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Why are socioeconomic health inequalities unacceptable? Studying the influence of explanatory framings on cognitive appraisals

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Abstract

Studies of aversion to health inequality have found that this is often greater when health outcomes are presented as varying with socioeconomic conditions. We sought to understand better why this is by studying the cognitive appraisals made about health inequality when presented with distinct explanatory framings. Across two pre-registered studies (N = 1321), UK and US participants judged the acceptability of life expectancy differences attributed to distinct framings: income, education, social class, neighborhood, lifestyle choices, and genetics. Health inequality was least acceptable when attributed to the four socioeconomic framings, and most acceptable for lifestyle choices and genetics. Six appraisal dimensions—complexity, malleability, inevitability, and extent driven by biological, psychological, and sociocultural causes—varied with framing and predicted views on health inequality. These dimensions could explain most of the drop in acceptability for health inequality attributed to socioeconomic

factors relative to a condition with no framing. This work illustrates for the first time the cognitive appraisals and causal intuitions that link different explanatory framings to views on health inequality. These framings are viewed as least acceptable because they reduce the perceived involvement of biological causes while increasing the perception that sociocultural and psychological factors contribute to health inequality.

Public significance statement: Academics use different socioeconomic variables to describe health inequalities. We show that different explanatory framings change appraisals about the causes, malleability, and inevitability of health inequalities. Socioeconomic explanations (income, education, social class, and neighborhood) reduce acceptability because they reduce the perception that health is biologically caused and increase the perceived role of sociocultural factors. Public support for intervention on health inequalities will be best served by framings that emphasize these differences

KEYWORDS

explanatory framings, lay perceptions, socioeconomic health inequalities

INTRODUCTION

The term "health inequalities" refers to the unequal distribution of health status and outcomes between societal groups defined by a variety of social or demographic factors. Securing public support and engagement is key for the success of interventions designed to reduce health inequalities (Marmot, 2010; Smith et al., 2021). Accordingly, researchers from a growing number of social science disciplines are studying lay perspectives on health inequalities. Building on sociological research on lay conceptions of illness (Helman, 2007; Pill & Stott, 1985), one robust strand of this work employs qualitative methods to document lay views and experiences of inequality and health (Blaxter, 1997; Smith & Anderson, 2018; Smith et al., 2021). Elsewhere, health economists ask respondents to make choices between different health distributions in order to calculate inequality aversion preferences (Comerford et al., 2023; Costa-Font & Cowell, 2019; McNamara et al., 2020). Others use simpler survey designs to ask about acceptable levels of health or income inequality in society (Bridger et al., 2023; Howarth et al., 2019; Macchia & Ariely, 2021). The contribution of the present work to this topic is to investigate how lay persons appraise different explanatory framings for health inequalities, such as income or education, and whether this influences their view on how acceptable that inequality is and whether something should be done about it.

Explanations and causal inferences

When researchers present health outcomes as covarying with some demographic variable, like income, education, or class, lay people may understand this as entailing the claim that the said demographic variable is relevant to explaining the variation in health outcomes. That is, choosing to measure health inequalities with respect to some variable taken as explanation giving. Explanation-giving is a communicative activity and audiences often infer that provided explanations are the most causally relevant (Kirfel et al., 2022). Accordingly, given explanations can signal whether and what kind of interventions may be feasible for addressing an issue.

To examine the inferences non-experts make when provided with different explanatory framings, Nettle et al. (2023) presented participants with a series of explanations (e.g., "Young men in the town of XXXX have a genetic propensity to kill") for problem behaviors such as homicide or teenage parenthood and asked them to make several ratings for each explanation. Responses indicated that participants grouped these framings into broader clusters of explanations that were compatible with biological (e.g., genetics, hormones), psychological (e.g., motivation, choices, and traits), and sociocultural (e.g., culture, social roles) superordinate categories. These clusters encompass and extend attributional dichotomies reported elsewhere such as individual-situational (Piff et al., 2020) and biogenetic-psychological judgments (Haslam & Kvaale, 2015), including in lay views of health and illness causation (Helman, 2007; MacFarlane & Kelleher, 2002). The three causal clusters also correspond well with separate domains of intuitive biology (Medin & Atran, 2004), intuitive psychology (Kamps et al., 2017), and intuitive sociology (Shutts & Kalish, 2021) each of which produces characteristic types of reasoning (Spelke & Kinzler, 2007). Accordingly, causal explanations synchronized with judgments about whether these behaviors could be changed and what kinds of interventions were appropriate to change them. Presenting participants with psychological explanations for behaviors led them to rate the behavior as simpler and more malleable; socioculturally caused behaviors were seen as more complex; and biological explanations led to lower malleability ratings. These patterns are consistent with the logic that biological explanations cue operating features of intuitive biology, which is that the world is immutable, natural, and predetermined (Heine et al., 2017) and less easily subject to change, personal choice or agency (Dar-Nimrod & Heine, 2011). In contrast, psychological explanations may induce greater perceived malleability if intuitive psychology principles explain behavior as a function of "transient and reversible inner states" (Nettle et al., 2023). In sum, relatively simple explanations or attributions can give rise to a range of inferences about how to change certain behaviors.

We sought to examine whether explanations for existing health inequalities would also influence causal inferences, and subsequently shape views of how acceptable they are and whether they should be addressed. This is worth investigating for a number of reasons. Firstly, it establishes whether these previously reported causal explanations that align with core cognitive systems (Nettle et al., 2023; Spelke & Kinzler, 2007) extend from problem behaviors to unequal distributions of outcomes across society. Secondly, and more crucially, it links to a foundational component of studies on preferences and attitudes towards health inequality: whether or not health inequality is depicted in a *univariate* or *bivariate* manner. Univariate conceptualizations of health inequality focus on views about distributions of health and longevity across a population in general, independent of any other variable (Howarth et al., 2019). Bivariate health inequality, in contrast, typically presents variation in health outcomes with respect to or as a function of another variable, grouping or domain, such as income or education.

Many studies on health inequality preferences examine them in a bivariate manner. One consequence of this is that it limits direct comparisons with income inequality aversion which is typically assessed as univariate (Costa-Font & Cowell, 2019). We assume that one source of concern here is that, relative to univariate conditions, bivariate framings may change judgments about health inequalities because they signal reasons for why they come about. Relevant to this is evidence that aversion to health inequality differs according to which the second variable is employed to study bivariate health inequality. Motivated by observations that studies employing socioeconomic framings tended to report greater inequality aversion (Hurley et al., 2020; McNamara et al., 2020). McNamara et al. (2021) examined health inequality aversion using a choice experiment in a UK sample. Respondents were more willing to prioritize the health of groups defined as relatively deprived (poorest in society) than groups defined by a particular disease. Put differently, respondents were more averse to health inequality when this was categorized by socioeconomic differences (richest and poorest in society) compared to non-socioeconomic factors (different disease profiles). What is not yet clear, however, is why people might be particularly averse to health inequality when it is depicted with respect to socioeconomic differences. We propose that this arises, at least partly, because socioeconomic framings elicit distinct inferences about the causes of health inequalities compared to framings not presented as socioeconomic.

A related issue is how exactly socioeconomic differences or variability is presented. Studies of lay perceptions of health inequality have typically examined health inequality attributed to income differences, such as in studies of income-related health inequality aversion (Hardardottir et al., 2021), ideal health distributions across income quintiles (Macchia & Ariely, 2021), or views on life expectancy differences between the rich and the poor (Bridger et al., 2023). While they provide valuable insights, such studies do not reflect the diversity of approaches actually employed in health inequality research. In their mapping analysis of the field, Collyer and Smith (2020) identified at least eight different clusters of leading international researchers working in health equity research. These clusters differentiated along geographical and disciplinary lines but also by their emphasis on particular factors. For instance, one cluster, primarily in the Netherlands, the United Kingdom, and the United States, focused on income-based health inequality, while another UK-based cluster represented those who study geographical and place-based approaches to health. There are a number of possibilities for how to operationalize socioeconomic conditions with respect to health or other outcomes and correspondingly much discussion about the best way to go about this (Antonoplis, 2023). While some have argued that different indicators, such as education or occupation, can be taken as transposable elements of the same underlying fundamental cause (Phelan et al., 2010), others contend that socioeconomic status (SES) indicators should not be used interchangeably, because SES-health associations vary according to which indicator is employed (Macintyre et al., 2003). In one critique of this kind, Geyer et al. argue that, despite arranging health outcomes in similar distributions, education, income, and occupational class each independently relate to health after mutual adjustment suggesting that they "tap into different causal mechanisms" (p. 804) (Geyer et al., 2006). They posit, for example, that net effects of education might reflect the role of greater health awareness or increased control, whilst income-related effects might capture easier access to material resources that boost health.

Whether such causal differences might also be intuitive to non-experts has not yet been investigated. The contribution of the current work therefore is to determine whether non-experts also infer distinct causal mechanisms when provided with different explanatory framings for health inequalities. Might they make separate inferences about underlying causes when they are presented, for example, with health inequality attributed to education versus social class? Or might such factors be viewed as being underpinned by more or less equivalent causal mechanisms?

Either outcome has implications for how to present and frame unequal health distributions when communicating with lay publics.

METHODS

We asked participants from the UK and the USA their views about differences in life expectancy when attributed to distinct explanatory framings (hereafter referred to as *framings* for brevity). There is already considerable study of the UK public's view of health inequality (Howarth et al., 2019; Smith et al., 2021) and we wished to include respondents from another English-speaking country with high levels of inequality. In line with previous work (Bridger et al., 2023; Kane et al., 2022; Smith et al., 2021), we asked participants to indicate their agreement that something should be done about them as well as about the overall acceptability of life expectancy inequality. We present participants with one of seven explanatory framings: no-framing, genetics, lifestyle choices, income, education, neighborhood, and social class.[1] The latter four framings were selected to capture a broad range of indicators employed in studies of health inequalities. We also examined views on health inequalities by lifestyle choices following evidence that health behaviors explain a considerable proportion of social gradients in health and mortality (Whitley et al., 2014), as well as concerns that health inequality policy often focuses on tackling social gradients in lifestyle choices and behaviors at the expense of upstream interventions that might address socioeconomic inequalities themselves (Baum & Fisher, 2014). While the genetic basis of socioeconomic health inequality is unclear and controversial (Mackenbach, 2005), we included this as a basis because people view genes as a key determinant of ill health (Schnittker, 2015) and because we wanted to examine responses for a category likely to invoke biological explanations.

We also highlight here other important aspects of the design. After completing a first pilot study (reported in the Supplement in full; see Tables S3–S4 and Figures S4–S7), we observed that it would be important to ensure we could differentiate participants' judgments about the framing itself (e.g., social class) from life expectancy differences related to it (e.g., life expectancy differences by social class). It may be, for example, that social class is viewed as a more intractable issue than life expectancy by social class (or vice versa), or that some participants interpreted the question as asking about the former while others answered about the latter. To determine whether this mattered, we added an additional between-subjects factor and manipulated whether participants were asked to rate the framing per se or life expectancy by that framing (we henceforth refer to this factor as *explanation target*). Table S1 presents an overview of the study design and the final sample size per cell.

Although primarily exploratory, in the spirit of transparent and open science, we preregistered the study design and analysis protocols prior to data collection: https://osf.io/4whtc. Divergence from planned analyses is acknowledged where relevant. Both studies received ethical approval from the ethics committee at Birmingham City University (/#11312/sub2/R(A)/2022/Dec/BLSSFAEC).

[1] We also conducted an initial pilot study ($N = 602$) which did not collect acceptability ratings in the no-framing condition. That study, which was valuable for finessing the design and materials reported here, is reported in full in the supplement. The findings across the two studies are consistent and we refer to this in the main text where relevant.

PARTICIPANTS

Seven hundred and nineteen participants took part and were recruited through the UK and US Prolific panels (2: UK = 364, US = 355). Use of platforms like Prolific is widespread in experimental psychology. They can rapidly produce large datasets, are more socioeconomically diverse than student participant pools and have been shown to replicate the results of in-person studies (Peer et al., 2022). A priori power analysis was precluded by the exploratory nature of the study design; nonetheless we sought to obtain a minimum of 100 participants in each of the framing conditions.

The mean age was 39.93 (SD = 13.89, range 18–83) and 48.95% (n = 352) identifying as female, 49.37% identified as male (n = 355). One participant identified as genderfluid, n = 6 as non-binary, and n = 6 preferred not to say. Participants who had taken part in the pilot study were not able to take part in the main study.

DESIGN AND MATERIALS

Participants were randomly allocated to one of the following framing conditions (income, neighborhood, education, social class, genetics, lifestyle choices, and no framing). All participants were presented with an initial text stating that *In Britain/the USA today, people in the longest-lived percentile live 15 years longer than those in the 1st percentile*, accompanied by a graphical depiction of life expectancy by percentile (adapted from Chetty et al. (2016)). Participants were then informed that these differences in life expectancy are mainly due to the framing statement they had been randomly allocated to. Figure S1 presents a screenshot of how this information and ancillary questions appeared to participants in the social class condition.

Participants were next presented with four questions in the following order. First, they were asked how acceptable these differences in life expectancy are (on a 0 to 100 slider, where 0 = *not at all acceptable* and 100 = *entirely acceptable*). This was followed with the question: *How much do you agree that something needs to be done to address these differences in life expectancy* [by [framing]]? on a scale from −50 (*strongly disagree*) to +50 (*strongly agree*). This was included in order to ensure the question assessed general support for intervention as in previous studies (Bridger et al., 2023; Smith et al., 2021), rather than urgency or priority.

The next questions were adapted from Nettle et al.'s (2023) measures of perceptions of inevitability, malleability, and complexity. We asked the extent to which participants agreed or disagreed (on a 100-point slider where −50 = *strongly disagree* and 50 = *strongly agree*), that differences: can be easily changed; are inevitable; have a simple cause; and are complex. Participants in the framing as explanation target condition were asked to make these ratings about the explanatory framing (e.g., *differences in social class have a simple cause*), whilst participants in the life expectancy by framing condition were asked about life expectancy by the framing (e.g., *differences in life expectancy by social class have a simple cause)*.

Subsequently, participants were asked to rate the contribution of 12 causal factors (in a randomized order) on a scale from 0 (*not at all driven by*) to 100 (*strongly driven by*). The response scale and phrasing of nine of these causal explanation items were adapted from Nettle and colleagues where ratings of explanations that relate to genetics, hormones, and evolutionary advantage were found to cluster together ("biological" cluster), ratings of choice, motivation, and psychological traits clustered together ('psychological' cluster), as did ratings of culture, social role, childhood experiences ("sociocultural" cluster) (Nettle et al., 2023). Items were rephrased to fit the current

paradigm (e.g., rate the extent to which *differences are driven by factors related to childhood experiences*). A further three items were added to capture features of what might be understood to be the case if something is driven by chance: factors that cannot be known, factors that cannot be controlled, and factors that cannot be predicted. These were included to determine whether these differentiated from biological causes, which are often conflated with chance attributions (Pill & Stott, 1985), and because views on chance and luck are known to be determinative in people's judgments about fair health outcomes (Tinghög et al., 2017). Due to an error, all participants were presented with two identically worded items relating to social roles (instead of the item "social pressure") and so responses to these two identical items were averaged. We therefore collected data on 12 causes rather than the pre-registered 13.

On the final page, participants were asked analogous questions about the extent to which differences should be driven by each of the causes. Henceforth, these items are referred to as measures of *ideal causation* to differentiate them from measures of perceived causal explanations described above and reported in the main text. Full reporting and analysis of ideal causation responses can be found in Supplemental Materials. These data are relegated to Supplemental materials for the sake of brevity and because they were a subsidiary objective although we do comment on these analyses where relevant.

Demographic questions at the end of the survey were restricted to gender and age. Along with standard information on study details, withdrawal, contact and data storage, at the point of debrief we took care to ensure that participants were informed that it is not the case that differences in health and life expectancy are driven by any one factor and that in reality, health and life expectancy are influenced by many different determinants at the same time. Participants were invited to learn more at an international webpage on the determinants of health.

RESULTS

The datasets and code supporting the conclusions of this article are available in the OSF repository, available at https://osf.io/jk7p5/.

PRIMARY OUTCOMES

Acceptability

The one-way between-subjects ANOVA on acceptability ratings showed a main effect of framing ($F(6,711) = 35.969$, $p < .001$, $\eta^2 = .233$) and Bonferroni-corrected contrasts indicated that acceptability differed for the no-framing condition relative to all other categories ($ps < .004$) and that acceptability for the no-framing condition lay in between those for specific framings (see Figure 1a). Acceptability ratings were significantly higher for lifestyle choices and genetics compared to all other framings (all $ps < .005$). There were no significant differences between ratings of acceptability for neighborhood, social class, income, and education, or between lifestyle choices and genetics. This replicated the pattern from the pilot study, with the addition that acceptability of life expectancy inequality per se lay at an intermediate level: more acceptable than differences by neighborhood, social class, income and education, but less acceptable than differences by lifestyle choice and genetics.

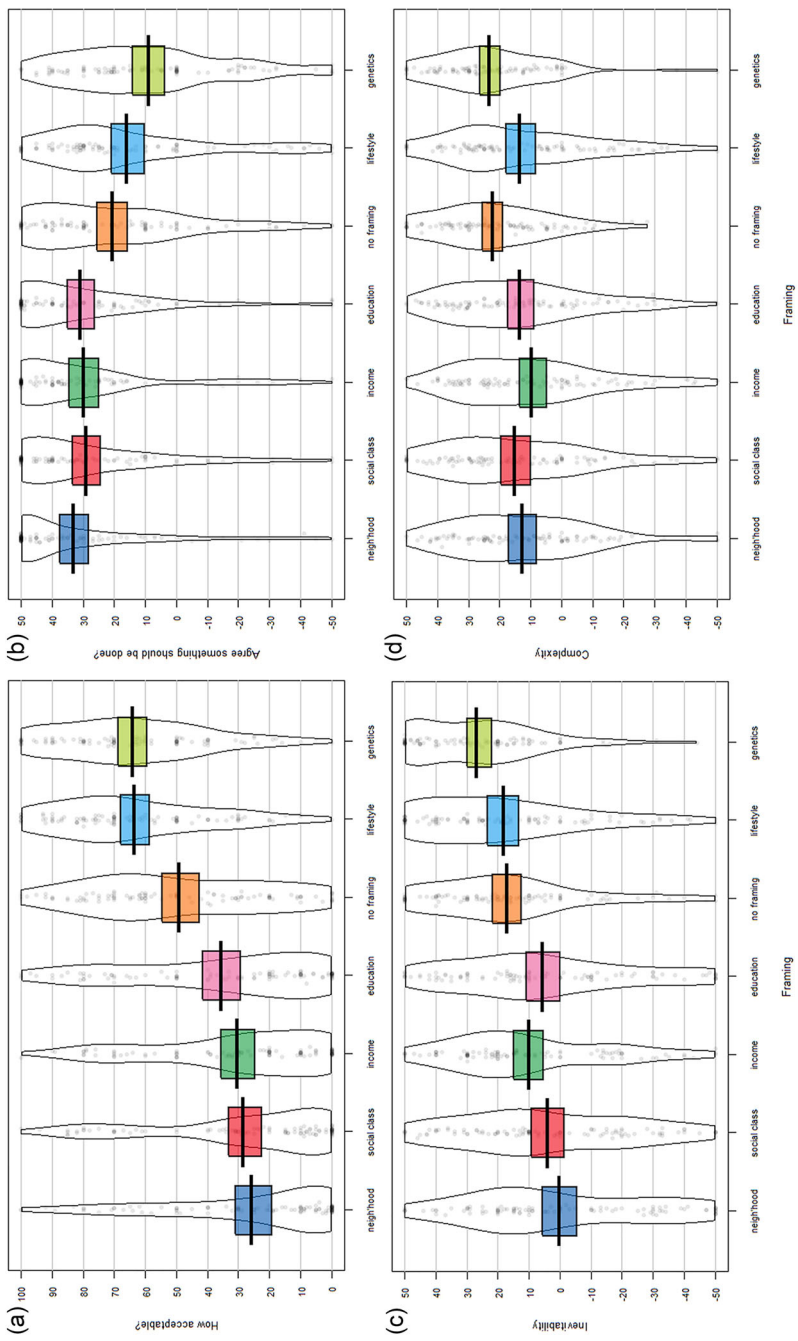

FIGURE 1 Distribution and density plots of participants' answers to questions on how acceptable (a), agreement that something should be done (b), inevitability (c), and complexity (d), for each framing condition. Thick lines represent the mean and shaded boxes depict 95% confidence intervals.

Support for intervention

There was also a significant main effect of framing for responses to this item ($F(6,710) = 13.542$, $p < .001$, $\eta^2 = .103$; see Figure 1b). Support for intervention was significantly lower for genetics than the no-framing condition ($p = .016$), neighborhood ($p < .001$), social class ($p < .001$), education ($p < .001$), and income ($p < .001$). Support for intervention was also significantly lower for lifestyle choices than for education ($p < .001$), income ($p = .001$), neighborhood ($p < .001$), and social class ($p = .004$). Support for intervention on neighborhood was significantly higher than for no framing ($p = .007$). Responses did not differ significantly between genetics and lifestyle choices ($p = .803$).

SECONDARY OUTCOMES: COGNITIVE APPRAISALS

Responses to items on how easily differences can be changed (malleability) and how inevitable (inevitability), which correlated negatively ($r = -.216$, $p < .001$) were analyzed separately. Agreement that differences have a simple cause and are complex were more strongly negatively correlated ($r = -.507$, $p < .001$) and so, in line with Nettle et al. (2023), responses to having a simple cause were reverse coded and the mean of the two items was calculated to capture an overall measure of complexity. Figures 2 and S2 show ratings of inevitability, complexity, and malleability (Figure S2) for the seven framing conditions.

Malleability

There was a main effect of framing for judgments of malleability ($F(6,711) = 9.85$, $p < .001$, $\eta^2 = .077$; see Figure S2). Genetics was rated as significantly less malleable than all other categories ($ps < .002$).

Inevitability

There was also a main effect for framing for inevitability judgments ($F(6,710) = 12.91$, $p < .001$, $\eta^2 = .098$; see Figure 1c). These were higher for the no-framing condition than for education ($p = .043$), neighborhood ($p < .001$), and social class ($p = .007$). They were also higher for genetics than all other categories ($ps < .001$) except lifestyle choices and no framing. Differences by lifestyle choices were viewed as more inevitable than by neighborhood ($p < .001$) and social class ($p = .003$).

Complexity

Finally, there was also a main effect of framing on complexity ($F(6,710) = 5.62$, $p < .001$, $\eta^2 = .045$; see Figure 1d). Differences without a framing and attributed to genetics did not differ in complexity from one another and were rated as more complex than income ($ps < .001$), neighborhood ($ps < .05$). Genetics was also rated as more complex than education ($p = .031$) and lifestyle choices ($p = .031$). Complexity ratings did not differ between other framing conditions. This serves as a form of manipulation check, confirming that participants were attending to the framing manipulation and that this simplified participants' views of health variation by reducing a complex issue to one principal cause.

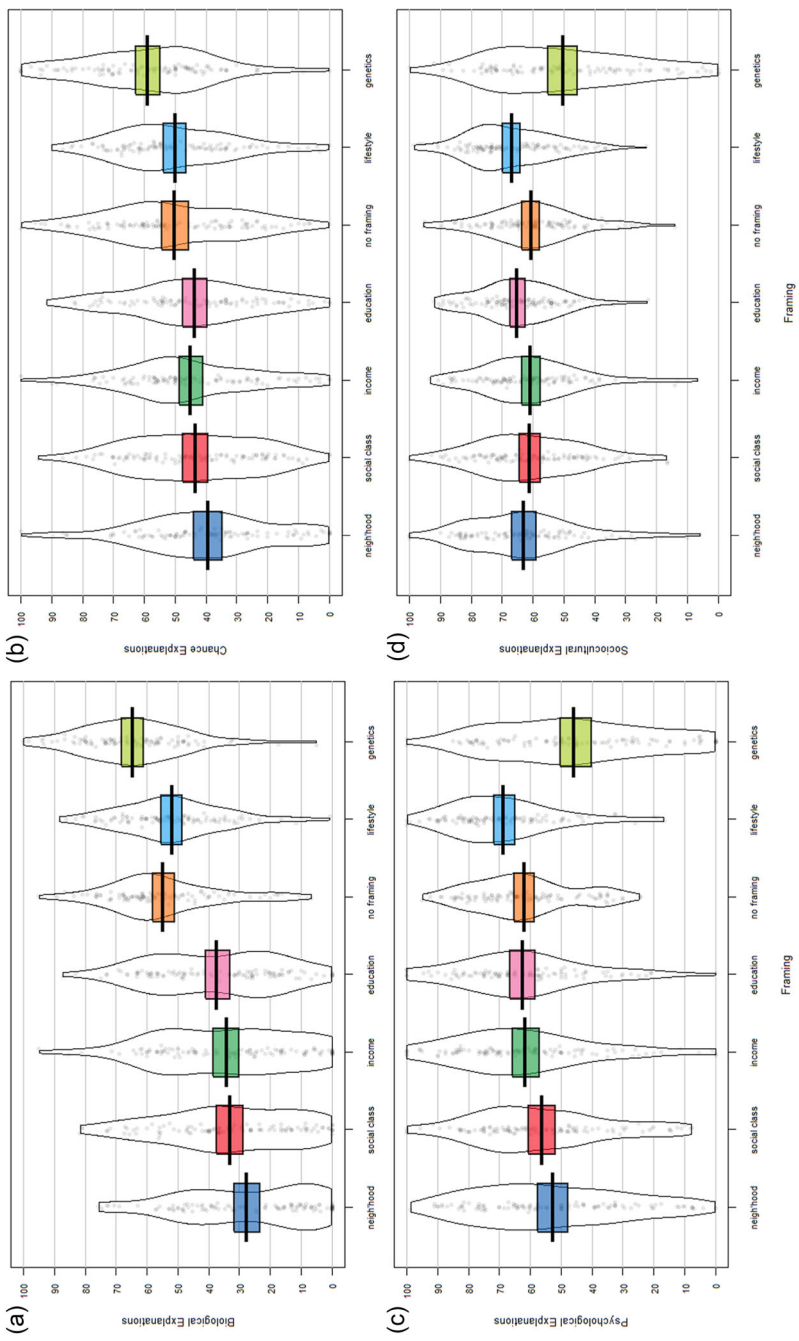

FIGURE 2 Distribution and density plots of the extent to which differences are perceived to be driven by biological (a), chance (b), sociocultural (c), and psychological explanations (d). Thick lines represent the mean and shaded boxes depict 95% confidence intervals.

Although not planned, for completeness we examined whether ratings on these dimensions were influenced by explanation target (life expectancy by framing vs. framing). These analyses are reported in full in Supplemental Materials. While there were no interactions with explanation target for judgments of malleability or complexity there were for inevitability ratings. Overall, participants viewed life expectancy differences by framings (e.g., life expectancy by education differences) to be less inevitable than the framings themselves (e.g., education differences). The exceptions to this were lifestyle choices (where inevitability ratings were comparable across explanation target) and social class (where life expectancy differences by social class were seen as more inevitable than social class differences per se; see Figure S3).

Structure of causal explanations

A Kaiser–Mayer–Olkin test on the ratings of the 12 causal explanations showed good sampling adequacy for perceived (overall mean sampling adequacy [MSA] = .83; lowest MSA was .73 for social roles) and ideal explanations (overall MSA = .83; lowest MSA was .66 for motivation). Initial scree plots conducted separately for the perceived and ideal causation items indicated that between two and four components should be extracted for perceived explanations and 4 components for ideal explanations. As a four-component solution was anticipated and most consistent across the two sets of causal explanation items, we conducted PCA analysis to extract four components by applying oblique (promax) rotation. The four-component solution was broadly comparable across perceived and ideal items. The first factor (biological explanations) included evolution (perceived factor loading = .83; ideal factor loading = .93), genetics (perceived = .88; ideal = .90), and hormones (perceived = .81; ideal = .83), while a second factor captured uncontrollable or chance causes: factors that cannot be predicted (perceived = .88; ideal = .93), known (perceived = .87; ideal = .91), or controlled (perceived = .74; ideal = .90). A third factor related to sociocultural factors: social roles (perceived = .90; ideal = .95), childhood experiences (perceived = .80; ideal = .87), and culture (perceived = .64; ideal = .86) and a fourth component related to psychological factors: choices (perceived = .92; ideal = .94) and motivations (perceived = .92; ideal = .91). The principal difference in component solutions for the two sets of items was that dispositional traits loaded on to the biological factor for perceived items (.56) but did not load onto any factors for ideal explanations. This item was removed from further analysis. Table S5 shows the correlations between the four components which were highest for the chance and biological components (perceived = .55, ideal = .51) and sociocultural and psychological components (perceived = .48, ideal = .36). Together the four components explained 70% of variance in responses to perceived causal explanations and 77% of ideal causal explanations. Measures for the four components were created by averaging ratings for the corresponding items. Figure 3 shows mean perceived causal explanation ratings for each framing. Planned analyses of causal explanations by framing, explanation target and perceived versus ideal causation are reported fully in the Supplemental Materials.

CATEGORICAL MEDIATION ANALYSES

In order to examine whether differences between each framing and the no-framing condition were mediated by the appraisal dimensions and causal explanations we conducted a planned multicategorical mediation analysis, using Hayes' PROCESS macro for regression-based approaches to

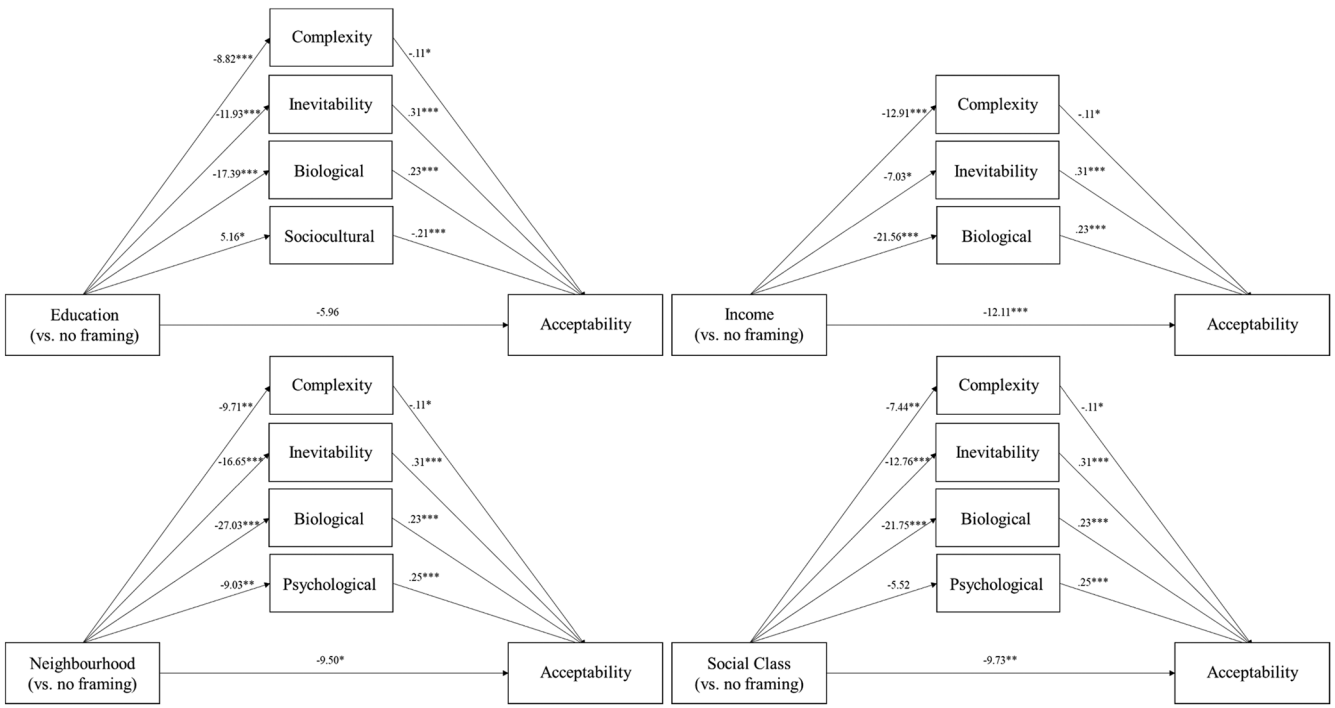

FIGURE 3 Conceptualization of direct and indirect effects from four socioeconomic framings (ref: no-framing) to acceptability through complexity, inevitability, biological, sociocultural, and psychological explanation ratings. Values indicate unstandardized coefficients. ***$p < .001$, **$p < .01$, and *$p < .05$.

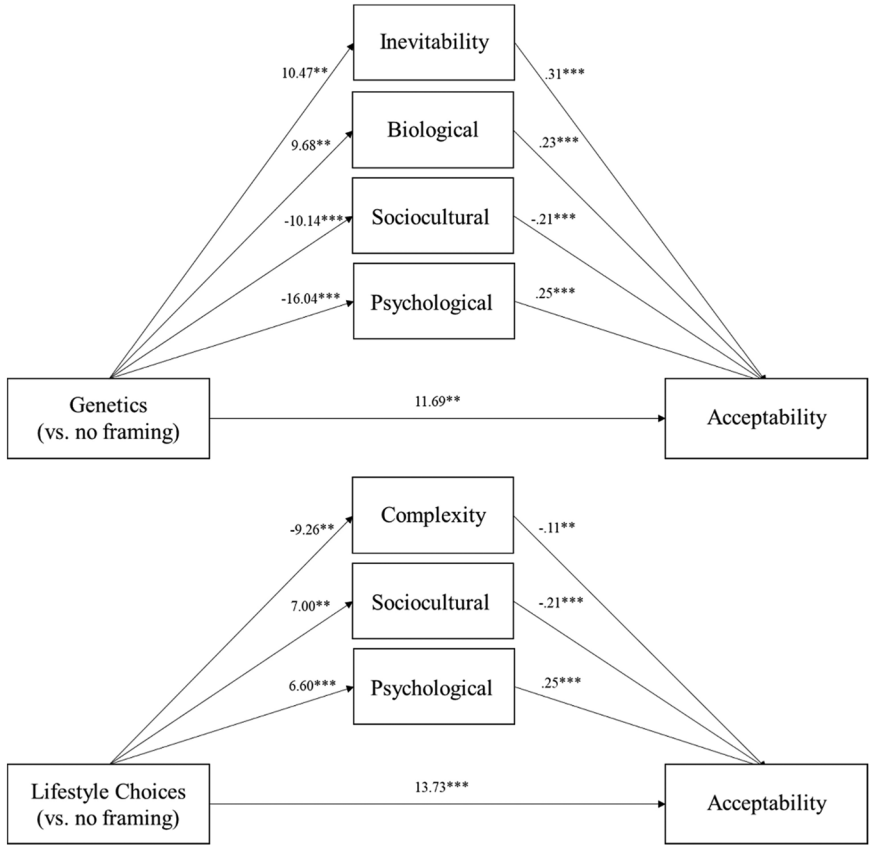

FIGURE 4 Conceptualization of direct and indirect effects from genetics and lifestyle choices (ref: no-framing) to acceptability through simplicity, inevitability, biological, sociocultural, and psychological explanation ratings. Values indicate unstandardized coefficients. ***$p < .001$, **$p < .01$, and *$p < .05$.

mediation (Hayes, 2013). The macro allows for simple quantification of the indirect pathway from predictor (in this case, each framing condition relative to no-framing) to the dependent variable (acceptability/agreement something should be done) via each mediator. The six framing conditions were thus dummy coded with no framing as the reference category, with malleability, inevitability and complexity ratings as well as the four causal explanation dimensions included as parallel mediators. Age, being in the UK (vs. US) and being male (vs. all other genders) were included as covariates. Standard errors were robust to heteroscedasticity (Cribari-Neto) and 10,000 bootstraps were drawn to obtain confidence intervals for indirect effects.

Table 1 (and Table S2) reports the total and indirect effects for models predicting ratings of acceptability and agreement that something should be done. Acceptability was higher and support for interventions lower for male participants than participants of other genders. UK and younger respondents were also more supportive of intervention on this issue. Table 1 shows that there were significant indirect effects on acceptability through most of the included mediators except for chance and malleability judgments. However, the exact pattern of mediation differed across framings (see Figures 3 and 4). For instance, relative to life expectancy differences not attributed to any framing, differences by education, income, neighborhood, and social class were less acceptable partially because they were viewed as less inevitable and less driven by biologi-

TABLE 1 Total and indirect effects for multi-categorical mediation model predicting ratings of acceptability ($n = 712$) and support for intervention ($n = 711$).

		How acceptable?		Something should be done?	
		B	**LL, UL 95% CI**	***B***	**LL, UL 95% CI**
	Intercept	43.70***	35.05, 52.35	29.34***	21.38, 37.31
Framing	No framing (ref)				
	Education	−13.83**	−22.01, −5.64	10.81**	4.28, 17.34
	Income	−18.34***	−25.98, −10.70	9.33**	2.65, 16.01
	Neighborhood	−23.34***	−31.18, −15.50	11.88***	5.26, 18.51
	Social Class	−19.98***	−27.82, −12.11	7.82*	1.24, 14.40
	Genetics	15.41***	8.00, 22.83	−12.79***	−19.80, −5.78
	Lifestyle Choices	14.65***	7.15, 22.14	−4.17	−11.27, 2.92
Covariates	UK	−1.91	−5.94, 2.13	4.09*	.53, 7.65
	Male	8.32***	4.24, 12.40	−9.48***	−13.09, −5.88
	Age	.05	−.09, .20	−.15*	−.28, −.02
		Indirect effects		Indirect effects	
Education	Malleability			1.16	.23, 2.53
	Inevitability	−3.71	−6.35, −1.42	2.43	.84, 4.34
	Complexity	1.00	.11, 2.28	−.86	−2.10, −.005
	Biological	−4.02	−6.54, −1.97		
	Sociocultural	−1.08	−2.32, −.20	1.39	.24, 2.93
Income	Inevitability	−2.19	−4.58, −.08	1.41	.03, 2.93
	Complexity	1.47	.22, 3.03	−1.31	−2.97, −.02
	Biological	−4.99	−7.90, −2.45		
Neighborhood	Inevitability	−5.18	−8.07, −2.71	3.37	1.32, 5.42
	Complexity	1.10	.15, 2.33	−.99	−2.33, −.08
	Biological	−6.26	−9.77, −3.15		
	Psychological	−2.21	−4.05, −.70	2.24	.74, 4.06
Social class	Inevitability	−3.97	−6.55, −1.68	2.58	1.03, 4.43
	Complexity	.85	.05, 1.98		
	Biological	−5.04	−8.15, −2.46		
	Psychological	−2.21	−4.05, −.70	1.37	.03, 2.91
Genetics	Malleability			−1.71	−3.26, −.51
	Inevitability	3.25	1.32, 5.41	−2.16	−3.76, −.86
	Biological	2.24	.84, 4.11		
	Sociocultural	2.12	.62, 4.08	−3.00	−5.13, −1.29
	Psychological	−3.92	−6.36, −1.92	3.98	1.99, 6.31
Lifestyle choices	Malleability			.90	.07, 2.16
	Complexity	1.10	.15, 2.33	−.94	−2.37, −.004
	Sociocultural	−1.47	−2.91, −.40	1.96	.68, 3.73
	Psychological	−1.35	−2.93, −.01	−1.64	−3.19, −.41

Note: Parentheses report upper limit (UL) and lower limit (LL) 95% confidence intervals (based on 10,000 bootstrap samples).
***$p < .001$, **$p < .01$, *$p < .05$.

cal explanations (hormones, genes, and evolution). Neighborhood and social class framings were less acceptable due to a decrease in the perceived role of psychological explanations (choices and motivations). Life expectancy attributions by genetics, however, were comparatively more acceptable as they were seen as more inevitable, more biologically based and less psychologically based. Lifestyle choices were viewed as more acceptable because they were also viewed as less complex, as well as more psychologically driven. Complexity ratings as well as sociocultural causes negatively predicted acceptability and therefore often acted as suppressors such that they operated against the prevailing direct and remaining indirect effects of framing on acceptability. For example, income-related life expectancy differences were seen as less complex than the no-framing condition, slightly offsetting the other effects that overall reduced acceptability for this condition. Similarly, lifestyle choices were viewed as more socioculturally driven than the no-framing condition, which counteracted effects of reduced complexity and increased psychological drivers.

Table 1 also depicts the corresponding pattern for support for intervention on health inequality. Again, there were significant indirect effects for sociocultural (education, genetics, and lifestyle) and psychological (genetics, lifestyle, neighborhood, and social class) explanations as well as inevitability and complexity ratings. However, in contrast to acceptability judgments, there were no significant indirect effects through biological explanations, whilst malleability ratings did mediate effects of education, genetics and lifestyle choices relative to no-basis.

Supplemental analysis

The remaining planned analyses are reported in the Supplemental Materials, alongside examination of effects of framing and sample. As in the pilot study, there was little evidence of interactions with country, with the following exceptions: support for intervention and inevitability judgments were higher in the UK sample and US respondents rated sociocultural explanations lower than UK respondents in the genetics condition. Unplanned moderated mediation analyses examined whether country influenced any of the direct and indirect pathways tested above. Psychological explanations were predictive of acceptability ratings in the UK sample only. There were no other significant interactions with country.

RESULTS SUMMARY

Acceptability of life expectancy inequality across explanatory framings was consistent across both studies: acceptability was lowest for life expectancy by income, social class, neighborhood, and education, and highest for life expectancy by lifestyle choices and genetics. Acceptability for life expectancy variation without a framing lay in the middle. An inverse pattern was observed for support for intervention (and judgments of priority to intervene in the pilot study). The 12 causal explanations reduced to the four anticipated superordinate categories: biological, chance, sociocultural, and psychological explanations. These causal dimensions behaved as expected; biological and chance explanations were most highly endorsed for genetics as a basis of inequality. Importantly, inevitability, complexity, and causal explanations partially mediated effects of framing on acceptability ratings. Table S2 reports the size of the indirect effects for each framing condition and shows that cumulatively, the included mediators explained between 31% (income) and 54% (neighborhood) of the total effects of the four socioeconomic framings. Health inequali-

ties that were rated as more inevitable, biological and psychologically driven were viewed as more acceptable, whilst those rated as more complex and socioculturally driven were less acceptable.

We examined whether judgments differed according to explanation target. There were no effects of explanation target on complexity or malleability ratings. However, inevitability ratings were on average higher for framing as explanation target rather than life expectancy by framing as the explanation target. Put differently, inequality in income was perceived as more inevitable than inequality in life expectancy by income; and this was true for all other framing conditions except lifestyle choices and social class.

GENERAL DISCUSSION

The current report is the first to experimentally study the causal inferences that non-experts make when presented with distinct explanations for health inequality. It also examines whether these inferences inform judgements of how acceptable health inequality is. Across two studies that compared a wider range of explanatory framings than any previous work (cf. Booske et al., 2011; Gollust et al., 2009; Gollust & Copella, 2014; Howarth et al., 2019), respondents viewed life expectancy inequality attributed to genetic factors and lifestyle choices as most acceptable, while health inequality attributed to four socioeconomic conditions—neighborhood, social class, income, and education—were least acceptable. Complementary patterns were observed for supporting interventions to address these health differences and the priority of doing so (see pilot study).

Previous work has reported that bivariate presentations of health inequality are generally less acceptable than univariate conceptions (Howarth et al., 2019). The current findings advance from this in the following ways. Firstly, they confirm that it is not the inclusion of another variable or framing condition per se that reduces acceptability—in some instances, the framing condition actually increased acceptability relative to a no-framing condition. Secondly, they confirm that socioeconomic framings are less acceptable than no or other framings (McNamara et al., 2020, 2021), but extend this to show that this reduced acceptability is comparable across a range of different indicators employed to measure socioeconomic conditions. Third, the present findings provide a psychological framework to help understand why acceptability is influenced by framings, by examining the cognitive appraisals that are elicited by different health inequality explanations.

Appraisals of inevitability, malleability, and complexity

A number of cognitive dimensions were identified that varied with framing and predicted views on health inequality. In the case of the four socioeconomic indicators these appraisals could explain between 31% (income) and 54% (neighborhood) of the total effect of framing on acceptability (see Table S2). One of these dimensions was ratings of how inevitable health differences were: health inequality viewed as inevitable was rated as more acceptable. Socioeconomic framings of inequality were viewed as less inevitable than health differences per se and this accounted for 38%–47% of the indirect effects of these categories on acceptability of inequality. Contrary to some concerns that framing health inequalities in more structural terms may induce a degree of fatalism (Kane et al., 2022), socioeconomic framings were associated with a reduced sense of inevitability relative to no framing.

Inevitability judgments were the only appraisals that systematically varied according to explanation target (i.e., whether participants were asked about framing vs. life expectancy attributed to that framing). For genetics, neighborhood, income and education-related differences, unequal allocations of these variables or measures were seen as more inevitable than the unequal health distributions they give rise to. In other words, while non-experts may see it as a fact of life that people are differently susceptible to genetic lotteries, are likely to live in different rather than the same neighborhoods and to vary in their income and education levels, they view it as less unavoidably the case that life expectancy should track these sources of human variation.

In contrast to Nettle et al. (2023) where inevitability ratings were subsumed under the dimension of malleability, judgments made in the current paradigm were only loosely related to views on how easy health inequalities are to change. For the present work, judgments about the inevitability of inequality were dissociable from judgments about whether they can change or should be changed. One important way in which these appraisals dissociated was in how they related to views on health inequality. Unlike inevitability judgments, the ease with which people believed inequalities could be addressed (malleability) was not related to acceptability judgments. It was however, related to agreeing that something should be done to address health inequalities. Whilst views on acceptability and support for intervention are generally inversely related to one another they appear to be underpinned by at least partly non-overlapping appraisals. Important for views on whether something should be done for health inequality, therefore, are evaluations of whether something can be done. For non-experts, this was particularly the case for health variation driven by education and lifestyle choices.

We also report that appraisals of the complexity of inequality were independently and negatively related to acceptability judgments: relative to health differences in the population per se, inequality attributed to all four SES framings as well as lifestyle choices were seen to be less complex and this had a net positive influence on acceptability ratings. In other words, certain framings were viewed as simpler than life expectancy variation without a framing and this was associated with increased acceptability.

Perceived causal explanations

We turn next to the four superordinate causal explanations. Viewing health inequality as being driven by sociocultural factors such as social roles, culture, and childhood experiences was associated with reduced acceptability of that inequality. We speculate that this may be because this is the causal dimension that respondents view as having the clearest implications for the shaping of an individual self that is distinct from others (Hornsey, 2008). They may therefore be reluctant to permit the same causal explanations that forge an individual sense of personhood to also lead to unequal longevity. Future work is required to establish this, but it is interesting to note that sociocultural explanations were the only causal explanation dimension that participants rated should be consistently lower under ideal circumstances relative to actual or perceived causes (see Supplemental Materials and Figure S6 for full analyses). Overall, this indicates a particular reluctance for sociocultural factors to contribute to inequality.

Although participants' ratings of the involvement of uncontrollable and unknowable factors varied across framing conditions, chance as a causal explanation was not related to acceptability and there were no indirect effects through these appraisals. Work on distributive justice principles often emphasizes a distinction between "option luck" (instances where outcomes are derived from deliberate and informed choices) and "brute luck" (instances where an individual has no

control) for people's views on health distributions (Tinghög et al., 2017). On this basis it may have been the case that framings attributed to brute luck or chance would differ in acceptability. There was little evidence of this here and it does not appear that this causal dimension adds value in understanding participants' views on inequality. However, insofar as ratings of psychological causes (choices and motivations) correspond with "option luck" there was some evidence for the flipside prediction that health inequality seen to be driven by individual choices and motivations are more acceptable. For instance, lifestyle choice-driven inequality was viewed as more acceptable in part because it was viewed as more psychologically driven. This is consistent with evidence that respondents are less willing to reduce unequal health caused by smoking behavior (Dolan et al., 2005) and the view that ethical or philosophical approaches to health inequality should exclude inequalities that arise from freely chosen behaviors.

There were small significant differences in the perceived contribution of psychological and sociocultural factors across the four SES conditions, but the most robust and largest driver of decreased acceptability across all four of the socioeconomic framings was a reduced perception that biological factors (e.g., evolution, hormones, and genes) cause health differences. This accounted for 50%–87% of the indirect effects for SES framings. Although public conceptions of health causes are generally multifactorial (Helman, 2007; Schnittker, 2015), in Western countries, biological factors such as genes are viewed as particularly important determinants of physical health outcomes (Freese & Shostak, 2009; Schnittker, 2015). The present findings indicate that a sizeable proportion of the reason why socioeconomic framings increase concerns about health inequality (relative to instances where socioeconomic factors are not referenced, such as in McNamara et al., 2021) is because they reduce the perceived involvement of biological determinants in causing health variation. One question is whether this reflects a form of inverse "naturalistic fallacy," or more precisely a "naturalness" preference (Li & Chapman, 2012), wherein social actors tend to reason that what is natural is also good (Dar-Nimrod & Lisandrelli, 2012; Foster-Hanson & Lombrozo, 2022; Ismail et al., 2011). By this reasoning, socioeconomic health inequality becomes less acceptable because the perceived contribution of "natural" causes such as evolution, genes and hormones are judged to be less than for health inequality per se.

Implications for intuitive causal theories of health and social inequalities

Many theories of lay models of health and illness allow for the observation that people hold complicated and sometimes contradictory causal models about health and illness (Helman, 2007; Hughner & Kleine, 2004; Pill & Stott, 1985). The current work is the first to experimentally examine how different framings of bivariate health inequality can elicit different emphasis on these folk causal models. We find that the underlying causal inferences correspond with and extend the range of typologies that have been applied to folk views of illness causation; some that differentiate individual health maintenance behaviors from uncontrollable external factors (Hughner & Kleine, 2004; Pill & Stott, 1985) as well as broader taxonomies that discern causal roles for the individual, natural world, social world, and supernatural world (Helman, 2007), or behavioral, biological, psychosocial from other (or "no") explanations (MacFarlane & Kelleher, 2002). The four dimensions of causal inferences extend beyond the simple dichotomous models in previous health and social attribution work such as choice versus chance (Tinghög et al., 2017) or choice versus genes (Dar-Nimrod & Lisandrelli, 2012). The dimension of unknowable and uncontrollable "chance" causes did not predict respondent views, however, the three dimensions that

align with core cognitive systems—intuitive psychology, biology, and sociology—did. It is encouraging that intuitive explanatory frameworks that arise from the application of core cognitive systems (Nettle et al., 2023; Spelke & Kinzler, 2007) also apply well to lay understanding of societal inequality.

Implications for public communications about health and social inequalities

It is well observed within social policy and public health circles that policy interventions for addressing health inequalities overly focus on lifestyle choices and behaviors at the expense of upstream structural interventions (Baum & Fisher, 2014; Smith et al., 2016), despite the evidence that health behaviors are themselves constrained and influenced by structural and socio-ecological factors (Pepper & Nettle, 2017). This tendency, often referred to as "lifestyle drift" (Williams & Fullagar, 2019) arises from a mixture of historical and ideological factors (Lantz et al., 2007). Another contributing factor highlighted by Baum and Fisher (2014) is that focusing on behavioral change has a "strong inherent logic" to it; if one perceives the cause to be behavioral then so should the intervention (see also Nettle et al., 2023). The present findings provide evidence for the first time that there are also cognitive *consequences* to framing lifestyle choices as the cause of health variation. This framing had a legitimizing effect that encouraged perception of the issue as less complex, primarily psychologically-driven and subsequently more acceptable. Framing health differences to be the result of lifestyle choices may therefore further reinforce the appeal of behavioral interventions (or even no interventions) by simplifying and legitimizing health inequality. One important caveat here is that the current mediation models were able to account for less than 10% of the overall effect of lifestyle choices on increased acceptability. Evidently the current framework is not yet comprehensive and future research may examine a broader range of socio-cognitive inferences elicited by conceptualizing inequality on the basis of lifestyle choices and behaviors.

Life expectancy inequality was viewed as markedly less acceptable when attributed to socioeconomic factors: neighborhoods, education, income, and social class. Presenting health equality in socioeconomic terms, such as Michael Marmot's famous assertion that "social and economic differences in health status reflect, and are caused by, social and economic inequalities in society" (Howarth et al., 2019; Marmot, 2010) is likely to reduce the acceptability of health inequalities precisely because it emphasizes sociocultural and minimizes biological causes. Across both studies, presenting health inequality with respect to any one of the four socioeconomic conditions led to a drop in perceived acceptability that was broadly comparable. Communicators and campaigners might therefore expect that framing health inequality with respect to education or social class has an attitudinal effect comparable to framing by income or neighborhoods. From a health communication perspective, this is reassuring for researchers who are measuring and reporting as well as policymakers who are campaigning around the role of specific socioeconomic health determinants who may wonder whether certain labels or framings are more influential than others. These results instead indicate an opportunity for building coalitions across different health inequality research silos (Collyer & Smith, 2020); when it comes to communicating this issue it is more important that socioeconomic factors of some kind are referred to rather than which specific factors are referenced. Future work may also consider whether this extends to multivariate presentations of socioeconomic determinants (e.g., Gollust et al., 2009) in the same way as these bivariate presentations.

Relatedly and finally, we reflect on what the current studies tell us about non-experts' intuitive causal view of different socioeconomic conditions. Neighborhood framings were marginally lower on biological and psychological ratings than the other SES conditions, but otherwise there were minimal differences across the socioeconomic factors: health inequalities in all four conditions were seen to be driven by a mix of sociocultural followed by psychological, then chance and even biological factors. We conclude that, in contrast to the nuanced causal differentiation made by some epidemiologists and measurement theorists (e.g., Antonoplis, 2023; Geyer et al., 2006), non-experts' intuitions about the causes of socioeconomic health inequality appear broadly transposable regardless of whether framed by education, income, social class, or neighborhood.

Limitations

An important caution to the above is that the current manipulations did not employ more passive framings (such as income-related health inequality) or actual examples of health inequality messaging used by agencies campaigning on this issue. This is because we were intending to test the key principle as to whether emphasizing a specific explanatory framing would shift views on acceptability by way of cognitive appraisals. We therefore opted for a strong experimental manipulation that asserted that differences were mainly due to one framing condition alone. Future work will need to examine these effects with softer messaging, such as presenting a framing condition as an example or in passing (e.g., income is one of the causes of differences in life expectancy).

In order to avoid adding further complexity to the current experimental design, we chose not to incorporate measures of participants' pre-existing causal attributions about these topics or their political orientation. There are good reasons to believe that these variables are likely to strongly influence public receptivity to social determinants messaging particularly for US samples, in light of evidence that Republicans are resistant to social determinants framings (Gollust et al., 2009; see also Kraus et al., 2009; Crist et al., 2023; Bridger et al., 2023). Accordingly, we would expect that the influence of socioeconomic framings might be less strong for participants who identify as right-wing and future work will need to examine the effect of this on cognitive appraisals. Relatedly, we also did not directly assess whether participants believed the framings they were presented with, which is important in light of evidence that Republicans and Democrats produce more counterarguments and reactance to different types of framing messages (Gollust & Copella, 2014).

Another limitation of the present work concerns the sample and sampling method. While our research interests were in determining the cognitive consequences of experimentally manipulating health inequality framings rather than making claims about the views of a nationally-representative population, it remains the case that we recruited via opportunity sampling on a non-representative sample. The usual caveats therefore apply and it is not appropriate to employ these results to make any claims about the views of the UK or US public in general, let alone from non-UK/US populations. Similarly, although we found little evidence that the effects of framing and underlying appraisals varied across the two countries—with some exceptions in inevitability ratings and the association between psychological explanations and acceptability—these studies were not designed to be sufficiently powered to make strong cross-country comparisons. Finally, in the current studies we did not examine whether acceptability and corresponding appraisals themselves vary with person-level factors because we did not record

demographic variables beyond age and gender (which are controlled for in the mediation analyses). Future studies should examine whether cognitions themselves vary across the social gradient in light of evidence that views on whether ill-health is driven by health behaviors, environmental factors and poverty, are associated with both objective and subjective markers of social status (Bridger, 2023).

CONCLUSION

Acceptability of health inequality was found to be influenced by explanatory framings, and framings also influenced causal intuitions and judgments of inevitability and complexity. This work is the first to unpack the cognitive consequences of different explanatory framings and how they relate to views on health inequality and to link these appraisals to intuitive causal models. These findings indicate that public support for intervening in health inequalities in the UK and the US will be best served by framings that emphasize sociocultural causes and decrease perceived inevitability as well as reduce perceptions of biological and psychological drivers of health inequality. Presenting health inequalities as a function of socioeconomic factors reduced the acceptability of health variation, regardless of whether this was framed in terms of neighborhood, income, education, or social class. Non-experts' intuitions about the contribution of sociocultural, psychological, and biological causes were similar, irrespective of which indicators were used to depict socioeconomic health inequality.

AUTHOR CONTRIBUTIONS

Emma K. Bridger and Daniel Nettle derived the original study idea. All authors contributed to the design of the studies. Emma K. Bridger wrote the experimental surveys, collected the data, conducted all analyses and wrote the original draft manuscript. All authors contributed to the review and editing of the final manuscript. All authors read and approved the final manuscript.

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DATA AVAILABILITY STATEMENT

The datasets and code supporting the conclusions of this article are available in the OSF repository, available at https://osf.io/jk7p5/?view_only=435bbff197954e66ba5640cada51b7d1

OPEN RESEARCH BADGES

This article has earned Open Data and PreRegistered badges. Data are available at https://osf.io/jk7p5/ and preregistered are available at https://osf.io/4whtc.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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