



How do perceived changes in inequality affect health?

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ABSTRACT

Individuals do not possess an entirely accurate assessment of the level of income differences in their society and so changes in quantitative measures of income inequality may not always align with changes in the perceptions of income inequality. This disconnect is partly driven by how people form their opinions about the level of inequality. In this study we explore whether there is an association between perceptions of inequality and health, and if so, how it differs depending on the specific channel through which people formed their opinions about changes in income inequality. Drawing on data from 31 European and Eurasian countries, we find that both men and women are more likely to report bad health when their perceptions of increasing inequality are formed through experiences of inequality in their communities than through media and other channels.

1. Introduction

Places with higher income inequality tend to have poorer health (Hill and Jorgenson, 2018; Pickett and Wilkinson, 2015; Subramanian and Kawachi, 2006; Truesdale and Jencks, 2016; Wilkinson and Pickett, 2009). Part of the explanation for these cross-national differences is that highly unequal environments also tend to have a greater number of materially deprived individuals, and poverty negatively affects health. Beyond poverty, inequality may affect health through psycho-social mechanisms too (Elstad, 1998). The theory behind this mechanism is that “larger income differences increase social distances” between socio-economic groups (Pickett and Wilkinson, 2015, p.323) and this will negatively affect health because larger social distances erode social trust and lead people to feel their lives are somehow less valuable. In other words, individual-level perceptions of macro-level inequality get under the skin through these psycho-social mechanisms, creating what Michael Marmot called “The Status Syndrome” (Marmot, 2004).

People do not, however, possess an entirely accurate assessment of the level of income differences in society and these misperceptions of the level of inequality could have implications for health. Indeed, would we expect health to get worse if people underestimated the true level income inequality (Hauser and Norton, 2017)? There is, therefore, a crucial distinction between income inequality as it is measured in statistics like the Gini coefficient (what we might call ‘objective’

inequality) and the lived experience of inequality which emerges from our everyday perceptions of the differences between groups (what we might call ‘subjective’ inequality) (Bolam et al., 2006; Chamberlain, 1997). This distinction matters because the theory underlying these psycho-social mechanisms presumes that they would be more closely associated with subjective inequality. Or, to put it more concretely, if we take two countries with exactly the same level of material inequality, then these theories suggest that health would be worse in the country where people perceive social distances to be large than the country where people believed social distances between groups were small (Buttrick et al., 2017; Oshio and Urakawa, 2014). Going further, this distinction also raises a number of other questions concerning the relationship between objective inequality, subjective inequality, and health. For example, what would we expect to happen to health if people perceive inequality to rise – that is, their sense of the distance between themselves and others increases – but the measured level of inequality remains unchanged? Alternatively, would health improve if people perceived income inequality to be falling even though by other objective metrics it was in fact increasing?

The centrality of our subjective perceptions of the level of inequality to the psycho-social mechanism connecting income inequality and health also raises questions about how people form their opinions about inequality. Broadly speaking, people learn about the levels of inequality through two broad sources: (1) personal observations and

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communications with others in their social environment and (2) the news media (Schröder, 2016). People see inequality all around them, they live with it every day. Our perceptions of the level of inequality will be informed by whether we see others sleeping on the street or whether we see people living harder or easier lives than ourselves. But we do not just learn about inequality through what we directly experience in our communities, we also encounter inequality through the national media. Official statistics are regularly reported in the news media and inequality-related issues sometimes receive widespread coverage and these will form inequality beliefs too (Hodgetts et al., 2004; Petrova, 2008).

Learning about changing inequality via these two alternative channels may affect health in quite different ways, and there is some debate about which is more important. For example, one argument is that people may feel changes in inequality in more visceral and immediate ways when they see inequality rising through their interpersonal associations (through family, friends, and local communities) (Benediktsson, 2018). This is the status syndrome at the micro-level. In contrast, Wilkinson and Pickett argue that the evidence in favour of the income inequality-health association is strongest at the macro-level, this may be especially true if more unequal societies ‘increas[e] ... inequality between areas [whilst] diminishing ... inequality within them’ (Pickett and Wilkinson, 2015, p. 323). If people are primarily acquiring their information about inequality from the news media then they are most likely to be receiving information about macro-level inequality and much less likely to be learning inequality in their specific community (Preston and Grisold, 2017; Schiffrin, 2015). In this instance, if people are experiencing status anxiety then it is most likely to be in relation to a whole country or to some sense of how hierarchical a society is (Wilkinson and Pickett, 2006). This remains an open debate, especially in the context of self-reported health, where the association with income inequality generally is weaker than the association between income inequality and physical health (Kondo et al., 2009).

To recap, our exploratory study is concerned with two main research questions: First, what are the links between subjectively perceived changing levels of inequality, objectively changing levels of inequality on macro-level, and self-reported health? And second, do specific channels of formation of inequality perceptions also play a role in shaping self-reported health? To address these questions, we draw on a unique data source which inquires into individuals’ perceptions of the changing gap between rich and poor in 2012–2016 as well as specific channels through which individuals formed their perceptions in 31 European and Eurasian countries. One of the advantages of this data-set was that the large number of countries allowed us to investigate how individual-level perceptions of the changing gap between rich and poor were related to changes in macro-level income inequality measure – Gini coefficient, and whether or not the latter affected the links between the perceptions of changing inequality and health.

2. Methods

2.1. Data

We used data for 31 countries from the Life in Transition Survey (LITS) collected in 2016 by the European Bank for Reconstruction and Development (EBRD) (EBRD, 2016). These countries are: Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Estonia, North Macedonia, Georgia, Germany, Greece, Hungary, Kazakhstan, Kosovo, the Kyrgyz Republic, Italy, Latvia, Lithuania, Moldova, Mongolia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkey, and Ukraine. We could not use data for Albania, Azerbaijan, and Uzbekistan due to the unavailability of comparable macro-level data on income inequality for these countries. The survey was designed by means of a multi-stage random probability stratified clustered sampling which insures the national representativeness of the collected data. Each country had a minimum of 50

primary sampling units each of which contained at least 20 secondary sampling units. In each selected household face-to-face interviews were administered by means of Computer-assisted Personal Interviewing. After list-wise deletion of observations with missing information, 3.5% of the total sample, 19,748 men and 25,285 women were available for our analysis. The sample size across countries as well as the detailed profiles of respondents by country, gender, and age are given in online supplementary materials (Table S1).

2.2. Self-reported health

LITS respondents were asked to assess their health as “very good”, “good”, “medium”, “bad” or “very bad”. The share of missingness for this variable was 0.3%. Although this measure has well-known limitations (Sen, 2002), it is widely used and is considered a good proxy for morbidity in the absence of physical examinations and has been also used extensively in the considered European and Eurasian countries (Balabanova and McKee, 2002; Cockerham et al., 2004; Gugushvili et al., 2019; Sieber et al., 2019; Jarosz and Gugushvili, 2019). We created a dummy variable for individuals’ self-reported health that took value of 1 if they reported bad or very bad health and zero otherwise.

2.3. Perceptions of growing inequality and channels affecting these perceptions

Our main explanatory variable is derived from a question that was asked to all survey respondents: “Do you think the gap between rich and poor in the past 4 years has stayed the same, become larger or become smaller in [country]?” Only 0.7% of the sample did not provide an answer to this question. Respondents could select one of four responses: “Stayed the same”, “became smaller”, “became larger”, and “don’t know”. We include in the analysis “don’t know” option because it is substantively relevant answer and might have links with individuals’ health. For those who reported decreasing or increasing inequality, a follow-up question was asked about the most important way through which they formed their perceptions: “Which one, if any, of the reasons on this card explains why you think the gap between the rich and poor has (answer from the previous question)?”. Respondents could choose one answer from the following seven alternatives: (a) “What I have seen in my neighbourhood”, (b) “what I have seen in a village or city outside of my neighbourhood”, (c) “information on TV”, (d) “information in printed press”, (e) “information on the internet”, (f) “discussion with friends and family”, and (g) “other”. For substantive and empirical reasons, due to the low number of observations for certain responses, we grouped these answer options into two categories. The first group included people who formed their perceptions about the changing gap between the rich and poor through personal observations or communications by combining answer options (a), (b), and (f), while the second category of respondents formed their perceptions based on mass media and other channels by combining answer options (c), (d), (e), and (g).

2.4. Individual-level covariates

To account for previously identified important covariates of self-reported health in multivariate analysis, we controlled for a rich set of socio-demographic and socio-economic variables. All models were adjusted for individuals’ age by creating dummies for 13 five-year age groups starting with those aged 18. Respondents’ residence was categorised as urban or rural area (Verheij, 1996). Marital status was categorised as never married, married, widowed, and divorced or separated (Liu and Umberson, 2008). Education was categorised as completion of primary, secondary, or tertiary levels (Balaj et al., 2017). Labour market status was categorised in three groups, those who never worked, unemployed, and those who were in work at the time of the survey (Norström et al., 2014). Subjective socio-economic position was operationalised by respondents’ self-placement on an imagined ten-step

ladder in which the first step reflected the poorest 10% of households and the tenth step represented the richest 10% households in the respective countries (Demakakos et al., 2008). The same question about the subjective socio-economic position of households was posed to respondents with a time reference “four years ago”. We used this information to generate a variable which shows change (min-max: -9, 9) in subjective socio-economic position between 2012 and 2016. Health-related material conditions were accounted for by two dummy variables which asked if respondents’ households could afford, on the one hand, (a) consumption of meat, chicken, fish or vegetarian equivalent each second day, and, on the other hand, (b) having adequate heating of dwelling where respondents lived (Labbe et al., 2015). The potential effect of trust on self-reported health was examined by asking about the extent to which respondents had trust in other people (Ferland, 2007). Social trust variable is introduced in a separate model because based on earlier findings it might mediate the association between inequality and health (Elgar, 2010). Among the described covariates, missingness was observed only for subjective socio-economic position (1.9% of the sample) and change in this position (2.7% of the sample), while for other variables there was virtually no missing cases. Pairwise correlations for all covariates are reported in online supplementary materials (Table S2).

2.5. Macro-level variables

To account for macro-level characteristics of countries where interviews were conducted, we controlled for income inequality and the level of the current economic development as well as change in income inequality in 2012–2016. The Standardized World Income Inequality Database (SWIID) is the most appropriate for comparative research in countries included in our analysis (Solt, 2016). The SWIID standardises the United Nations University’s World Income Inequality Database using a custom missing-data algorithm. We used net Gini coefficients to show the distribution of real disposable income in 2016 and its change from 2012 (or the nearest year for which data were available). Economic development was estimated by GDP per capita based on purchasing power parity (PPP). Data were in constant 2011 international dollars and were derived from the World Bank’s World Development Indicators (WDI) database (World Bank, 2017).

2.6. Statistical analysis

We fitted age-adjusted multivariate multilevel mixed-effects logistic regressions with robust standard errors adjusted for country clustering of individuals. In these models, level 1 consisted of individuals and level 2 consisted of countries in which LITS survey was conducted. For the latter level, we accounted for the level of economic development, income inequality, and change in income inequality variable in 2012–2016. To explore whether change in inequality at the macro-level moderated the effects of individuals’ perceptions on bad self-reported health, we included in the mixed-effects logistic regressions cross-level interactions between change in the Gini coefficient and perceptions of changing inequality. Models were estimated separately by gender using Stata 15 function “melogit” and the results are presented as odds ratios (OR) with corresponding 95% confidence intervals (CIs).

We also make an assumption that interpersonal and media channels through which individuals learnt about increasing inequality can be viewed as specific exposures. Therefore, we also conducted treatment-effects estimation for observational data. We estimated the average treatment effect (ATE) by inverse-probability weighting (IPW). This approach uses estimated probability weights to correct for missing data arising from the fact that each subject is observed in only one of the potential outcomes – having bad or medium/good health. IPW modeling is based on a two-step approach. First, it estimates the parameters of the treatment model and computes the estimated inverse-probability weights. Next, it uses the estimated inverse-probability weights to

compute weighted averages of the outcomes for each treatment level – in our case interpersonal and media channels of inequality perceptions’ formation. The contrasts of these weighted averages provide the estimates of the ATEs. The main advantage of IPW approach is that its weighting scheme corrects for the missing potential outcomes. These treatment estimators were derived using Stata 15 function for treatment-effects estimation for observational data “teffects” with specification of “ipw” and the results for ATE are presented as a percentage change of the mean bad self-reported health with corresponding 95% CIs.

3. Results

3.1. Descriptive statistics and bivariate associations

Table 1 presents descriptive statistics and bivariate associations of the perceptions of changing inequality and other covariates with self-reported health. More than one-fifth of individuals in the pooled sample of men and women across our sample of 31 countries stated that the gap between rich and poor in the past 4 years stayed the same. People who also reported bad health were less likely (~4–5 percentage points lower) to think inequality had stayed the same than people reported medium or good health. On the other hand, about 66% of men and women (separately) declared that inequalities increased in last four years. On this question, people in bad health were more likely to say inequality had increased (again ~5 percentage points higher). Very few people thought inequality between the rich and poor had fallen, yet this response was more common (~two percentage points) among individuals with fair or good self-reported health.

As for other covariates, we observed negative associations between self-reported health, on the one hand, and rural residency, never married marital status, widowhood, low education, unemployment, low socio-economic status, unaffordability of fish, meat, and chicken, unavailability of heating, and distrust in strangers. In other words, the associations of covariates with self-reported health were in the expected directions.

3.2. Are perceptions of changes in inequality associated with self-reported health?

Next, in Tables 2 and 3, we formally estimate whether self-reported health is associated with perceptions of changes in inequality using multilevel mixed-effects logistic regression models which consecutively include individual characteristics, contextual-level explanations and their cross-level interactions. Among both men and women in all our models, we find clear association between perceptions about changes in the gap between rich and poor and self-reported health. Among men, the odds for those who stated that inequality increased were 18% (1.18, CI 1.03, 1.34) higher to report bad health in Model 2 than the odds for those who thought it had stayed the same. Also, those women who did not know if the gap between rich and poor changed were consistently more likely to report bad health. These associations were not affected by the introduction of individual-level covariates including social trust, although marital status, education, labour market situation, socio-economic ladder, affordability of basic amenities, and social trust were all important covariates of self-reported health (and in the expected direction).

Of more interest, we find our results are also consistent once we account for macro-level covariates too. Indeed, most of these contextual variables turned out not to be related to health. Only the level of economic development (GDP PPP per capita) was negatively associated with women’s bad self-reported health, with an odds ratio of 0.78 (CI 0.64, 0.94) for a 1 SD change in the country’s wealth. Of particular interest here, is whether changes in income inequality, measured using the Gini coefficient, interacts with individuals’ own perceptions of changing inequality. We find no interaction effects: perceptions of inequality are correlated with health irrespective of changes in our macro-level

Table 1
Descriptive statistics and bivariate associations.

	Men				Women			
	Full sample (n = 19,748), % and mean	Sample with bad health (n = 2,106), % and mean	Sample with median and good health (n = 17,642), % and mean	P-values	Full sample (n = 25,285), % and mean	Sample with bad health (n = 3,782), % and mean	Sample with median and good health (n = 21,503), % and mean	P-values
<i>Gap between rich and poor in past 4 years ...</i>								
Stayed the same	23.0	17.5	23.7	–	22.2	17.9	23.0	–
Don't know	5.5	5.8	5.4	–	6.6	8.6	6.2	–
Became smaller				–				–
<i>The most important way you formed your perception ...</i>	5.3	4.2	5.5	–	4.8	3.4	5.1	–
Personal observations	3.1	2.6	3.2	–	2.9	1.7	3.1	–
Media and other channels	2.2	1.6	2.3	–	1.9	1.7	2.0	–
Became larger				–				–
<i>The most important way you formed your perception ...</i>	66.2	72.5	65.4	–	66.4	70.0	65.7	–
Personal observations	35.6	41.2	34.9	–	35.7	39.2	35.1	–
Media and other channels	30.6	31.3	30.5	<0.000	30.7	30.8	30.6	<0.000
Type of settlement								
Urban	56.2	51.8	56.7	–	59.0	56.8	59.4	–
Rural	43.8	48.2	43.3	<0.000	41.0	43.2	40.6	= 0.003
Marital status								
Never married	22.3	13.1	23.4	–	15.7	7.8	17.1	–
Married	63.9	61.2	64.2	–	52.5	38.5	54.9	–
Widowed	6.4	15.5	5.4	–	20.5	43.5	16.4	–
Divorced/separated	7.3	10.1	7.0	<0.000	11.3	10.2	11.5	<0.000
Education								
Primary	25.9	39.3	24.3	–	27.0	43.7	24.1	–
Secondary	50.9	47.2	51.4	–	48.1	42.6	49.1	–
Tertiary	23.2	13.5	24.4	<0.000	24.9	13.7	26.9	<0.000
Labour market status								
Never worked	15.3	18.0	15.0	–	23.8	26.4	23.4	–
Unemployed	26.4	60.3	22.3	–	33.0	58.6	28.5	–
Working	58.3	21.7	62.7	<0.000	43.2	15.0	48.1	<0.000
Socio-economic ladder								
Subjective position	4.61	3.72	4.72	<0.000	4.48	3.59	4.64	<0.000
Change in subjective position	–0.19	–0.44	–0.16	<0.000	–0.23	–0.40	–0.20	<0.000
Household cannot afford								
Fish, meat or chicken	31.0	48.9	28.8	<0.000	34.0	54.8	30.5	<0.000
Heating	13.0	24.2	11.7	<0.000	15.9	27.5	13.8	<0.000
Trust in strangers								
Distrust	36.3	48.1	34.9	–	38.6	48.8	36.8	–
Neither nor	31.3	26.0	32.0	–	28.6	24.8	29.2	–
Trust	29.3	23.5	30.0	–	30.0	23.9	31.1	–
Difficult to say	3.1	2.3	3.1	<0.000	2.8	2.5	2.8	<0.000

Notes: The P-values are from bivariate tests of differences in means or proportions between bad and median/good health. Source: Authors' calculations based on data from EBRD (2016).

measure of income inequality. In part, this is because there is no correlation between changes in income inequality according to the Gini coefficient and the proportion of people who state that the gap between rich and poor has increased or decreased (see Fig. 1).

3.3. How do people learn about inequality and is this associated with health?

If perceptions of inequality are correlated with self-reported health – independent of the actual changes in income inequality – then how people form these beliefs about changes in the gap between rich and poor may also have implications for health. We therefore differentiate – among individuals who declared that the gap between rich and poor increased in the past four years – between individuals who formed this belief about this increase through everyday experience (in their village,

neighbourhood, or other areas close by, as well as through other personal communications with friends and family members) and those who formed their beliefs about inequality through national media sources (such as TV, printed media, internet, and other means). We focus on those who believed inequality increased because very few people in bad health declared that inequality had fallen in the last four years (88 men and 129 women across 31 countries) and so we were unable to differentiate between two main channels of perception formation within this group.

Multilevel logistic regressions in Table 4 are identical to Models 3 and 4 in Tables 2 and 3 except that now we differentiate two groups in our key explanatory variable. Here, our results differ slightly from what we observed before. Both men and women who believe inequality has increased are more likely to report bad health, but only if they formed their opinion about inequality through personal observations and

Table 2

Odds ratios from multilevel mixed-effects logistic regressions for declaring bad self-reported health among men.

	Model 1		Model 2		Model 3		Model 4	
	OR	[CI95]	OR	[CI95]	OR	[CI95]	OR	[CI95]
Individual-level variables								
<i>Gap between rich and poor ...</i>								
Stayed the same	1.00	–	1.00	–	1.00	–	1.00	–
Don't know	1.12	[0.86,1.45]	1.14	[0.89,1.48]	1.14	[0.89,1.48]	1.10	[0.83,1.46]
Became smaller	0.97	[0.74,1.28]	0.96	[0.73,1.27]	0.96	[0.73,1.27]	0.95	[0.71,1.25]
Became larger	1.20	[1.06,1.37]	1.18	[1.03,1.34]	1.18	[1.03,1.34]	1.17	[1.02,1.33]
<i>Type of settlement</i>								
Urban	1.00	–	1.00	–	1.00	–	1.00	–
Rural	1.03	[0.89,1.19]	1.03	[0.89,1.19]	1.03	[0.89,1.19]	1.03	[0.89,1.19]
<i>Marital status</i>								
Never married	1.06	[0.83,1.35]	1.06	[0.83,1.36]	1.06	[0.83,1.35]	1.06	[0.83,1.35]
Married	0.73	[0.62,0.86]	0.73	[0.62,0.86]	0.73	[0.62,0.86]	0.73	[0.61,0.86]
Widowed	0.81	[0.62,1.05]	0.80	[0.61,1.05]	0.80	[0.61,1.05]	0.80	[0.61,1.05]
Divorced/separated	1.00	–	1.00	–	1.00	–	1.00	–
<i>Education</i>								
Primary	1.00	–	1.00	–	1.00	–	1.00	–
Secondary	0.80	[0.70,0.92]	0.80	[0.70,0.92]	0.80	[0.70,0.92]	0.80	[0.70,0.92]
Tertiary	0.63	[0.54,0.73]	0.64	[0.54,0.74]	0.63	[0.54,0.74]	0.63	[0.54,0.74]
<i>Labour market status</i>								
Never worked	1.00	–	1.00	–	1.00	–	1.00	–
Unemployed	1.26	[1.07,1.48]	1.25	[1.06,1.47]	1.25	[1.06,1.47]	1.25	[1.06,1.48]
Working	0.35	[0.28,0.42]	0.34	[0.28,0.42]	0.34	[0.28,0.42]	0.34	[0.28,0.42]
<i>Socio-economic ladder</i>								
Subjective position	0.85	[0.80,0.90]	0.86	[0.81,0.91]	0.86	[0.81,0.91]	0.86	[0.81,0.91]
Change in subjective position	0.98	[0.94,1.03]	0.98	[0.93,1.03]	0.98	[0.93,1.03]	0.98	[0.93,1.03]
<i>Household cannot afford</i>								
Fish, meat or chicken	1.55	[1.36,1.76]	1.53	[1.35,1.74]	1.53	[1.35,1.74]	1.53	[1.35,1.74]
Heating	1.30	[1.07,1.58]	1.30	[1.07,1.58]	1.30	[1.07,1.58]	1.30	[1.07,1.58]
<i>Trust in strangers</i>								
Distrust	–	–	1.00	–	1.00	–	1.00	–
Neither nor	–	–	0.72	[0.62,0.83]	0.72	[0.62,0.83]	0.72	[0.62,0.83]
Trust	–	–	0.70	[0.61,0.81]	0.70	[0.61,0.81]	0.70	[0.61,0.81]
Difficult to say	–	–	0.53	[0.36,0.77]	0.53	[0.36,0.77]	0.53	[0.36,0.77]
Macro-level variables								
GDP PPP per capita (z-score)	–	–	–	–	0.91	[0.74,1.10]	0.90	[0.74,1.10]
Net Gini coefficient	–	–	–	–	0.98	[0.94,1.03]	0.98	[0.94,1.03]
Change in net Gini coefficient, %	–	–	–	–	0.93	[0.85,1.03]	0.94	[0.85,1.04]
Cross-level interactions								
Don't know * change in Gini	–	–	–	–	–	–	0.97	[0.86,1.08]
Became smaller * change in Gini	–	–	–	–	–	–	0.98	[0.89,1.07]
Became larger * change in Gini	–	–	–	–	–	–	0.99	[0.96,1.02]
Random intercept								
Intraclass correlation coefficient	1.36	[1.12,1.65]	1.36	[1.12,1.66]	1.31	[1.11,1.55]	1.31	[1.11,1.55]
Bayesian information criterion	0.086		0.085		0.076		0.076	
Akaike information criterion	10,902.1		10,863.9		10,860.4		10,860.0	
Individuals/countries	10,673.3		10,627.2		10,623.7		10,623.2	
	19,748/31		19,748/31		19,748/31		19,748/31	

Note: Significant associations are shown in bold.

Source: Authors' calculations based on data from EBRD (2016).

communications. Importantly, this is not explained by macro-level covariates (such as the level of economic development and even the level of income inequality) although the odds ratios are slightly stronger for women (OR 1.34, CI 1.20, 1.49) than men (OR 1.29, CI 1.10, 1.51). This is not true for the other channel of perception formation. Here, learning about increasing inequality through media and other channels increased the risk of bad self-reported health among women (OR 1.17, CI 1.04, 1.31), but not men.

One problem with these estimates, however, is that they do not account for bias created by differential selection into these different channels of information about inequality. We mitigate this bias using IPW treatment effect estimators which calculate ATE as a percentage of the mean value of bad self-reported health (see Fig. 2). More precisely, we report the percentage change in bad self-reported health that would occur – among individuals who thought that gap between rich and poor increased – contingent on whether they formed their beliefs of increasing inequality through personal observations and communications or via media and other channels. Our results suggest that the average level of bad self-reported health increased by an estimated 26.4% (CI 11.3, 41.5) and 18.4% (CI 8.4, 28.4) when, respectively, men

and women learnt that the gap between rich and poor increased through personal observations and communications relative to the situation when men and women believed that this gap stayed the same. The similar estimates for those who thought that gap increased based on media and other channels were indistinguishable from zero with large CIs.

3.4. Robustness checks

We conducted several additional robustness checks of the main findings and all the results are shown in online supplementary materials. First, we re-analysed the effect of perceptions on inequality change only with the sample of 26 post-socialist countries (Table S3). Second, instead of accounting for short-term inequality change in 2012–2016, we included in our analysis change in net Gini coefficients for the longer period from 2006 to 2016 (Table S4). Third, we again run the same models as reported in the main analyses in Tables 2 and 3, but this time with random effects for perception of changing inequality (Table S5). Fourth, in order to test if the link between perceptions of inequality and self-reported health is moderated by individuals' socio-economic status,

Table 3

Odds ratios from multilevel mixed-effects logistic regressions for declaring bad self-reported health among women.

	Model 1		Model 2		Model 3		Model 4	
	OR	[CI95]	OR	[CI95]	OR	[CI95]	OR	[CI95]
Individual-level variables								
<i>Gap between rich and poor...</i>								
Stayed the same	1.00	–	1.00	–	1.00	–	1.00	–
Don't know	1.27	[1.03,1.57]	1.28	[1.04,1.57]	1.28	[1.04,1.57]	1.28	[1.03,1.60]
Became smaller	0.84	[0.63,1.11]	0.85	[0.64,1.13]	0.85	[0.64,1.12]	0.84	[0.61,1.16]
Became larger	1.26	[1.15,1.38]	1.24	[1.13,1.36]	1.24	[1.13,1.36]	1.23	[1.12,1.35]
<i>Type of settlement</i>								
Urban	1.00	–	1.00	–	1.00	–	1.00	–
Rural	0.96	[0.85,1.09]	0.96	[0.85,1.08]	0.96	[0.85,1.08]	0.96	[0.85,1.08]
<i>Marital status</i>								
Never married	0.97	[0.76,1.22]	0.97	[0.77,1.23]	0.97	[0.77,1.23]	0.97	[0.77,1.23]
Married	0.81	[0.68,0.97]	0.82	[0.68,0.98]	0.81	[0.68,0.97]	0.81	[0.68,0.97]
Widowed	0.88	[0.75,1.03]	0.88	[0.76,1.03]	0.88	[0.76,1.02]	0.88	[0.76,1.02]
Divorced/separated	1.00	–	1.00	–	1.00	–	1.00	–
<i>Education</i>								
Primary	1.00	–	1.00	–	1.00	–	1.00	–
Secondary	0.69	[0.62,0.76]	0.69	[0.63,0.76]	0.69	[0.63,0.76]	0.69	[0.63,0.76]
Tertiary	0.52	[0.46,0.59]	0.53	[0.47,0.60]	0.53	[0.47,0.60]	0.53	[0.47,0.60]
<i>Labour market status</i>								
Never worked	1.00	–	1.00	–	1.00	–	1.00	–
Unemployed	0.99	[0.88,1.12]	0.99	[0.88,1.11]	0.99	[0.88,1.12]	0.99	[0.88,1.12]
Working	0.42	[0.35,0.50]	0.42	[0.35,0.51]	0.42	[0.35,0.51]	0.42	[0.35,0.51]
<i>Socio-economic ladder</i>								
Subjective position	0.81	[0.78,0.85]	0.82	[0.78,0.86]	0.82	[0.78,0.86]	0.82	[0.78,0.86]
Change in subjective position	1.02	[0.97,1.08]	1.02	[0.97,1.08]	1.02	[0.97,1.08]	1.02	[0.97,1.08]
<i>Household cannot afford</i>								
Fish, meat or chicken	1.56	[1.40,1.75]	1.55	[1.39,1.74]	1.55	[1.38,1.73]	1.55	[1.38,1.73]
Heating	1.31	[1.12,1.53]	1.31	[1.12,1.54]	1.31	[1.12,1.53]	1.31	[1.12,1.53]
<i>Trust in strangers</i>								
Distrust	–	–	1.00	–	1.00	–	1.00	–
Neither nor	–	–	0.79	[0.69,0.90]	0.79	[0.69,0.90]	0.79	[0.69,0.90]
Trust	–	–	0.75	[0.68,0.83]	0.75	[0.68,0.83]	0.75	[0.68,0.83]
Difficult to say	–	–	0.78	[0.58,1.06]	0.78	[0.57,1.06]	0.78	[0.57,1.06]
<i>Macro-level variables</i>								
GDP PPP per capita (z-score)	–	–	–	–	0.78	[0.64,0.94]	0.78	[0.64,0.94]
Net Gini coefficient	–	–	–	–	0.98	[0.94,1.03]	0.98	[0.94,1.03]
Change in net Gini coefficient, %	–	–	–	–	0.93	[0.84,1.03]	0.94	[0.82,1.07]
Cross-level interactions								
Don't know * change in Gini	–	–	–	–	–	–	1.00	[0.94,1.07]
Became smaller * change in Gini	–	–	–	–	–	–	0.99	[0.88,1.11]
Became larger * change in Gini	–	–	–	–	–	–	0.99	[0.95,1.03]
Random intercept								
Intraclass correlation coefficient	0.095	[1.15,1.74]	0.095	[1.15,1.74]	0.073	[1.13,1.50]	0.074	[1.13,1.50]
Bayesian information criterion	16,656.9		16,627.2		16,619.0		16,618.7	
Akaike information criterion	16,420.9		16,383.0		16,374.9		16,374.5	
Individuals/countries	25,285/31		25,285/31		25,285/31		25,285/31	

Note: Significant associations are shown in bold.

Source: Authors' calculations based on data from [EBRD \(2016\)](#).

we interacted our main explanatory variable with individuals' subjective position in social hierarchy (Table S6). Fifth, to explicitly account for country differences in our pooled sample, we fitted logistic regressions with country fixed effects (Table S7). And sixth, instead of odds ratios from multilevel mixed-effects logistic regressions we calculated more robust incidence-rate ratios from multilevel mixed-effects Poisson regressions (Table S8). The findings from these auxiliary tests reveal that using the sample of only post-socialist countries, considering changes in income inequality in 2006–2016, accounting for the moderating effect of subjective socio-economic status, and fitting models with various specifications do not affect the findings reported in the main analysis.

4. Discussion

Income inequality is correlated with poorer health but it remains unclear whether the psycho-social effects of inequality are rooted in objective dimensions of inequality (that is, the material distribution of income or wealth) or subjective dimensions of inequality (that is, the perceptual basis of inequality). Indeed, if the subjective dimension

matters, how we form our beliefs about inequality, whether our opinions are based on everyday experiences or reporting through the national media, may also have health implications, especially if the form of inequality that matters for health is aggregate or national inequality and not inequality in our local communities ([Erdem et al., 2019](#); [Pickett and Wilkinson, 2015](#)).

Our results indicate that subjective assessments of changes in inequality are correlated with self-reported health. When men and women believe the gap between rich and poor has increased they are more likely to report bad health, even after controlling for the large number of covariates of self-reported health in our multilevel logistic regression models. Moreover, how we form these beliefs about inequality seems to matter too. When perceptions of increasing inequality are formed through everyday experience of inequality in our communities or through personal communication with family and friends, both men and women were more likely to report bad health than those who believed that the gap stayed the same. Women, but not men, were also more likely to report bad health if they learned about inequality through the mass media, although our treatment estimators indicated that the effect of learning about growing inequality via

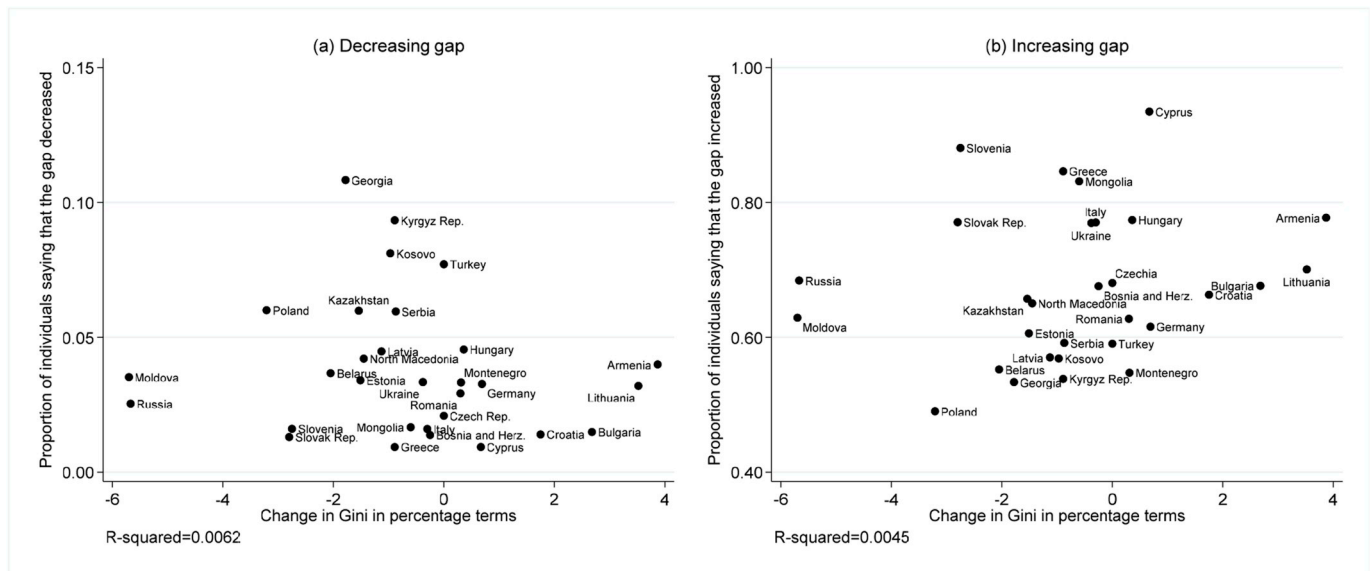


Fig. 1. Bivariate associations between share of respondents reporting decreasing/increasing gap between rich and poor and change in Gini coefficient in percentage terms in respective countries.

Source: Authors' calculations based on data from EBRD (2016).

Table 4

Odds ratios from multilevel mixed-effects logistic regressions for declaring bad self-reported health.

	Men				Women			
	Model 1		Model 2		Model 3		Model 4	
	OR	[CI95]	OR	[CI95]	OR	[CI95]	OR	[CI95]
Individual-level variables								
Gap between rich and poor...								
Stayed the same	1.00	–	1.00	–	1.00	–	1.00	–
Don't know	1.14	[0.88,1.48]	1.14	[0.89,1.48]	1.27	[1.04,1.57]	1.27	[1.04,1.57]
Became smaller	0.96	[0.73,1.27]	0.97	[0.73,1.27]	0.85	[0.64,1.13]	0.85	[0.64,1.13]
Became larger								
Personal observations	1.29	[1.10,1.51]	1.29	[1.10,1.51]	1.34	[1.20,1.49]	1.34	[1.20,1.49]
Media and other channels	1.05	[0.91,1.22]	1.06	[0.91,1.23]	1.13	[1.01,1.27]	1.14	[1.01,1.28]
Random intercept	1.36	[1.12,1.65]	1.32	[1.11,1.55]	1.41	[1.14,1.73]	1.30	[1.13,1.49]
Individual-level variables	Yes	–	Yes	–	Yes	–	Yes	–
Macro-level variables	No	–	Yes	–	No	–	Yes	–
Intraclass correlation coefficient	0.085		0.077		0.094		0.073	
Bayesian information criterion	10,853.5		10,850.2		16,615.9		16,618.1	
Akaike information criterion	10,616.7		10,613.4		16,371.8		16,365.8	
Individuals/countries	19,748		19,748		25,285		25,285	

Note: Significant associations are shown in bold.

Source: Authors' calculations based on data from EBRD (2016).

interpersonal channels resulted in increases in poor health for both men and women, while learning about inequality through the mass media did not.

From one vantage point, our results are a puzzle. The most consistent evidence supporting the relationship between income inequality and health comes from models that estimate the national level of inequality and not the local level of inequality (Chen and Gotway Crawford, 2012; Wilkinson and Pickett, 2006). Whereas, our results suggest it is the lived experience of inequality in our towns and communities that is more strongly correlated with poor self-reported health. One explanation for this seeming divergence could be our dependent variable: self-reported health. Certainly the relationship between life expectancy and self-reported health is weak when measured at the national level (Dorling and Barford, 2009; Johnston et al., 2009), and yet this in and of itself is troubling, especially if we believe psycho-social mechanisms explain why income inequality affects health. This is because – to put it crudely – if income inequality creates stress and stress is what leads to increased mortality and other physical forms of ill health (Delhey and

Dragolov, 2014) then we could expect lower levels of self-reported health, which is largely associated with mental health, to also be observed in countries with high levels of inequality.

Another important aspect to our results is the connection between objective and subjective measures of inequality. We know that people do not accurately assess the level of inequality in their society (Norton and Ariely, 2011), indeed Gini coefficients (one of the measures most often used in research on this topic) are largely meaningless to the general public. This creates a problem because it is unclear what we would expect to happen to health if subjective perceptions of inequality suggest the gap between rich and poor have increased when the statistics on income inequality suggest no change. This is not merely a thought experiment but this is what has happened in many European countries over the last decade. Our results suggest that objective measures of inequality are largely unrelated to perceptions of inequality and that it is precisely these subjective forms of inequality that appear to be most strongly correlated with poor self-reported health.

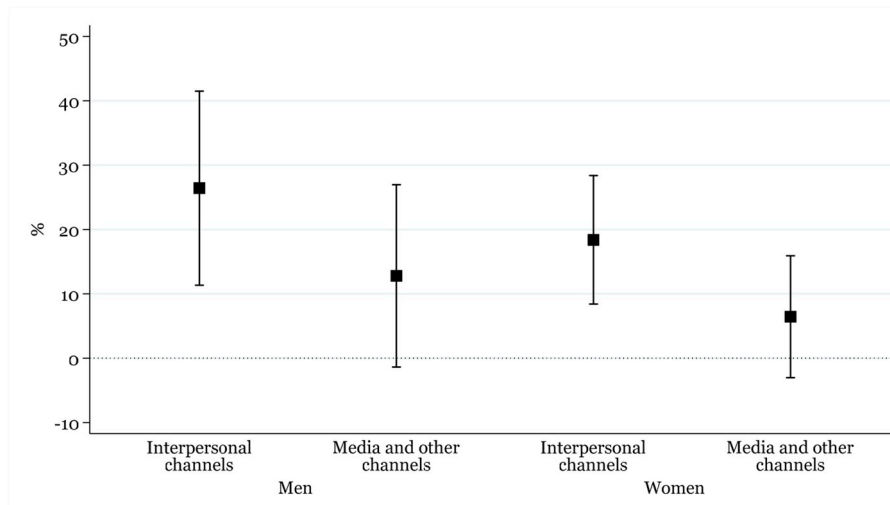


Fig. 2. Average treatment effect (ATE) as a percentage of the mean value of self-reported bad health from inverse-probability weighting (IPW) estimators. Notes: IPW estimators account for treatment independent variables identical to those used in Model 1, Table 4 and country fixed effects. Error bars represent CI95%. Source: Authors' calculations based on data from EBRD (2016).

4.1. Limitations

Our study has a number of limitations. First, our results could be driven by the particular set of countries in our sample. The data we use comes largely from post-socialist societies where the symbolic valence of inequality has quite different connotations in the collective psyche of these countries. This matters because mostly of the data on income inequality and health comes from North American or Western/Northern European countries, where the gap between rich and poor means something different in the context of long-lasting and stable democratic institutions and the established principles of free market economy (Kreidl, 2000).

Second, although we knew which were the most important channels in forming inequality perceptions of those who reported decreasing or increasing gap between rich and poor, LITS did not ask respondents about the most important channels of inequality perceptions if they reported that the gap remained the same in 2012–2016. Third, since the data were cross-sectional without a possibility to follow up survey participants, we could not claim a causal relationship between the channels of perception formation and individuals' self-reported health. Our treatment estimators, though, come as close as possible to causality that can be achieved with the analysis of observational data. We cannot exclude the possibility, however, that individuals' health affects their perceptions of changing inequality and the selection of channels through which they form these perceptions. For instance, those who suffer from bad health may experience adverse economic shocks and thus report higher income inequalities. Fourth, in our analysis we accounted for the wide range of covariates of self-reported health, but future research could investigate who are likely to report decreasing or increasing gap between rich and poor and who are likely to form these perceptions via specific interpersonal and media channels.

4.2. Conclusion

Our results do not, of course, suggest that income inequality does not affect health, indeed our findings reinforce the basic premise of earlier work by Wilkinson and Pickett, Michael Marmot, and others: when people see and feel inequality in their everyday lives then their health is generally worse. At the same time, our results do not suggest that increases in the Gini coefficient will necessarily harm health. This is because increasing inequality will only affect self-reported health if people actually see and feel this increase in inequality in their everyday lives.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.healthplace.2019.102276>.

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