies considering changes in benefit payments**

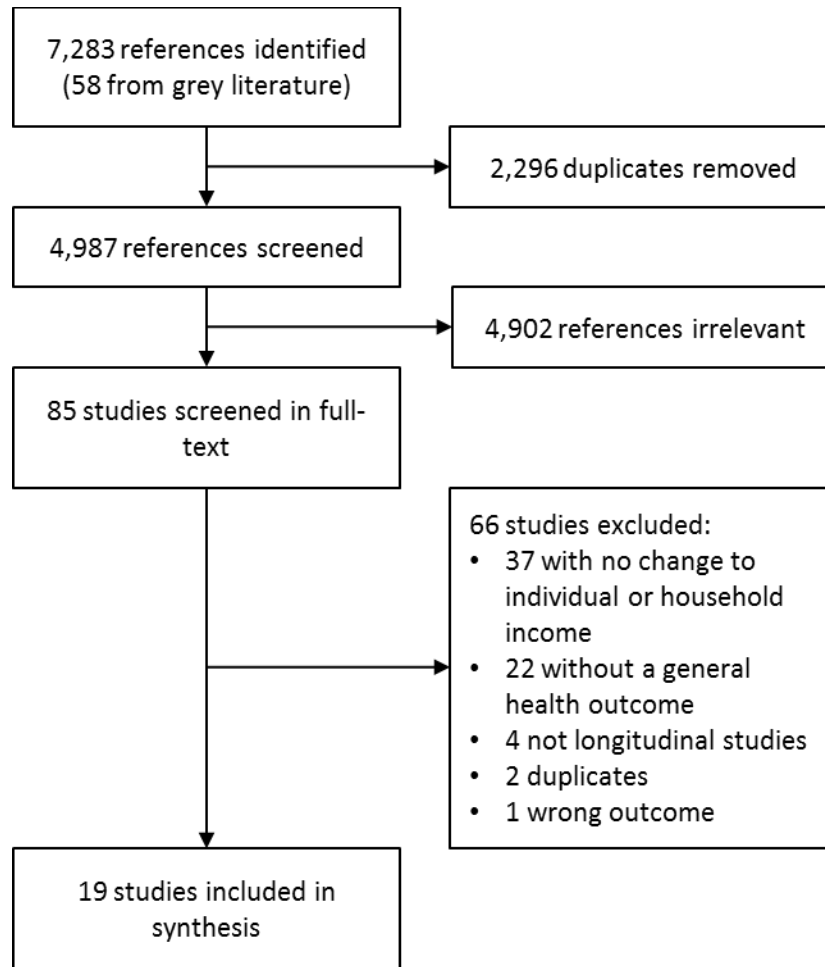
Study	Critical appraisal <sup>a</sup>	Context	Outcome <sup>c</sup>	Effect of increased income <sup>b</sup>	Summary of findings
Evans & Garthwaite, 2010 <sup>41</sup>	1 2 3* 4* 5 6 7 8 9	USA 1994-2002 21-40y mothers	SAH	↑	Increased Earned Income Tax Credits (EITC) increased the reporting of better health by 1.35 percentage points. The fully adjusted model estimated that an additional \$1,000 increases reporting of very good/excellent health by 0.2 percentage points.
Milligan & Stabile, 2009 <sup>42</sup>	1 2* 3 4 5 6 7 8 9	Canada 1994-2004 Children ≤17y and their mothers	Parental-assessed health	0	Overall there was no change in general child health following increases in child benefits, but it worsened amongst boys (although many specific health outcomes were much more positive).
Larrimore, 2011 <sup>36</sup>	1 2* 3 4 5 6 7 8 9	USA 1992-2005 Low income adults aged 22-62y	SAH	↔	Increased Earned Income Tax Credits (EITC) led to a small but imprecise improvement in health such that an increase of \$1,000 was associated with a 0.154 percentage point increase in the likelihood of being in excellent health and 0.025 percentage point decline in the probability of being in poor health.
Wilde et al., 2014 <sup>43</sup>	i ii iii iv v	USA 1996-2010 Disadvantaged adults	Mortality	↔	Those randomized to the 'Connecticut Jobs First' programme compared to the existing 'Aid to Families with Dependent Children' programme had no change in their mortality despite higher income and employment.

<sup>a</sup> The critical appraisal was coded as follows: presence of a representative sample = 1; appropriate control group used = 2; baseline response greater than 60% = 3; follow-up response greater than 80% = 4; non-response and drop-out adjusted for = 5; conclusions substantiated by date presented = 6; majority of confounders adjusted for = 7; evidence of protection from contamination = 8; appropriate statistical tests used = 9 (\*denotes that a criterion was partially met). For the only randomised controlled trial (Wilde 2014), the critical appraisal was coded as: i = adequate method of concealment of allocations; ii = study participants and personnel blinded from knowledge of the allocated interventions; iii = outcome assessors blinded from knowledge of the allocated interventions; iv = attrition and exclusions reported and reasons provided; v = selection outcome reporting examined by review authors?

<sup>b</sup> ↑ = change in income associated with change in health in same direction (i.e. increase or decrease in both); ↔ = change in income associated with no change in health or the change was insignificant at p=0.05; 0 = other income-health relationship.

<sup>c</sup> SAH = self-assessed health.

Figure 1 – PRISMA flowchart



## Discussion

### Main results

We identified 19 studies examining the impacts of changes in individual or household income on general health or mortality measures. Fourteen studies considered changes in income over time by tracking a population panel or cohort without any specific change in policy or a specific event, and all were high quality. Ten of these studies showed that increased income led to increased self-assessed health,<sup>25-34</sup> two found no association,<sup>35,36</sup> and two found that people whose income varied most (either up or down) had worsening health.<sup>37,38</sup> There were three high quality studies identified which examined the impacts of one-off changes in income, relating to lottery wins and inheritances.<sup>30,39,40</sup> Although two found small positive impacts from increased income, these were imprecise and uncertain.<sup>30,40</sup> Finally, there were four studies of the impacts of income changes arising from the social security system.<sup>41-43</sup> Two examined the impact of an increase in the Earned Income Tax Credit in the USA, finding improved self-assessed health for mothers but a smaller and uncertain improvement for low income adults.<sup>36,41</sup> The others

found no change in mortality following a change to a 'Jobs First' social security scheme.<sup>43</sup> Amongst a report of a wide range of outcomes, no change was found in parental-assessed health amongst children overall, following an increase in child benefits in Canada (although this worsened for boys).<sup>42</sup>

### Strengths and weaknesses

This study used a systematic approach to searching the literature and included peer-reviewed and grey literature. All citations were independently dual screened for relevance and the data extraction and critical appraisal was checked by a second reviewer. The review is therefore transparent and reproducible in its approach. The diversity in how the changes in income and changes in health outcome was reported across studies precluded a quantitative comparison or synthesis of studies, despite the interventions and outcomes being very similar across many of the studies. This means that we cannot provide any kind of estimate of the scale of the health impact from changes in health arising from a synthesis of the included studies. It is possible some relevant studies were missed because of publication bias (that we were unable to statistically check for because of the diversity in interventions and outcomes) and because of our English language search terms. There are likely to be studies considering the impact of changes in income on specific rather than general health outcomes, but these were outside the scope of the review.

### How this fits with the existing literature

Our review focused on studies using a general health outcome. Other studies have considered specific health outcomes or related outcomes such as happiness.<sup>44</sup> For example, a study examining the relationship between income and subjective well-being among migrant workers in China found a U-shaped relationship.<sup>45</sup> Another looked at the effects of an increase in household income in East Germany on life satisfaction (or happiness) after the fall of the Berlin wall.<sup>46</sup> Others have considered the impact of income changes on disability<sup>47</sup> and the incidence of mental disorders.<sup>48</sup> It is known that changes in income at group level are associated with changes in health: the starkest example being the fall and rise in income inequalities and health inequalities in both the USA and the UK over the 20<sup>th</sup> Century.<sup>7,10,11</sup>

### Implications

There is good evidence that people who experience increased income over their life experience improvements in their self-assessed health compared to those who did not. However, the health impacts of specific policies, or of one-off changes to people's income, is less clear. The evidence base for impacts on all-cause mortality is very sparse. The available evidence does support the role of income as a fundamental determinant of health and health inequalities, although the quantity of evidence at the individual level is limited. There is therefore a need for new studies which can examine the impacts of changes in individual incomes over time on a wider range of health outcomes, including mortality, and studies which consider the health impacts of policy changes which modify the incomes of individuals.

### Contributors

GM and MR developed the concept for this study. GM wrote the protocol with input from WH and MR. GA undertook the searches in consultation with AY and GM. AY and GM screened the data. AY led the critical appraisal, data extraction and drafting of the manuscript with GM acting as second reviewer. WH and MR provided advice on the inclusion of some studies. All authors provided critical input to the redrafting of the manuscript and approved the final draft.

**Acknowledgements**

Anmol Yagnik was granted a Global Health Travel Award by York University to the amount of \$4,000 (CAD) to travel to Scotland and work on this project. No other funding was received for this work.

**Competing interests**

We declare no competing interests.



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