Received: 12 December 2020 | Accepted: 31 January 2022

DOI: 10.1111/1467-9566.13445

ORIGINAL ARTICLE

SOCIOLOGY OF HEALTH & ILLNESS

Are stress-related pathways of social status differentiation more important determinants of health inequities in countries with higher levels of income inequality?

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Funding information
The International Food Policy Study was funded by the Canadian Institutes of Health Research (PJT-162167). The current analysis was funded by a Canadian Institutes of Health Research Operating Grant (FRN 156728) and a Petro-Canada Young Innovator Award in Community Health. SN was supported by a Libin Cardiovascular Research Institute

Abstract

We explored socioeconomic gradients in self-rated overall health (SROH) using indicators of materialist (educational attainment and perceived income adequacy) and psychosocial perspectives (subjective social status (SSS)) among adults living in countries with varying levels of income inequality, and the importance of psychosocial stress in mediating these associations. If psychosocial processes at the individual and societal levels correspond, associations between SSS and SROH should be higher among adults in countries with higher income inequality, and psychosocial stress should be a

of Alberta/Cumming School of Medicine Postdoctoral Award. KML was supported by a National Health and Medical Research Council Emerging Leadership Fellowship (APP1173803). The study funders had no role in designing the study, in the collection, analysis or interpretation of the data, in the writing of the article or in the decision to submit it for publication.

more important mediator of these associations. We used multigroup structural equation models to analyse cross-sectional data from the International Food Policy Study of adults (n = 22,824) in Australia, Canada, Mexico, the UK and the United States. Associations between SSS and SROH were not higher in more unequal countries, nor was psychosocial stress a more important mediator of these associations. Inequities in SROH in more unequal countries may not predominantly reflect stress-related pathways of social status differentiation.

KEYWORDS

health inequities, income inequality, materialist perspective, psychosocial perspective, socioeconomic position

INTRODUCTION

Individuals' position within the social hierarchy, termed socioeconomic position (SEP), shapes their access to health promoting resources and vulnerability to adverse environmental conditions (World Health Organization, 2010). These associations have endured over time despite focused efforts to reduce and eliminate them (Mackenbach, 2012). Indeed, SEP is acknowledged as a fundamental determinant of health and health inequities, because no matter what the profile of prevalent risk factors and diseases, individuals with greater power, prestige, money, beneficial social connections and/or knowledge consistently fare better (Link & Phelan, 1995). Two of the major, albeit not mutually exclusive explanations for health inequities are the materialist and psychosocial perspectives.

A materialist perspective regards health inequities primarily as a consequence of differential access to resources that can support optimal health (World Health Organization, 2010). In the literature, SEP is most often operationalized in line with a materialist perspective of health inequities, using objective socioeconomic indicators of household income, educational attainment and/or occupational status (Braveman et al., 2005; Loignon & Woehr, 2017; Olstad & McIntyre, 2019). Educational attainment is a particularly valuable indicator given that it tends to be stable over time; is causally prior to many changes in health status; shapes occupation, income and access to an array of social and cultural resources; and is associated with physical and mental health (Galobardes et al., 2006; Hamad et al., 2018). Subjective indicators can also be used to assess materialist dimensions of SEP and may in fact provide a more comprehensive and precise perspective of how they relate to health. For instance, whereas measures of absolute household income assume the same meaning of a given level of income across individuals, subjective measures such as perceived income adequacy allow consideration of cost of living, availability of other familial and government supports, wealth, employer-provided benefits, debts and societal norms as to what constitutes an adequate standard of living. Notably, others have shown that perceived income adequacy is a multidimensional indicator of a variety of economic resources in many countries, along with complementary nonmonetary resources that can alleviate financial strain (Danigelis & McIntosh, 2001; Gildner et al., 2019; Hagenaars & de Vos, 1988; Litwin

& Sapir, 2009). Perceived income adequacy is associated with self-rated health, mental health and mortality, independent of absolute household income (Blazer et al., 2005; Cheng et al., 2002; Gildner et al., 2019; Sun et al., 2009).

The psychosocial hypothesis posits that individuals rank themselves relative to others in society with more/fewer resources (Wilkinson, 1996, 2005). Individuals who perceive themselves as lower in rank may feel less able to influence their environments, overcome external threats or pursue advantageous opportunities, leading to psychosocial stress that activates stress-related neuroendocrine pathways that cause physiological damage (Dickerson & Kemeny, 2004; Kraus et al., 2013a; McEwen, 2008; Steptoe, 2008). The MacArthur national ladder of subjective social status (SSS) is an ideal indicator to investigate a psychosocial, rank-based perspective of health inequities, given that it explicitly asks individuals to compare their level of income, educational attainment and occupational status to others' (Cundiff & Matthews, 2017; Hoebel & Lampert, 2020; Hoebel et al., 2017). Evidence substantiates that social comparative processes are indeed invoked by SSS (Hoebel & Lampert, 2020; Tan et al., 2020) and that SSS is associated with objective and subjective measures of physical and mental health, independent of a range of objective socioeconomic indicators (Cundiff & Matthews, 2017; Cundiff et al., 2013; Euteneuer, 2014; Nobles et al., 2013; Prag, 2020; Senn et al., 2014; Tang et al., 2016) and psychosocial factors (Bradshaw et al., 2017; Nobles et al., 2013; Singh-Manoux et al., 2003).

Empirical evidence on the mechanisms through which material and psychosocial factors shape health inequities remains limited. Psychosocial stress may mediate both materialist and psychosocial pathways, although the pathways remain distinct by virtue of the stress being fundamentally *material* or *social* in its origins. Systematic reviews find mixed support for the notion that psychosocial stress mediates associations between objective socioeconomic indicators of SEP (i.e. materialist pathways) and health (Claassen et al., 2019; Matthews et al., 2010). By comparison, psychosocial stress arising from social comparisons is theorized to be a central pathway within the psychosocial perspective (Wilkinson, 1996, 2005), yet the evidence pertaining to whether psychosocial stress mediates psychosocial pathways is similarly mixed (Bradshaw et al., 2017; Callan et al., 2015; Garey et al., 2016; Senn et al., 2014; Subramanyam et al., 2012). Further clarification of the relative importance of psychosocial stress as a mediator of materialist and psychosocial pathways would provide valuable mechanistic insights to understand how SEP 'gets under the skin'.

In addition to understanding mechanisms at the individual level, robust theoretical understandings depend upon explicating the contextual forces that ultimately give rise to, maintain and reproduce health inequities. The level of income inequality within societies is one such contextual factor and is primarily associated with the psychosocial perspective, although others posit neo-materialist explanations (Lynch et al., 2000). According to the former, in societies that present more readily observable signs of rank, individuals regularly enter into social interactions in which their social status is known (Kraus et al., 2013a). For those situated in inferior positions, the chronic experience of low social status activates threat reactions and associated stress, leading to poor health trajectories and health inequities (Wilkinson & Pickett, 2009). Importantly, these social comparisons occur even among those at the top of the hierarchy who experience material sufficiency, and are thought to be a key reason why health diminishes with *each* step down the social ladder (Layte & Whelan, 2014). Thus, the psychosocial perspective posits a clear connection between pathways at the individual and societal levels, whereby the importance of stress-related pathways of social status differentiation should be higher in countries with greater income inequality (Wilkinson, 2005; Wilkinson & Pickett, 2008). That is, a larger distance between rungs on the 'social ladder' should increase status competition and its attendant negative health effects within more unequal nations. However, to our knowledge just one study has

examined variance in the size of health gradients according to SSS within more and less equal nations (Prag et al., 2016), and none have compared the direct and indirect effects of SSS to other indicators of SEP to elucidate mechanisms underlying health inequities in these nations.

This paper addresses two substantive issues in relation to health gradients internationally and the mechanisms that give rise to them. First, we examine the strength of associations between SEP indicators that tap into materialist and psychosocial perspectives with self-rated overall health (SROH) among adults living in countries with higher and lower levels of income inequality. We use educational attainment and perceived income adequacy to capture objective and subjective dimensions of the materialist perspective, and SSS to capture a predominantly psychosocial perspective. By examining associations of all three indicators with SROH simultaneously, we can begin to apprehend how the determinants of health inequities vary internationally. Given prior evidence (Cundiff & Matthews, 2017), we expect SSS to show distinct associations with SROH, independent of both materialist indicators. We also expect that associations between SSS and SROH will be higher among adults living in countries with higher levels of income inequality, in accordance with psychosocial theory. If our expectations are borne out, they will provide initial evidence of the importance of psychosocial pathways internationally and will indicate a correspondence between psychosocial pathways at the individual and societal levels.

Second, we examine the importance of psychosocial stress in mediating associations between educational attainment, perceived income adequacy and SSS with SROH among adults living in countries with higher and lower levels of income inequality. If psychosocial stress generated by social comparisons is a predominant mechanism underlying health inequities as the psychosocial hypothesis posits, then psychosocial stress should be a more important mediator of associations between SSS and SROH, and a less important mediator of associations between educational attainment and perceived income adequacy with SROH. Moreover, given that health inequities at the individual level are the result of broader societal structures and processes (World Health Organization, 2010), we would expect psychosocial stress to be a more important mediator of associations between SSS and SROH among adults living in countries with higher levels of income inequality. Thus, the current study will provide novel evidence concerning the determinants of inequities in self-rated health and the pathways that give rise to them, including whether and how these pathways differ according to the broader social context.

METHODS

Study design and participants

We analysed cross-sectional data from the 2018 wave of the International Food Policy Study (IFPS). The IFPS is an annual online survey of a population-based sample of adults aged ≥18 years living in Australia, Canada, Mexico, the UK and the United States (US). These countries span those with relatively high (i.e. Gini coefficients of disposable income in 2016: US = 38.2; Mexico = 44.8), moderate (Australia = 32.5; UK = 33.1) and lower (Canada = 30.4) levels of income inequality (Solt, 2019). Importantly, our analysis privileges in-depth and focused description of pathways underlying health inequities over simplification and summarization across many.

Full details of the IFPS methodologies are available elsewhere (International Food Policy Study, 2020). Briefly, participants were randomly drawn from each country's respective online Nielsen Consumer Insights Global Panel or their partner panels (https://www.nielsen.com/us/en/about-us/panels/) using quota sampling procedures to approximate the population distribution of sex,

age, education and language. Country-specific panels were recruited using both probability and non-probability-based sampling methods using standardized procedures. A total of 28,684 eligible adults completed a survey using a unique access link, of which 22,824 (Australia $n = 4103$; Canada $n = 4397$; Mexico $n = 4135$; UK $n = 5549$; US $n = 4640$) provided usable responses as determined via data integrity checks (e.g. correctly stated the current month, <3 extreme responses, completed survey in ≥15 min) (Appendix 1). The total participation rate was 6.5% (number of usable survey responses divided by number of invitations sent), while the cooperation rate was 69.2% (number of usable survey responses divided by number of eligible participants who accessed the survey link) (American Association for Public Opinion Research, 2016).

This study was approved by the University of Waterloo Research Ethics Committee (ORE #21460) and the University of Calgary Health Research Ethics Board (REB20-0586). All participants provided consent prior to participating and were remunerated in accordance with their panel's customary incentive structure.

Data collection

Questionnaires were similar across countries, although some questions were adapted using country-specific terminology (surveys available at: http://foodpolicystudy.com/methods/). The questionnaire items used in this study were drawn or adapted from previous national surveys or relevant research studies, as detailed below. Surveys were conducted in English, French and Spanish.

Exposures

Educational attainment

Participants reported their highest attained level of education (Statistics Canada, 2014). Responses were classified as low (secondary or lower), middle (postsecondary qualification below University degree) or high education (university degree or higher).

Perceived income adequacy

Participants reported perceived income adequacy (Gildner et al., 2019; Hagenaars & de Vos, 1988; Litwin & Sapir, 2009) by answering the question: 'Thinking about your total monthly income, how difficult or easy is it for you to make ends meet?'. Responses were classified as low (very difficult/difficult), middle (neither easy nor difficult) or high income (easy/very easy).

Subjective social status

The MacArthur Scale of SSS national ladder (Adler et al., 2000; MacArthur Research Network on SES & Health, 2008) was used to assess SSS with the following question: 'Think of this ladder as representing where people stand in [nation]. At the top of the ladder (step 10) are the people who have the most money and education, and the most respected jobs. At the bottom of the ladder (step 1) are the people who have the least money and education, and the least respected jobs or no job. Where would you place yourself on this ladder? Pick the number for the step that shows where you think you stand at this time in your life, relative to other people in [nation]'. Multiple studies substantiate that ladder rankings have sound psychometric properties and are

not confounded by negative affect or depression (Adler et al., 2000; Cundiff & Matthews, 2017; Cundiff et al., 2013; Kraus et al., 2013b; Operario et al., 2004).

Mediator

Psychosocial stress

Participants reported the level of stress experienced on most days (from not at all to extremely stressful) (Statistics Canada, 2017). Similar single-item measures have demonstrated good reliability, moderate to strong correlations with validated multi-item stress (Littman et al., 2006) and wellbeing instruments (Elo et al., 2003), and have been associated with prospective health-related outcomes (Salminen et al., 2014).

Outcome

Self-rated overall health

SROH was modelled as a latent variable consisting of self-rated general and mental health. Participants self-rated their general health as poor, fair, good, very good or excellent (Statistics Canada, 2017). Self-rated health is regarded as a comprehensive and informative health measure for population-level research (Jylha, 2009). It has been associated with income inequality in several cross-national studies (Detollenaere et al., 2018; Prag et al., 2014), correlates well with other indicators of morbidity (Cohen et al., 1995; Jylha et al., 2006) and consistently predicts mortality (Idler & Benyamini, 1997; Jylha et al., 1998; Nielsen et al., 2008; Schnittker & Bacak, 2014) in many nations. Evidence indicates few differences in reporting by sex (Jylha et al., 1998; Lazarevic & Brandt, 2020; Zajacova et al., 2017) and among (European) countries despite varying levels of income inequality (Jylha et al., 1998; Lazarevic & Brandt, 2020; Verropoulou, 2009). Differences in reporting by age exist (Lazarevic & Brandt, 2020), and therefore, age was considered a potential confounder.

Participants similarly self-rated their mental health as poor, fair, good, very good or excellent (Statistics Canada, 2017). Self-rated mental health status exhibits strong and consistent associations with a wide range of mental morbidity measures (Mawani & Gilmour, 2010).

Data analysis

Statistical analyses

All analyses were stratified by nation and weighted using country-specific poststratification sample weights based on age group, sex, region, race/ethnicity and education. Analyses were conducted in Stata v 15.1 (StataCorp, Texas, USA), with $p < 0.05$ indicating statistically significant differences.

Descriptive statistics were calculated overall and according to categorical SSS. A multigroup structural equation modelling approach was used to simultaneously evaluate total, direct and indirect effects of educational attainment, perceived income adequacy and SSS on SROH, mediated by psychosocial stress (Figure 1). The exposures and mediator were represented as manifest variables, while the outcome of SROH was represented as a continuous latent construct (Rhemtulla et al., 2012). The three indicators of SEP were allowed to correlate to examine their independent

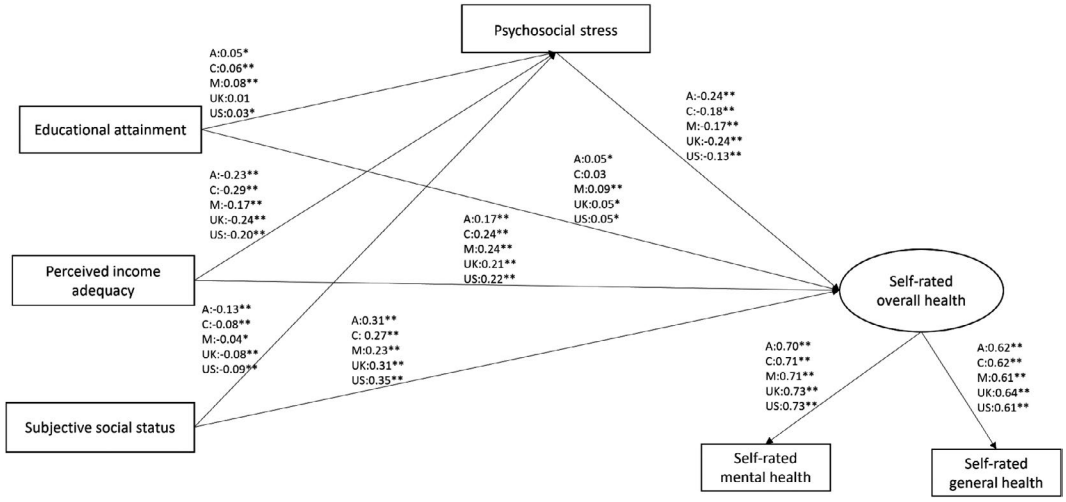

FIGURE 1 Structural equation model of associations between educational attainment, perceived income adequacy and subjective social status with self-rated overall health mediated by psychosocial stress among adults living in Australia (A), Canada (C), Mexico (M), the UK and the United States (US). Coefficients are standardized. Results are based on survey-weighted data. Adjusted for sex and age; *$p < 0.05$; **$p < 0.001$

effects. There were no statistically significant interactions between the exposures and the mediator. Directional paths were added from age and sex to all variables in the model to adjust for them.

Path coefficients were standardized, and the total effect of each SEP indicator was decomposed into indirect (mediated) and direct (unmediated) effects. Although most prior studies have modelled SSS as a mediator of associations between objective SEP and health, objective and subjective indicators of SEP are only moderately correlated, indicating that SSS has unique effects on health that do not stem from objective indicators (Cundiff & Matthews, 2017; Hoebel & Lampert, 2020; Prag, 2020). By modelling SSS as an exogenous exposure, we were able to examine the total effects of SSS, not simply those mediated via objective indicators.

Between country differences in total, indirect and direct effects were tested via bootstrapped standard errors (500 replications) (Ryu & Cheong, 2017). These analyses did not adjust for clustering, as the ICC in our data set was 0.01, indicating that the majority of the variation was within, rather than between nations (Vajargah & Masoomehnikbakht, 2015).

Good model fit was indicated by Tucker Lewis index and comparative fit index >0.94 (Hu & Bentler, 1999), and standardized root mean square residuals and root mean square error of approximation <0.08 (Hooper et al., 2008; McDonald & Ho, 2002). We also tested whether our measurement models and the structural relationships among the variables in our models were invariant across countries using three multigroup nested models with increasing constraints (Gregorich, 2006; Moreno-Agostino et al., 2021). The first model tested configural invariance to verify model fit across countries. The second model assessed metric invariance (i.e. equal factor loadings) to ensure that the meaning of the latent construct was equivalent in all countries. The third model tested structural invariance to determine whether there were cross-national differences in associations between variables in the model. Values of Δ comparative fit index <0.01 and Δ root mean square error of approximation <0.015 indicated measurement and structural invariance (Chen, 2007).

To retain as many participants in the analyses as possible, responses of don't know/refuse to answer (these options were available for all questions) were recoded as missing (<2.2% of respondents selected this option for any single question). Missing data were minimal (educational

attainment 0.3%, perceived income adequacy 0.8%, SSS 2.1%, psychosocial stress 1.1%, mental health 1.1% and general health 1.2%) and were handled using full information maximum likelihood under a missing at random assumption.

RESULTS

Descriptive statistics

The sample was nearly evenly split between males and females, with an average age of 39.3 (Mexico) to 48.1 years (Canada) (Appendix 2). With the exception of Mexico, more than 40% of participants in all countries reported a low educational attainment, with slightly more than a quarter reporting low perceived income adequacy. Although participants in Mexico were less likely to have a low educational attainment (19.9%), a higher proportion perceived their income to be inadequate (43.9%) compared to those living in the other four countries (25.1–29.7%). The average SSS was similar across countries and ranged from 5.0 (Mexico) to 6.0 (USA), with the majority of participants ranking themselves as 'average' (i.e. rungs 5–6; 37.1–40.9%). The majority of participants reported that most days were not very or a bit stressful (67.9–78.9%), having good to very good mental health (54.5–67.5%) and fair to good general health (64.7–71.9%).

Correlation matrix and model fit

Correlations among variables in the model were low to moderate, with similar patterns across countries (Appendix 3). Goodness-of-fit statistics indicated acceptable model fit (Appendix 4). Measurement (configural and metric) invariance was achieved for the model with and without mediators (Appendix 5). Structural invariance for the mediation model was not achieved, indicating cross-country differences in associations between variables in the model, which we describe subsequently.

Total effects

There was a significant positive total effect of educational attainment on SROH in the UK, Mexico and the United States ($\beta = 0.048–0.083$) (Table 1; Figures 1 and 2). There was also a significant positive total effect of perceived income adequacy ($\beta = 0.232–0.301$) and SSS ($\beta = 0.246–0.371$) on SROH in all countries. Whereas the total effects of educational attainment and perceived income adequacy did not differ by country, the total effects of SSS on SROH were the highest in the United States, the UK and Australia, with no differences between them, and the lowest in Canada and Mexico.

Direct effects

Females in all countries reported higher levels of psychosocial stress than males, while those living in the United States also reported poorer SROH than males (Appendix 6). As age increased psychosocial stress declined and SROH improved in all countries. The direct effects of educational attainment, perceived income adequacy, SSS and psychosocial stress on SROH were significant in all countries with one exception (i.e. educational attainment in Canada; Table 1; Figures 1 and 3).

TABLE 1 Direct, indirect and total effects of educational attainment, perceived income adequacy and subjective social status on self-rated overall health mediated by psychosocial stress

Path	Coefficient[a] (SE)	*p* value	Proportions	Differences across countries[b]
Direct effects			**Proportion of total effect**	
Educational attainment -> self-rated overall health				
Australia	0.054 (0.022)	0.016	Inconsistent mediation	NS
Canada	0.034 (0.022)	0.124	Inconsistent mediation	M
Mexico	0.099 (0.023)	<0.001	Inconsistent mediation	C
United Kingdom	0.051 (0.018)	0.006	Inconsistent mediation	NS
United States	0.057 (0.019)	0.003	Inconsistent mediation	NS
Perceived income adequacy -> self-rated overall health				
Australia	0.173 (0.029)	<0.001	74.8%	NS
Canada	0.246 (0.028)	<0.001	81.7%	NS
Mexico	0.245 (0.023)	<0.001	87.5%	NS
United Kingdom	0.211 (0.024)	<0.001	78.2%	NS
United States	0.221 (0.025)	<0.001	89.1%	NS
Subjective social status -> self-rated overall health				
Australia	0.318 (0.031)	<0.001	90.5%	NS
Canada	0.272 (0.029)	<0.001	94.2%	US
Mexico	0.239 (0.022)	<0.001	97.1%	UK; US
United Kingdom	0.316 (0.024)	<0.001	94.0%	M
United States	0.359 (0.027)	<0.001	96.7%	C; M
Psychosocial stress -> self-rated overall health				
Australia	−0.248 (0.025)	<0.001	-	US; M
Canada	−0.187 (0.028)	<0.001	-	NS
Mexico	−0.177 (0.026)	<0.001	-	A
United Kingdom	−0.241 (0.024)	<0.001	-	US
United States	−0.131 (0.025)	<0.001	-	A; UK
Indirect effects			**Proportion mediated by psychosocial stress[c]**	
Educational attainment -> psychosocial stress -> self-rated overall health				
Australia	−0.012 (0.003)	0.007	Inconsistent mediation	NS
Canada	−0.012 (0.002)	<0.001	Inconsistent mediation	NS

(Continues)

TABLE 1 (Continued)

Path	Coefficient[a] (SE)	*p* value	Proportions	Differences across countries[b]
Mexico	−0.015 (0.002)	<0.001	Inconsistent mediation	UK; US
United Kingdom	−0.002 (0.002)	0.472	Inconsistent mediation	M
United States	−0.005 (0.001)	0.043	Inconsistent mediation	M
Perceived income adequacy -> psychosocial stress -> self-rated overall health				
Australia	0.058 (0.043)	<0.001	25.1%	US; M
Canada	0.055 (0.006)	<0.001	18.2%	US; M
Mexico	0.030 (0.004)	<0.001	12.5%	A; C; UK
United Kingdom	0.059 (0.005)	<0.001	21.7%	US; M
United States	0.027 (0.019)	<0.001	10.8%	A; C; UK
Subjective social status -> psychosocial stress -> self-rated overall health				
Australia	0.033 (0.002)	<0.001	9.4%	C; US; M
Canada	0.016 (0.001)	0.001	5.7%	A
Mexico	0.007 (0.001)	0.052	2.8%	A
United Kingdom	0.020 (0.002)	<0.001	5.9%	NS
United States	0.012 (0.001)	0.004	3.2%	A
Total effects				
Educational attainment				
Australia	0.041 (0.016)	0.073	-	NS
Canada	0.021 (0.015)	0.340	-	NS
Mexico	0.083 (0.015)	<0.001	-	NS
United Kingdom	0.048 (0.014)	0.012	-	NS
United States	0.052 (0.012)	0.008	-	NS
Perceived income adequacy				
Australia	0.232 (0.020)	<0.001	-	NS
Canada	0.301 (0.019)	<0.001	-	NS
Mexico	0.275 (0.017)	<0.001	-	NS
United Kingdom	0.270 (0.019)	<0.001	-	NS
United States	0.248 (0.019)	<0.001	-	NS
Subjective social status				
Australia	0.352 (0.010)	<0.001	-	M
Canada	0.288 (0.009)	<0.001	-	US
Mexico	0.246 (0.007)	<0.001	-	A; UK; US

TABLE 1 (Continued)

Path	Coefficient[a] (SE)	*p* value	Proportions	Differences across countries[b]
United Kingdom	0.336 (0.008)	<0.001	-	M
United States	0.371 (0.008)	<0.001	-	C

Note: NS, nonsignificant; SE, standard error.

Adjusted for sex and age; Results are based on survey-weighted data.

[a]Standardized coefficients.

[b]A = Australia; C = Canada; M = Mexico; UK = United Kingdom; US = United States of America; compared via bootstrapped standard errors (500 replications); $p < 0.05$.

[c]Assessed using the absolute values for both indirect and direct effects as [indirect effect/ (total indirect effect +exposure direct effect)]*100.

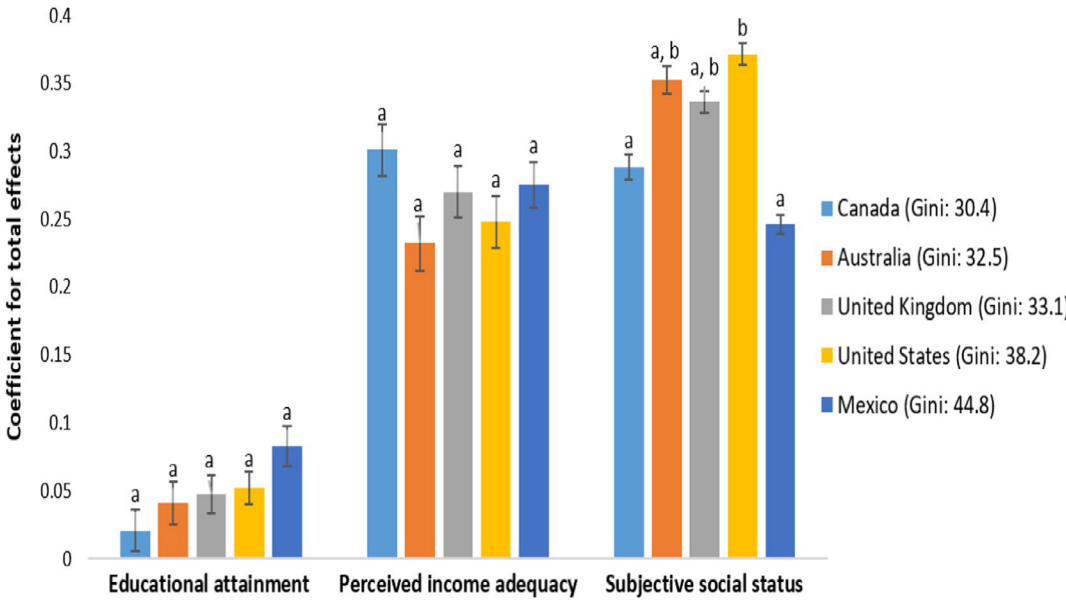

FIGURE 2 Total effects of educational attainment, perceived income adequacy and subjective social status on self-rated overall health among adults living in Australia, Canada, Mexico, the UK and the United States. Coefficients are standardized. Results are based on survey-weighted data. Adjusted for sex and age. Countries are ordered from lowest to highest level of income inequality based on Gini coefficients of disposable income in 2016. Bars with different letters are significantly different from one another ($p < 0.05$)

Indirect effects

There was a significant negative indirect effect of educational attainment on SROH through psychosocial stress in all countries except the UK (β = −0.005 to −0.015) (Table 1; Figure 1). That is, a higher educational attainment was associated with higher psychosocial stress, which was in turn associated with lower SROH. Due to this inconsistent mediation (i.e. the indirect and direct effects were opposite in sign), the proportion mediated could not be calculated.

There was a significant positive indirect effect of perceived income adequacy (β = 0.027–0.059) and SSS (β = 0.007–0.033) on SROH through psychosocial stress in all countries (Table

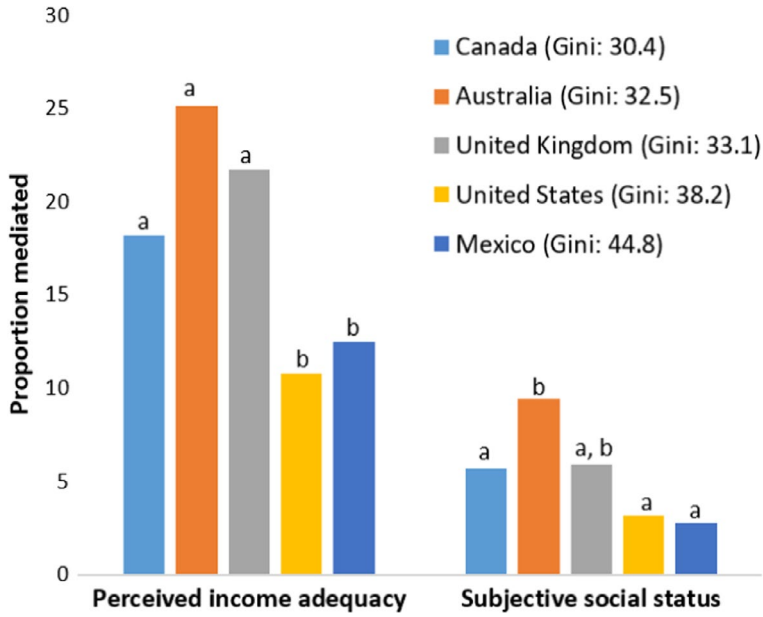

FIGURE 3 Indirect effects of perceived income adequacy and subjective social status on self-rated overall health among adults living in Australia, Canada, Mexico, the UK and the United States. Results are based on survey-weighted data. The proportion mediated was calculated as the indirect effect divided by the total effect. Adjusted for sex and age. Countries are ordered from lowest to highest level of income inequality based on Gini coefficients of disposable income in 2016. Bars with different letters are significantly different from one another ($p < 0.05$)

1; Figures 1 and 3). The indirect effects of perceived income adequacy on SROH appeared to be higher (10.8%-25.1% of total effect mediated) than the indirect effects of SSS on SROH (2.8%-9.4% of total effect mediated), although the statistical significance of these differences was not tested. Psychosocial stress was a more important mediator of associations between perceived income adequacy and SROH in Australia, Canada and the UK compared to Mexico and the United States. Psychosocial stress was also a more important mediator of associations between SSS and SROH among adults living in Australia, whereas it was similarly low in all other countries.

DISCUSSION

We examined the comparative size of gradients in SROH internationally using SEP indicators that aligned with materialist and psychosocial mechanisms, and the extent to which these pathways were mediated by psychosocial stress. By conducting these analyses in countries with lower and higher levels of income inequality, we generated novel evidence on the theoretical alignment between psychosocial processes at the individual and societal levels. Our findings demonstrated that the choice of SEP indicator matters, as all three indicators captured quantitatively and qualitatively distinct dimensions of inequities in SROH. The total effects of SSS on SROH were similar to, or higher than the total effects of educational attainment and perceived income adequacy on SROH, highlighting the importance of rank-based projections of status. However, inequities in SROH were not consistently higher in more unequal countries, regardless of the indicator used, nor was psychosocial stress a more important mediator of associations between SSS and SROH

in these countries. We therefore found little evidence of correspondence between psychosocial pathways at the individual and societal levels.

With respect to our first objective, SSS exhibited distinct associations with SROH that were similar to, or larger than associations between materialist indicators and SROH. Notably, the total effects of the two subjective indicators far exceeded the total effects of educational attainment, suggesting the relative value of subjective indicators of SEP in understanding the social patterning of SROH. This is consistent with evidence that associations between SSS and subjective wellbeing are higher than associations with objective indicators, and with education in particular (Tan et al., 2020). It is not clear whether our findings would have differed had we used household income, rather than educational attainment, to capture an objective materialist perspective. However, others have shown that education-based inequities in self-rated health exceed income-based inequities in countries with higher levels of income inequality, suggesting that our findings may be robust to the choice of materialist indicators (Beckfield & Olafsdottir, 2013).

The total effects of SSS on SROH were the highest in the United States, the UK and Australia, with no differences between them, and the lowest in Canada and Mexico. If rank-based perceptions of status were more important determinants of inequities in SROH in more unequal countries, we would have expected the total effects of SSS to be the highest in the United States and Mexico and the lowest in Canada. These results are in agreement with a comparable study which found that associations between SSS and self-rated health did not vary according to the level of income inequality among 29 nations (Prag et al., 2016). For nonhealth outcomes, evidence from a recent meta-analysis actually suggests that associations between SSS and subjective wellbeing may be *higher* in countries with lower income inequality (Tan et al., 2020). There was similarly no evidence that gradients in SROH using materialist indicators were higher in more unequal countries, a finding that is also broadly consistent with others' (Beckfield & Olafsdottir, 2013; Semyonov et al., 2013). Our initial tests therefore suggested that inequities in SROH were not consistently higher in more unequal countries, regardless of the indicator used. Thus, we found limited alignment between psychosocial mechanisms at the individual and societal levels. It may be that increasing globalization has reduced the importance of income inequality at a national level in shaping inequities in SROH, as individuals may have expanded their reference groups beyond national boundaries to those in other countries (Delhey & Kohler, 2006; Lindemann & Saar, 2014). Alternatively, contextual factors other than the level of national income inequality may be more salient determinants of these associations (Lindemann & Saar, 2014).

It is possible that the effects of income inequality might differ in an upper middle income country such as Mexico, where basic material needs are less easily met compared to in higher income countries (Wilkinson, 1996). However, Mexico is considered more advanced than its peers, and its per capita gross domestic product places it along the top of the Preston curve, where returns to life expectancy from increases in national wealth diminish substantially (Deaton, 2003; Wilkinson, 1996). Moreover, the risk of premature mortality in Mexico is 38% higher compared to in countries with a Gini coefficient <0.3, indicating that its high level of income inequality is associated with substantial negative health effects (Kondo et al., 2009). In addition, Curran and Mahutga (Curran & Mahutga, 2018) have shown that income inequality may be more detrimental to health in poorer nations. Thus, our expectations of higher inequities in SROH according to SSS in Mexico were both theoretically and evidence-informed. Nevertheless, we seek further corroboration or refutation of our hypotheses via our subsequent, more stringent tests.

With respect to our second hypothesis, our findings provide little empirical support for the salience of stress-related pathways underlying inequities in SROH, regardless of the indicator used. Contrary to expectations, a higher educational attainment was associated with *higher* psychosocial

stress, which was associated with poorer SROH. Similar 'glitches' in the education–health gradient have been reported in the United States, the UK and Canada (Singh-Manoux et al., 2003; Veenstra, 2005; Veenstra & Vanzella-Yang, 2020; Zajacova et al., 2012). It was also unexpected that psychosocial stress proved to be a more important mediator of associations between perceived income adequacy and SROH than it was for SSS. Thus, perceiving one's income to be inadequate may be a greater source of health-damaging stress than perceiving oneself to have a lower level of education, income and/or a less prestigious occupation relative to others. It was particularly surprising that psychosocial stress should mediate such a small proportion of associations between SSS and SROH, given that the psychosocial hypothesis attributes the negative health effects of income inequality largely to toxic stress arising from invidious social comparisons (Kondo et al., 2008; Wilkinson, 1996, 2005) and that social evaluative threats are among the most powerful stressors (Dickerson & Kemeny, 2004). Other studies have also found small (Bradshaw et al., 2017; Garey et al., 2016; Senn et al., 2014) or no indirect effects (Callan et al., 2015; Subramanyam et al., 2012) of SSS on health-related outcomes mediated by stress. This may suggest that the effects of SSS may be mediated via other psychosocial pathways, such as anger, depression, anxiety, neuroticism and sense of control (Cundiff et al., 2013; Kan et al., 2014; Lundberg & Kristenson, 2008; Marmot & Wilkinson, 2001; Matthews et al., 2010). Alternatively, SSS may capture both stress inducing (i.e. upward) and dampening (i.e. downward) comparisons that counteract one another. Other macrolevel factors may also modify the effects of income inequality.

Psychosocial stress was not a more important mediator of associations between SSS and SROH in more unequal countries. The indirect effects of SSS were the highest in Australia, a country with a moderate level of income inequality, and similarly low in the other four countries. The patterning of the indirect effects of perceived income adequacy on SROH was similarly paradoxical, as stress was a more important mediator in the three countries with the lowest levels of income inequality. Results from our second test therefore corroborated our initial findings that psychosocial pathways at the individual level were not more important within more unequal countries, indicating little correspondence between psychosocial mechanisms at the individual and societal levels. Notably, a related literature has examined key tenets of the psychosocial hypothesis based on the construct of status anxiety (i.e. individual perceptions of being looked down upon), with mixed findings (Layte, 2012; Layte et al., 2019; Layte & Whelan, 2014). Thus, further theoretical development may be needed to understand psychosocial processes that generate inequities in SROH.

Strengths and limitations

We leveraged data from a large, cross-national study that used identical sampling procedures and questionnaires in five countries, thereby allowing direct comparisons. We advanced prior work by examining associations between multiple indicators of SEP with SROH in nations not included in prior analyses, by examining physical and mental health outcomes, and most notably by modelling underlying mechanisms.

The sample was recruited using both probability and non-probability-based methods and was therefore not nationally representative. Survey weights were therefore applied to improve representativeness. Although the participation rate was low, low response rates are common in online surveys (e.g. the baseline response rate in the UK Biobank study was 5.5%) and are not a good indicator of non-response bias (American Association for Public Opinion Research, 2021; Batty et al., 2020; Groves & Peytcheva, 2008). Moreover, the cooperation rate was relatively high.

Consistent with our aims, our analyses were stratified by nation to support detailed analysis of mediating pathways within a small number of nations and were not powered nor intended to assess country-level effects. Constructing structural equation models for dozens of nations would have yielded an extremely complex pattern of total, direct and indirect effects for each of the three indicators of SEP that would have been difficult to interpret. It will therefore be important to replicate these findings among other nations.

Given the cross-sectional nature of our data, causality and directionality cannot be inferred. However, longitudinal (Blazer et al., 2005; D'Hooge et al., 2018; Garbarski, 2010; Nobles et al., 2013) and experimental (Bratanova et al., 2016; Muscatell et al., 2016; Pieritz et al., 2016; Schubert et al., 2016) studies substantiate the directionality of associations modelled here. Although some suggest the effects of income inequality on health may take up to 15 years to materialize (Blakely et al., 2000), this should not have affected our results as Gini coefficients in all five nations varied by only 0.5–2.6 points between 2000 and 2016.

While exposures and outcomes were self-reported, as summarized above they have all been associated with objective health outcomes and/or mortality in prior studies. Although some evidence indicates few cross-national differences in reporting of self-rated health, it will nevertheless be important to replicate our findings using objective health indicators due to the potential for group-specific understandings of health, reporting norms and reference groups (Lazarevic & Brandt, 2020). Our use of a latent indicator of SROH also helped to address measurement error, and measurement invariance was achieved, indicating that the meaning of the latent construct was equivalent in all countries. Importantly, the four higher income nations shared many similarities (e.g. large and predominantly White European ancestry populations that are becoming increasingly multicultural, democratic liberal welfare regimes, history of colonialism), but differed with respect to income inequality, which also strengthens confidence in our findings. Nevertheless, no two nations are identical, and it remains possible that other differences between nations could account for our findings, such as differences in the sociodemographic composition of their populations, social support policies and economic productivity. Finally, with respect to our mediator, it is not clear to what extent our single item measure of psychosocial stress fully captured long-term stressful exposures across all relevant domains in all countries.

This research makes two distinct contributions to the literature pertaining to health inequities and the mechanisms that give rise to them. First, findings demonstrate the importance of both materialist and psychosocial pathways in shaping inequities in SROH internationally. As such, greater incorporation of indicators such as SSS within research may help to achieve a more comprehensive understanding of mechanisms underlying health inequities, and corresponding leverage points for intervention. Second, inequities in SROH were not consistently higher in more unequal countries, nor were stress-related pathways of social status differentiation more important in these nations. These findings point to the need for further theoretical development to understand psychosocial processes that generate health inequities, both at the individual and societal levels. In this respect, future investigations could explore other mediators of these associations, and whether other axes of social stratification moderate associations between income inequality and health, such as the unequal distribution of social capital, along with broader sociocultural norms and policies. Moreover, in an increasingly global society, the geographic scale at which such associations are examined may need to be reconsidered. Ultimately, a better understanding of how psychosocial processes shape health inequities can inform more effective policy responses to disrupt them.

ACKNOWLEDGMENTS

None.

CONFLICT OF INTEREST

KML is a consultant for HeadUp Labs. DLO and DJTC have received support from a Petro-Canada Young Innovator Award in Community Health. All other authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

Dana Lee Olstad: Conceptualization (lead); Formal analysis (supporting); Funding acquisition (equal); Investigation (lead); Methodology (lead); Resources (lead); Supervision (lead); Writing – original draft (lead); Writing – review & editing (lead). **Sara Nejatinamini:** Conceptualization (supporting); Formal analysis (lead); Methodology (supporting); Writing – review & editing (supporting). **Lana Vanderlee:** Data curation (lead); Funding acquisition (equal); Investigation (supporting); Methodology (equal); Writing – review & editing (supporting). **Katherine Livingstone:** Investigation (supporting); Methodology (supporting); Writing – review & editing (supporting). **David Campbell:** Investigation (supporting); Methodology (supporting); Writing – review & editing (supporting). **Karen Tang:** Investigation (supporting); Methodology (supporting); Writing – review & editing (supporting). **Leia Minaker:** Data curation (supporting); Investigation (supporting); Methodology (supporting); Writing – review & editing (supporting). **David Hammond:** Conceptualization (supporting); Data curation (lead); Funding acquisition (lead); Investigation (equal); Methodology (equal); Resources (lead); Validation (lead); Writing – review & editing (supporting).

ETHICS STATEMENT

This study was approved by the University of Waterloo Research Ethics Committee (ORE #21460) and the University of Calgary Health Research Ethics Board (REB20-0586).

PATIENT CONSENT

All participants provided written informed consent to participate.

DATA AVAILABILITY STATEMENT

Data described in the article, code book and analytic code will be made available upon request pending application and approval by DH. Address correspondence to david.hammond@uwaterloo.ca.

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REFERENCES

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy white women. *Health Psychology*, 19, 586–592. https://doi.org/10.1037/0278-6133.19.6.586

American Association for Public Opinion Research (2016). *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. 9th edition. [Online]. https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf

American Association for Public Opinion Research (2021). *Response Rates - An Overview [Online]*. https://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx

Batty, G. D., Gale, C. R., Kivimaki, M., Deary, I. J., & Bell, S. (2020). Comparison of risk factor associations in UK Biobank against representative, general population based studies with conventional response rates: Prospective cohort study and individual participant meta-analysis. *BMJ*, 368, m131.

Beckfield, J., & Olafsdottir, S. (2013). Health inequalities in global context. *American Behavioral Scientist*, 57, 1014–1039.

Blakely, T. A., Kennedy, B. P., Glass, R., & Kawachi, I. (2000). What is the lag time between income inequality and health status? *Journal of Epidemiology and Community Health*, 54, 318–319.

Blazer, D. G., Sachs-Ericsson, N., & Hybels, C. F. (2005). Perception of unmet basic needs as a predictor of mortality among community-dwelling older adults. *American Journal of Public Health*, 95, 299–304.

Bradshaw, M., Kent, B. V., Henderson, W. M., & Setar, A. C. (2017). Subjective social status, life course SES, and BMI in young adulthood. *Health Psychology*, 36, 682–694.

Bratanova, B., Loughnan, S., Klein, O., Claassen, A., & Wood, R. (2016). Poverty, inequality, and increased consumption of high calorie food: Experimental evidence for a causal link. *Appetite*, 100, 162–171. https://doi.org/10.1016/j.appet.2016.01.028

Braveman, P. A., Cubbin, C., Egerter, S., Chideya, S., Marchi, K. S., Metzler, M., & Posner, S. (2005). Socioeconomic status in health research: One size does not fit all. *JAMA*, 294, 2879–2888. https://doi.org/10.1001/jama.294.22.2879

Callan, M. J., Kim, H., & Matthews, W. J. (2015). Predicting self-rated mental and physical health: The contributions of subjective socioeconomic status and personal relative deprivation. *Frontiers in Psychology*, 6, 1415. https://doi.org/10.3389/fpsyg.2015.01415

Chen, F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling*, 14, 464–504.

Cheng, Y. H., Chi, I., Boey, K. W., Ko, L. S., & Chou, K. L. (2002). Self-rated economic condition and the health of elderly persons in Hong Kong. *Social Science and Medicine*, 55, 1415–1424.

Claassen, M. A., Klein, O., Bratanova, B., Claes, N., & Corneille, O. (2019). A systematic review of psychosocial explanations for the relationship between socioeconomic status and body mass index. *Appetite*, 132, 208–221.

Cohen, G., Forbes, J., & Garraway, M. (1995). Interpreting self reported limiting long term illness. *BMJ*, 311, 722–724.

Cundiff, J. M., & Matthews, K. A. (2017). Is subjective social status a unique correlate of physical health? A meta-analysis. *Health Psychology*, 36, 1109–1125.

Cundiff, J. M., Smith, T. W., Uchino, B. N., & Berg, C. A. (2013). Subjective social status: Construct validity and associations with psychosocial vulnerability and self-rated health. *International Journal of Behavioral Medicine*, 20, 148–158.

Curran, M., & Mahutga, M. (2018). Income inequality and population health: A global gradient? *Journal of Health and Social Behavior*, 59, 536–553.

Danigelis, N. L., & Mcintosh, B. R. (2001). Gender's effect on the relationships linking older Americans' resources and financial satisfaction. *Research on Aging*, 23, 410–428.

Deaton, A. (2003). Health, inequality, and economic development. *Journal of Economic Literature*, XLI, 113–158.

Delhey, J., & Kohler, U. (2006). From national bounded to Pan-European inequalities? On the importance of foreign countries as reference groups. *European Sociological Review*, 22, 125–140.

Detollenaere, J., Desmarest, A. S., Boeckxstaens, P., & Willems, S. (2018). The link between income inequality and health in Europe, adding strength dimensions of primary care to the equation. *Social Science and Medicine*, 201, 103–110.

Dhooge, L., Achterberg, P., & Reeskens, T. (2018). Mind over matter. The impact of subjective social status on health outcomes and health behaviors. *PLoS One*, 13, e0202489.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, 130, 355–391.

Elo, A. L., Leppanen, A., & Jahkola, A. (2003). Validity of a single-item measure of stress symptoms. *Scandinavian Journal of Work, Environment & Health*, 29, 444–451.

Euteneuer, F. (2014). Subjective social status and health. *Current Opinion Psychiatry*, 27, 337–343.

Galobardes, B., Shaw, M., Lawlor, D. A., Lynch, J. W., & Davey Smith, G. (2006). Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health*, 60, 7–12.

Garbarski, D. (2010). Perceived social position and health: Is there a reciprocal relationship? *Social Science and Medicine*, 70, 692–699.

Garey, L., Reitzel, L. R., Kendzor, D. E., & Businelle, M. S. (2016). The potential explanatory role of perceived stress in associations between subjective social status and health-related quality of life among homeless smokers. *Behavior Modification*, 40, 303–324. https://doi.org/10.1177/0145445515612396

Gildner, T. E., Liebert, M. A., Capistrant, B. D., D'este, C., Snodgrass, J. J., & Kowal, P. (2019). Perceived income adequacy and well-being among older adults in six low- and middle-income Countries. *Journals of Gerontology Series B, Psychological Sciences and Social Sciences*, 74, 516–525.

Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care*, 44, S78–94.

Groves, R. M., & Peytcheva, E. (2008). The impact of nonresponse rates on nonresponse bias: A meta-analysis. *Public Opinion Quarterly*, 72, 167–189. https://doi.org/10.1093/poq/nfn011

Hagenaars, A., & De Vos, K. (1988). The definition and measurement of poverty. *The Journal of Human Resources*, 23, 211–221.

Hamad, R., Elser, H., Tran, D. C., Rehkopf, D. H., & Goodman, S. N. (2018). How and why studies disagree about the effects of education on health: A systematic review and meta-analysis of studies of compulsory schooling laws. *Social Science and Medicine*, 212, 168–178. https://doi.org/10.1016/j.socscimed.2018.07.016

Hoebel, J., & Lampert, T. (2020). Subjective social status and health: Multidisciplinary explanations and methodological challenges. *Journal of Health Psychology*, 25, 173–185.

Hoebel, J., Maske, U. E., Zeeb, H., & Lampert, T. (2017). Social Inequalities and depressive symptoms in adults: The role of objective and subjective socioeconomic status. *PLoS One*, 12, e0169764. https://doi.org/10.1371/journal.pone.0169764

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6, 53–60.

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling*, 6, 1–55.

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior*, 38, 21–37.

International Food Policy Study (2020). http://foodpolicystudy.com/about/

Jylha, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science and Medicine*, 69, 307–316.

Jylha, M., Guralnik, J. M., Ferrucci, L., Jokela, J., & Heikkinen, E. (1998). Is self-rated health comparable across cultures and genders? *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 53, S144–S152.

Jylha, M., Volpato, S., & Guralnik, J. M. (2006). Self-rated health showed a graded association with frequently used biomarkers in a large population sample. *Journal of Clinical Epidemiology*, 59, 465–471.

Kan, C., Kawakami, N., Karasawa, M., Love, G. D., Coe, C. L., Miyamoto, Y., Ryff, C. D., Kitayama, S., Curhan, K. B., & Markus, H. R. (2014). Psychological resources as mediators of the association between social class and health: Comparative findings from Japan and the USA. *International Journal of Behavioral Medicine*, 21, 53–65.

Kondo, N., Kawachi, I., Subramanian, S. V., Takeda, Y., & Yamagata, Z. (2008). Do social comparisons explain the association between income inequality and health?: Relative deprivation and perceived health among male and female Japanese individuals. *Social Science and Medicine*, 67, 982–987. https://doi.org/10.1016/j.socscimed.2008.06.002

Kondo, N., Sembajwe, G., Kawachi, I., Van Dam, R. M., Subramanian, S. V., & Yamagata, Z. (2009). Income inequality, mortality, and self rated health: Meta-analysis of multilevel studies. *BMJ*, 339, b4471. https://doi.org/10.1136/bmj.b4471

Kraus, M. W., Adler, N., & Chen, T. W. (2013b). Is the association of subjective SES and self-rated health confounded by negative mood? An experimental approach. *Health Psychology*, 32, 138–145.

Kraus, M., Tan, J., & Tannenbaum, M. (2013a). The social ladder: A rank-based perspective on social class. *Psychological Inquiry*, 24, 81–96.

Layte, R. (2012). The association between income inequality and mental health: Testing status anxiety, social capital, and neo-materialist explanations. *European Sociological Review*, 28, 498–511.

Layte, R., Mccrory, C., Cheallaigh, C. N., Bourke, N., Kivimaki, M., Ribeiro, A. I., Stringhini, S., & Vineis, P. (2019). A comparative analysis of the status anxiety hypothesis of socio-economic inequalities in health based on 18,349 individuals in four countries and five cohort studies. *Scientific Reports*, 9, 796. https://doi.org/10.1038/s41598-018-37440-7

Layte, R., & Whelan, C. (2014). Who feels inferior? A test of the status anxiety hypothesis of social inequalities in health. *European Sociological Review*, 30, 525–535.

Lazarevic, P., & Brandt, M. (2020). Diverging ideas of health? Comparing the basis of health ratings across gender, age, and country. *Social Science and Medicine*, 267, 112913.

Lindemann, K., & Saar, E. (2014). Contextual effects on subjective social position: Evidence from European countries. *International Journal of Comparative Sociology*, 55, 3–23.

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior*. Spec No 80–94.

Littman, A. J., White, E., Satia, J. A., Bowen, D. J., & Kristal, A. R. (2006). Reliability and validity of 2 single-item measures of psychosocial stress. *Epidemiology*, 17, 398–403.

Litwin, H., & Sapir, E. V. (2009). Perceived income adequacy among older adults in 12 countries: Findings from the survey of health, ageing, and retirement in Europe. *Gerontologist*, 49, 397–406. https://doi.org/10.1093/geront/gnp036

Loignon, A., & Woehr, D. (2017). Social class in the organizational sciences: A conceptual integration and meta-analytic review. *Journal of Management*, 2017, 1–28.

Lundberg, J., & Kristenson, M. (2008). Is subjective status influenced by psychosocial factors? *Social Indicators Research*, 89, 375–390.

Lynch, J. W., Smith, G. D., Kaplan, G. A., & House, J. S. (2000). Income inequality and mortality: Importance to health of individual income, psychosocial environment, or material conditions. *BMJ*, 320, 1200–1204. https://doi.org/10.1136/bmj.320.7243.1200

Macarthur Research Network on Ses and Health (2008). *The macarthur scale of subjective social status [Online]*. https://macses.ucsf.edu/research/psychosocial/subjective.php

Mackenbach, J. P. (2012). The persistence of health inequalities in modern welfare states: The explanation of a paradox. *Social Science and Medicine*, 75, 761–769.

Marmot, M., & Wilkinson, R. G. (2001). Psychosocial and material pathways in the relation between income and health: a response to Lynch et al *BMJ*, 322(7296), 1233–1236. https://doi.org/10.1136/bmj.322.7296.1233

Matthews, K. A., Gallo, L. C., & Taylor, S. E. (2010). Are psychosocial factors mediators of socioeconomic status and health connections? A progress report and blueprint for the future. *Annals of the New York Academy of Sciences*, 1186, 146–173.

Mawani, F. N., & Gilmour, H. (2010). Validation of self-rated mental health. *Health Reports*, 21, 61–75.

Mcdonald, R. P., & Ho, M. H. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, 7, 64–82.

Mcewen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European Journal of Pharmacology*, 583, 174–185. https://doi.org/10.1016/j.ejphar.2007.11.071

Moreno-Agostino, D., De La Fuente, J., Leonardi, M., Koskinen, S., Tobiasz-Adamczyk, B., Sanchez-Niubo, A., Chatterji, S., Haro, J. M., Ayuso-Mateos, J. L., & Miret, M. (2021). Mediators of the socioeconomic status and life satisfaction relationship in older adults: A multi-country structural equation modeling approach. *Aging & Mental Health*, 25(3), 585–592.

Muscatell, K. A., Dedovic, K., Slavich, G. M., Jarcho, M. R., Breen, E. C., Bower, J. E., Irwin, M. R., & Eisenberger, N. I. (2016). Neural mechanisms linking social status and inflammatory responses to social stress. *Social Cognitive and Affective Neuroscience*, 11, 915–922.

Nielsen, A. B., Siersma, V., Hiort, L. C., Drivsholm, T., Kreiner, S., & Hollnagel, H. (2008). Self-rated general health among 40-year-old Danes and its association with all-cause mortality at 10-, 20-, and 29 years' follow-up. *Scandinavian Journal of Public Health*, 36, 3–11.

Nobles, J., Weintraub, M. R., & Adler, N. E. (2013). Subjective socioeconomic status and health: Relationships reconsidered. *Social Science and Medicine*, 82, 58–66.

Olstad, D. L., & Mcintyre, L. (2019). Reconceptualising precision public health. *British Medical Journal Open*, 9, e030279.

Operario, D., Adler, N., & Williams, D. (2004). Subjective social status: Reliability and predictive utility for global health. *Psychology and Health*, 19, 237–246.

Pieritz, K., Sussenbach, P., Rief, W., & Euteneuer, F. (2016). Subjective social status and cardiovascular reactivity: An experimental examination. *Frontiers in Psychology*, 7, 1091.

Prag, P. (2020). Subjective socio-economic status predicts self-rated health irrespective of objective family socio-economic background. *Scandinavian Journal of Public Health*, 1403494820926053.48, 707–714.

Prag, P., Mills, M., & Wittek, R. (2014). Income and income inequality as social determinants of health: Do social comparisons play a role? *European Sociological Review*, 30, 218–229.

Prag, P., Mills, M. C., & Wittek, R. (2016). Subjective socioeconomic status and health in cross-national comparison. *Social Science and Medicine*, 149, 84–92.

Rhemtulla, M., Pe, B.-L., & Savalei, V. (2012). When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological Methods*, 17, 354–373. https://doi.org/10.1037/a0029315

Ryu, E., & Cheong, J. (2017). Comparing indirect effects in different groups in single-group and multi-group structural equation models. *Frontiers in Psychology*, 8, 747.

Salminen, S., Kouvonen, A., Koskinen, A., Joensuu, M., & Vaananen, A. (2014). Is a single item stress measure independently associated with subsequent severe injury: A prospective cohort study of 16,385 forest industry employees. *BMC Public Health*, 14, 543. https://doi.org/10.1186/1471-2458-14-543

Schnittker, J., & Bacak, V. (2014). The increasing predictive validity of self-rated health. *PLoS One*, 9, e84933.

Schubert, T., Sussenbach, P., Schafer, S. J., & Euteneuer, F. (2016). The effect of subjective social status on depressive thinking: An experimental examination. *Psychiatry Research*, 241, 22–25.

Semyonov, M., Lewin-Epstein, N., & Maskileyson, D. (2013). Where wealth matters more for health: The wealth-health gradient in 16 countries. *Social Science and Medicine*, 81, 10–17.

Senn, T. E., Walsh, J. L., & Carey, M. P. (2014). The mediating roles of perceived stress and health behaviors in the relation between objective, subjective, and neighborhood socioeconomic status and perceived health. *Annals of Behavioral Medicine*, 48, 215–224. https://doi.org/10.1007/s12160-014-9591-1

Singh-Manoux, A., Adler, N. E., & Marmot, M. G. (2003). Subjective social status: Its determinants and its association with measures of ill-health in the Whitehall II study. *Social Science and Medicine*, 56, 1321–1333.

Solt, F. (2019). *Measuring Income Inequality Across Countries and Over Time: The Standardized World Income Inequality Database - Gini Index of Disposable Income 2016*. SWIID Version 8.2, November 2019 [Online]. https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi: https://doi.org/10.7910/DVN/LM4OWF

Statistics Canada (2014). *Canadian Community Health Survey – Annual Component 2014 [Online]*. https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getInstanceList&Id=1263799

Statistics Canada (2017). *Canadian Community Health Survey – Annual Component 2017 [Online]*. https://www23.statcan.gc.ca/imdb/p3Instr.pl?Function=getInstrumentList&Item_Id=507367&UL=1V

Steptoe, A. (2008). *Psychobiological processes linking socio-economic position with health. Social inequalities in health: New evidence and policy implications*. Oxford University Press.

Subramanyam, M. A., Diez-Roux, A. V., Hickson, D. A., Sarpong, D. F., Sims, M., Taylor, H. A., Williams, D. R., & Wyatt, S. B. (2012). Subjective social status and psychosocial and metabolic risk factors for cardiovascular disease among African Americans in the Jackson Heart Study. *Social Science and Medicine*, 74, 1146–1154. https://doi.org/10.1016/j.socscimed.2011.12.042

Sun, F., Hilgeman, M. M., Durkin, D. W., Allen, R. S., & Burgio, L. D. (2009). Perceived income inadequacy as a predictor of psychological distress in Alzheimer's caregivers. *Psychology and Aging*, 24, 177–183.

Tan, J. J. X., Kraus, M. W., Carpenter, N. C., & Adler, N. E. (2020). The association between objective and subjective socioeconomic status and subjective well-being: A meta-analytic review. *Psychological Bulletin*, 146, 970–1020. https://doi.org/10.1037/bul0000258

Tang, K. L., Rashid, R., Godley, J., & Ghali, W. A. (2016). Association between subjective social status and cardiovascular disease and cardiovascular risk factors: A systematic review and meta-analysis. *British Medical Journal Open*, 6, e010137. https://doi.org/10.1136/bmjopen-2015-010137

Vajargah, K., & Masoomehnikbakht (2015). Application REMLmodel and determining cut off of ICC by multilevel model based on Markov Chains simulation in health. *Indian Journal of Fundamental and Applied Life Science*, 5, 1423–1448.

Veenstra, G. (2005). Social status and health: Absolute deprivation or relative comparison, or both? *Health Sociology Review*, 14, 121–134.

Veenstra, G., & Vanzella-Yang, A. (2020). Does household income mediate the association between education and health in Canada? *Scandinavian Journal of Public Health*, 1403494820917534.

Verropoulou, G. (2009). Key elements composing self-rated health in older adults: A comparative study of 11 European countries. *European Journal of Ageing*, 6, 213–226. https://doi.org/10.1007/s10433-009-0125-9

Wilkinson, R. (1996). *Unhealthy societies: The afflictions of inequality*. Routledge.

Wilkinson, R. (2005). *The impact of income inequality: How to make sick societies healthier*. New Press.

Wilkinson, R. G., & Pickett, K. E. (2008). Income inequality and socioeconomic gradients in mortality. *American Journal of Public Health*, 98, 699–704.

Wilkinson, R., & Pickett, K. (2009). Income inequality and social dysfunction. *Annual Review of Sociology*, 35, 493–511.

World Health Organization (2010). *A conceptual framework for action on the social determinants of health*. Social determinants of health discussion paper 2 [Online]. Geneva, Switzerland: WHO Document Production Services. Available: http://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf [Accessed November 2 2020]

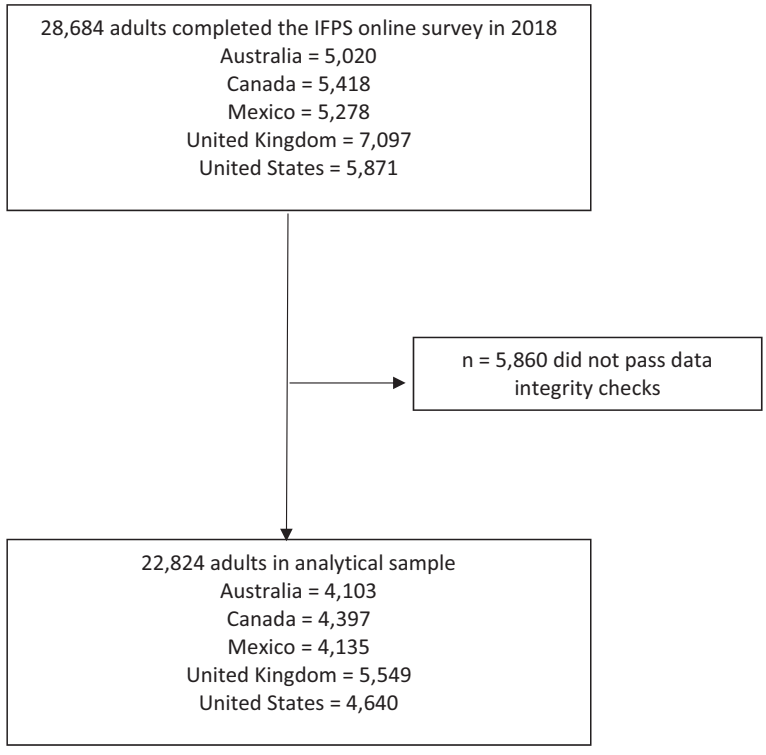
Zajacova, A., Huzurbazar, S., & Todd, M. (2017). Gender and the structure of self-rated health across the adult life span. *Social Science and Medicine*, 187, 58–66.

Zajacova, A., Rogers, R. G., & Johnson-Lawrence, V. (2012). Glitch in the gradient: Additional education does not uniformly equal better health. *Social Science and Medicine*, 75, 2007–2012.

How to cite this article: Olstad, D. L., Nejatinamini, S., Vanderlee, L., Livingstone, K. M., Campbell, D. J. T., Tang, K., Minaker, L. M., & Hammond, D. Are stress-related pathways of social status differentiation more important determinants of health inequities in countries with higher levels of income inequality? *Sociology of Health & Illness*. 2022;44:663–691. https://doi.org/10.1111/1467-9566.13445

APPENDIX 1

Participant Flow Chart for the International Food Policy Study (IFPS) 2018



APPENDIX 2

Characteristics of participants by country and by subjective social status (n = 22,824)

	Australia						Canada
		Subjective social status (weighted %)					
	Overall						Overall
	n = 4103	1–2	3–4	5–6	7–8	9–10	n = 4397
Age mean (SE)	46.4 (0.3)	48.9 (0.9)	49.0 (0.6)	46.2 (0.4)	44.9 (0.6)	39.3 (1.3)	48.1 (0.3)
Sex							
Male	49.1	9.4	19.2	38.4	27.5	5.3	49.3
Female	50.9	7.1	23.8	43.3	22.9	2.7	50.6
Educational attainment							
Low	42.0	11.2	26.4	40.3	19.0	3.0	42.5
Middle	32.2	8.3	21.6	43.0	24.3	2.6	33.2
High	25.6	3.2	13.3	39.4	36.4	7.4	24.2
Perceived income adequacy							
Low	28.2	23.8	39.3	27.8	6.4	2.4	28.4
Middle	37.4	3.1	21.9	54.3	19.1	1.3	37.0
High	34.2	1.1	6.7	37.8	46.2	8.0	34.4
Subjective social status Mean (SE), *Proportion (%)*	5.3 (0.03)	*8.2*	*21.5*	*40.9*	*25.2*	*4.0*	5.3 (0.03)
Psychosocial stress							
Not at all	12.2	5.3	16.6	38.2	31.8	7.8	9.5
Not very	28.1	6.9	15.3	41.2	32.4	4.0	29.0
A bit	42.6	6.1	23.8	44.7	23.0	2.2	41.0
Very	12.9	14.4	31.4	36.8	14.3	2.8	14.9
Extremely	4.0	26.3	25.9	22.5	14.5	10.5	5.4
Self-rated mental health							
Poor	7.8	22.8	31.1	33.0	10.5	2.3	7.0
Fair	17.4	12.4	31.3	40.0	14.4	1.6	15.3
Good	31.9	5.7	22.2	44.6	24.7	2.6	33.1
Very good	26.4	5.2	16.4	42.6	30.8	4.8	28.7
Excellent	16.2	5.2	13.3	37.3	36.2	7.8	15.7
Self-rated general health							
Poor	5.5	28.9	38.4	24.3	4.7	3.5	5.1
Fair	25.5	12.3	30.3	39.7	16.0	1.5	24.9
Good	45.5	5.0	20.4	45.8	26.0	2.5	47.0
Very good	18.2	4.0	11.1	41.0	38.0	5.7	19.3
Excellent	5.0	5.1	9.4	24.9	38.9	21.5	3.5

					Mexico					
Subjective social status (weighted %)					Overall	Subjective social status (weighted %)				
1–2	3–4	5–6	7–8	9–10	*n* = 4135	1–2	3–4	5–6	7–8	9–10
47.0 (1.2)	47.8 (0.7)	47.9 (0.5)	49.3 (0.6)	47.8 (1.7)	39.3 (0.2)	37.8 (2.1)	39.2 (0.7)	38.0 (0.4)	40.8 (0.4)	37.8 (1.2)
7.1	20.0	37.8	30.1	4.7	47.5	1.5	13.3	41.4	39.0	4.6
9.3	25.2	40.7	21.9	2.7	52.4	1.1	17.0	38.9	39.6	3.1
13.6	29.9	36.4	17.3	2.7	19.9	1.9	29.2	43.7	22.3	2.7
5.7	22.4	43.6	25.8	2.3	13.2	1.7	16.2	46.1	34.2	1.6
2.3	10.8	38.1	41.3	7.3	66.8	1.0	10.9	37.9	45.5	4.6
23.2	41.0	27.4	6.7	1.5	43.9	2.2	24.8	44.4	26.9	1.5
3.1	23.6	51.9	20.2	0.9	38.7	0.5	8.5	42.9	44.7	3.2
1.1	6.8	35.6	48.0	8.2	17.2	0.6	5.6	23.3	59.5	10.8
8.2	*22.6*	*39.3*	*26.0*	*3.7*	5.0 (0.03)	*1.3*	*15.3*	*40.1*	*39.3*	*3.8*
5.0	15.5	34.9	34.2	10.2	6.7	2.0	13.9	29.4	44.8	9.6
4.1	17.6	40.7	34.3	3.1	31.1	1.3	13.4	40.7	40.5	3.8
7.2	23.8	44.2	22.0	2.6	47.8	0.9	14.6	41.1	40.6	2.6
15.1	32.5	30.6	19.5	2.0	12.3	1.3	20.9	41.1	33.1	3.4
24.4	28.8	26.4	12.2	8.0	1.8	5.4	27.2	40.6	16.0	10.6
28.5	36.8	21.0	13.1	0.5	1.9	3.9	25.2	34.9	30.5	5.3
13.2	33.9	36.3	14.3	2.1	13.1	2.4	25.6	42.9	28.0	1.0
6.2	24.0	45.1	22.3	2.3	35.3	1.2	17.5	44.3	34.5	2.1
3.8	17.7	41.2	33.9	3.2	32.2	0.8	11.3	39.7	43.9	4.0
6.1	12.6	34.3	36.5	10.3	17.3	0.9	8.9	31.3	50.6	8.2
31.3	33.7	26.4	8.1	0.2	4.7	4.6	36.0	34.1	23.3	1.8
11.6	33.6	36.5	15.6	2.5	24.9	1.8	20.6	43.6	31.8	1.9
5.7	19.6	44.0	27.9	2.6	51.0	0.8	14.2	40.8	41.2	2.7
3.0	15.0	38.5	37.0	6.3	16.5	1.0	6.0	36.2	49.7	6.7
3.4	13.6	24.0	41.1	17.7	2.6	0.9	3.0	33.2	41.3	21.4

	United Kingdom					
	Overall	Subjective social status (weighted %)				
	n = 5549	1–2	3–4	5–6	7–8	9–10
Age; mean (SE)	48.0 (0.2)	46.4 (0.8)	48.2 (0.5)	48.0 (0.4)	49.2 (0.6)	40.2 (1.3)
Sex						
Male	48.8	9.0	25.1	37.9	23.6	4.1
Female	51.1	10.2	30.0	40.6	17.6	1.4
Educational attainment						
Low	48.5	13.8	31.1	37.4	15.8	1.7
Middle	23.0	8.2	30.2	41.6	17.6	2.3
High	28.3	3.8	19.9	40.9	30.5	4.6
Perceived income adequacy						
Low	25.1	28.9	41.2	23.8	4.6	1.3
Middle	36.5	5.2	32.9	46.0	14.8	0.9
High	38.3	1.2	13.7	43.3	36.3	5.3
Subjective social status Mean (SE), *Proportion (%)*	5.5 (0.03)	*9.6*	*27.6*	*39.3*	*20.5*	*2.7*
Psychosocial stress						
Not at all	12.9	6.1	22.2	38.0	29.8	3.6
Not very	26.5	3.9	24.3	44.2	25.3	2.0
A bit	42.4	8.8	28.5	41.4	19.1	1.9
Very	12.8	17.9	37.4	30.6	11.7	2.2
Extremely	5.3	33.3	27.7	22.3	7.4	9.1
Self-rated mental health						
Poor	10.3	33.6	37.6	24.4	3.7	0.5
Fair	18.3	14.4	38.1	35.0	11.4	0.8
Good	29.2	5.7	27.7	45.9	18.7	1.9
Very good	25.3	3.5	22.7	42.0	27.9	3.7
Excellent	16.7	6.4	17.8	37.9	32.3	5.5
Self-rated general health						
Poor	7.7	31.9	38.5	22.0	7.2	0.2
Fair	30.3	13.1	37.2	35.3	13.3	0.8
Good	40.2	6.1	24.7	45.4	21.8	1.8
Very good	16.9	3.1	16.5	40.3	34.1	5.7
Excellent	4.7	7.4	12.7	35.5	30.3	13.9

United States					
	Subjective social status (weighted %)				
Overall $n = 4640$	**1–2**	**3–4**	**5–6**	**7–8**	**9–10**
46.8 (0.2)	47.9 (1.2)	47.1 (0.6)	47.6 (0.4)	47.4 (0.5)	39.5 (0.8)
48.7	6.3	23.6	32.5	27.7	9.7
51.2	7.0	24.6	41.6	20.7	5.9
58.8	9.2	29.3	37.5	17.2	6.6
9.7	6.8	26.5	41.1	22.0	11.3
31.4	1.8	13.9	35.4	37.4	11.3
29.7	17.9	43.9	29.7	6.2	2.0
34.2	3.1	24.8	46.6	21.9	3.5
36.0	0.6	7.6	34.4	40.5	16.6
6.0 (0.03)	*6.6*	*24.1*	*37.1*	*24.1*	*7.8*
12.2	5.3	17.2	31.9	28.2	17.2
28.8	4.0	21.5	39.6	29.5	5.2
39.1	5.7	25.8	40.5	23.4	4.4
14.6	10.0	28.9	34.6	16.0	10.3
5.0	22.9	29.3	16.6	12.3	18.7
4.5	23.0	45.8	21.4	9.3	0.3
13.0	12.9	37.6	37.3	9.5	2.4
30.2	5.3	26.4	42.8	21.6	3.7
30.1	4.8	18.7	37.8	28.4	10.1
21.9	4.1	16.1	31.6	33.2	14.8
4.7	26.6	31.4	31.3	9.6	0.9
20.6	12.6	36.8	35.0	12.7	2.6
44.1	4.7	26.0	42.4	23.0	3.6
22.7	2.1	13.5	34.6	36.5	13.1
7.8	25.2	79.2	24.1	32.3	33.1

APPENDIX 3

Correlation matrix

	Measures	Perceived income adequacy	Educational attainment	Subjective social status	Psychosocial stress	General health	Mental health
Australia	Perceived income adequacy	1					
	Educational attainment	0.14*	1				
	Subjective social status	0.53*	0.22*	1			
	Psychosocial stress	−0.28*	0.06*	−0.19*	1		
	General health	0.29*	0.13*	0.34*	−0.22*	1	
	Mental health	0.27*	0.03*	0.27*	−0.46*	0.47*	1
Canada	Perceived income adequacy	1					
	Educational attainment	0.21*	1				
	Subjective social status	0.54*	0.30*	1			
	Psychosocial stress	−0.34*	0.02	−0.22*	1		
	General health	0.30*	0.15*	0.32*	−0.18*	1	
	Mental health	0.33*	0.07*	0.31*	−0.43*	0.45*	1
Mexico	Perceived income adequacy	1					
	Educational attainment	0.12*	1				
	Subjective social status	0.35*	0.23*	1			
	Psychosocial stress	−0.16*	0.03*	−0.08*	1		
	General health	0.24*	0.11*	0.24*	−0.19*	1	
	Mental health	0.23*	0.13*	0.22*	−0.22*	0.45*	1

	Measures	Perceived income adequacy	Educational attainment	Subjective social status	Psychosocial stress	General health	Mental health
United Kingdom	Perceived income adequacy	1					
	Educational attainment	0.10*	1				
	Subjective social status	0.51*	0.23*	1			
	Psychosocial stress	−0.32*	0.03*	−0.21*	1		
	General health	0.29*	0.13*	0.34*	−0.19*	1	
	Mental health	0.36*	0.06*	0.35*	−0.49*	0.49*	1
United States	Perceived income adequacy	1					
	Educational attainment	0.21*	1				
	Subjective social status	0.53*	0.25*	1			
	Psychosocial stress	−0.24*	−0.01	−0.15*	1		
	General health	0.32*	0.16*	0.40*	−0.14*	1	
	Mental health	0.31*	0.12*	0.32*	−0.39*	0.47*	1

* Bivariate correlation $p < 0.05$.

APPENDIX 4

Goodness of fit statistics

Fit statistic	Australia	Canada	Mexico	United Kingdom	United States
RMSEA	0.068	0.074	0.027	0.080	0.054
CFI	0.982	0.978	0.995	0.976	0.987
TLI	0.912	0.892	0.974	0.880	0.937
SRMR	0.017	0.018	0.007	0.020	0.013

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMSR, standardized root mean square residuals; TLI, Tucker Lewis index.

APPENDIX 5

Goodness of fit indices for measurement and structural invariance models

Parameter constraints	Model without mediator					Model with mediator				
	X^2 (df)	CFI	ΔCFI	TLI	RMSEA	X^2 (df)	CFI	ΔCFI	TLI	RMSEA
Configural invariance	288.90 (15)	0.973	_	0.919	0.065	289.24 (15)	0.982	_	0.911	0.065
Metric invariance	345.91 (19)	0.968	0.005	0.924	0.063	345.69 (19)	0.979	0.003	0.917	0.063
Metric and structural invariance	_	_	_	_	_	544.41 (55)	0.968	0.011	0.957	0.045

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; TLI, Tucker Lewis index.

APPENDIX 6

Direct effects of sex and age on self-rated overall health and psychosocial stress

Path	Coefficient[a] (SE)	*p* value
Sex -> self-rated overall health		
Australia	−0.011 (0.019)	0.560
Canada	−0.026 (0.020)	0.200
Mexico	−0.018 (0.020)	0.366
United Kingdom	−0.027 (0.017)	0.115
United States	−0.053 (0.019)	0.007
Age -> self-rated overall health		
Australia	0.114 (0.020)	<0.001
Canada	0.109 (0.021)	<0.001
Mexico	0.127 (0.022)	<0.001
United Kingdom	0.049 (0.021)	0.019
United States	0.103 (0.021)	<0.001
Sex -> psychosocial stress		
Australia	0.045 (0.016)	0.006
Canada	0.042 (0.164)	0.008
Mexico	0.074 (0.018)	<0.001
United Kingdom	0.047 (0.015)	0.001
United States	0.046 (0.017)	0.007

Path	Coefficient[a] (SE)	*p* value
Age -> psychosocial stress		
Australia	−0.255 (0.017)	<0.001
Canada	−0.253 (0.018)	<0.001
Mexico	−0.168 (0.020)	<0.001
United Kingdom	−0.266 (0.016)	<0.001
United States	−0.222 (0.017)	<0.001

Abbreviation: SE, Standard error.

[a] Standardized coefficients.