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Posted Date: 11 March 2026

doi: 10.20944/preprints202603.0877.v1

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Time Dimension of the Link Between Income Inequality and Health: The Immediate, Cumulative, and Comparative Effects

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Abstract

The income inequality hypothesis (IIH) posits that greater income dispersion harms individual health through psychosocial pathways. Yet decades of empirical research—especially in cross-national settings—have yielded inconsistent findings. This study revisits the IIH by distinguishing three temporal dimensions of inequality: immediate (current levels), cumulative (long-run averages), and comparative (recent change). Using harmonized Gini series linked to repeated cross-sections of the World Values Survey (1981-2016) across more than 90 countries and regions, we estimate multilevel models that adjust for individual and national covariates. Results reveal a consistent negative association between worsening inequality over the prior decade and self-rated health—supporting a comparative, time-sensitive specification of the IIH. In contrast, immediate and cumulative inequality often show null or even positive associations, particularly in less developed contexts and under random-effects estimation. These patterns suggest that inequality's health consequences are temporally contingent, and that long-run deterioration in distributional conditions poses a particular threat to population health and should be closely monitored in future research and policy.

Keywords: income inequality; self-rated health; temporal dynamics; social determinants of health; multilevel/hierarchical models; cross-national analysis

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1. Background

In contrast to the substantial gains in human life expectancy achieved over the twentieth century [1], the past three decades have seen a marked deceleration—and in some settings and population subgroups, stagnation or reversal—in longevity progress [2]. Reflecting these constraints, medical and public health scholars argue that a further "radical" extension of human life expectancy on the scale observed in the twentieth century is implausible under foreseeable conditions [1]. Consistent with these concerns, progress against major causes of death has been uneven across countries. For example, the risk of dying from non-communicable diseases increased during the 2010s in a nontrivial share of countries—33 of 185 (18%) for females and 38 (21%) for males [3]. Improvements in maternal mortality have also slowed since the mid-2010s [4], prompting United Nations agencies to warn that recent headwinds may jeopardize fragile gains [5]. The COVID-19 pandemic further exposed the vulnerability of recent progress: global life expectancy declined between 2019 and 2021 by approximately 1.8 years, effectively erasing roughly a decade of prior gains [6]. Collectively, these patterns have been described by the World Health Organization as a major reversal of long-term mortality improvements, with far-reaching implications for human development, threatening the achievement of health-related Sustainable Development Goals (SDGs) and undermining decades of global health progress [7,8].

While recent academic and policy attention has gravitated toward proximal medical and sanitary risks—particularly in the wake of the COVID-19 pandemic—a convergence of structural, chronic, and social forces has long been recognized as the deeper engine of population health disparities and mortality crises worldwide [9,10]. These forces include upstream environmental and socioeconomic determinants that shape the distribution of health risks across the life course and between communities [11,12]. Yet despite decades of theoretical and empirical attention, macro-level contextual factors such as income inequality remain incompletely understood. Most notably, Richard Wilkinson and collaborators first claimed that inequality affects health through psychosocial mechanisms rooted in perceived status, chronic stress, and social comparison [13–16], but subsequent cross-national studies have yielded mixed evidence. A recent large-scale meta-analysis found no consistent association between income inequality and well-being or mental health, thereby reopening debate over the empirical foundation of inequality–health linkages and underscoring the need for improved theorization and measurement strategies [17]. These debates suggest that the central challenge is no longer whether income inequality matters for health, but how it should be conceptualized, measured, and situated within broader temporal and social processes shaping population well-being.

Accordingly, our study contributes to this ongoing discussion by advancing a dynamic, time-sensitive framework that may help explain previous inconsistencies in cross-national research on income inequality and health. We distinguish between three temporal dimensions of inequality exposure—its contemporaneous level, long-run accumulation, and trajectory of change—and examine their respective associations with self-rated health using repeated cross-sectional data from over 90 countries in the 1981–2016 World Values Survey. By comparing modeling strategies and stratifying by development level, we provide new evidence that aligns the income inequality hypothesis with the broader shift toward structural and temporal explanations for global health disparities.

1.1. Theoretical Debates: Relative or Absolute Deprivation?

Would macro contextual risks, such as income inequality undermine health? This remains an open question. Richard Wilkinson [13–15] first pioneered a systematic proposition on the adverse contextual effect of income inequality on health. Wilkinson argues that, in developed countries, where basic living standards are met for the majority, one's relative social position, rather than absolute material resources, becomes a crucial determinant of health. In particular, the less privileged experience stronger relative deprivation and more psychological distress in the presence of greater income inequality. High level of societal polarization leads to excessive competition, interpersonal friction, declining social trust, and corroding social capital, resulting in disrupted social connection, low self-esteem, anxiety, depression, insecurity, and loss of control for the socially disadvantaged. Thus, the income inequality hypothesis (IIH) posits that income inequality is harmful to individual well-being primarily through psychosocial pathways.

However, the IIH is fiercely challenged by the absolute income hypothesis (AIH), which argues that the assumed relationship in the IIH is a statistical artifact [18]. The AIH claims that the correlation between income inequality and population health is compositional rather than contextual. Although narrowing income inequality can benefit population health, it is because the protective effect of individual income on health is concave and thus redistributing income from wealthy to impoverished individuals can lead to improved average health. Therefore, it is necessary to examine the "contextual" effect of income inequality on health by controlling for the "compositional" effect of individual income.

Furthermore, the neo-materialism pathway introduces another perspective [19]. It posits that progressive-liberal governments tend to reduce social inequality, expand medical insurance coverage, and promote public health. Consequently, social regimes and associated public policies can be confounding variables in the income inequality-health link. This is echoed by Piketty's [20] historical-comparative investigation on the political and ideological origins of income inequality. That is, income inequality is an outcome of cultural norms, social regimes and political ideologies, which also influence population health. To decisively examine the IIH, these cross-national heterogeneities must be taken into consideration.

In short, while the IIH proposes persuasive psychosocial mechanisms that income inequality does harm to health, the AIH and the neo-materialism hypothesis offer alternative explanations. Resolving these theoretical debates calls for careful empirical investigations.

1.2. Empirical Evidence: Stagnant and Inconsistent Findings

While Wilkinson's theoretical framework is ground-breaking, the empirical evidence has lagged and has offered inconsistent findings, with conclusions heavily dependent on spatial and temporal data coverages. Early studies usually relied on aggregate data at various levels spanning from country to community, where the failure to control for individual income compromises its competence for testing IIH and AIH. Despite lacking unanimous support, many of these studies report a negative association between income inequality and population health [16,21]. Besides, a systematic review on more than 150 studies [22] shows that most research (around 70%) reports supportive results, particularly in cross-national contexts. Though recent work largely overcomes the aggregate data limitation through a direct introduction of individual covariates into multilevel/hierarchical models, results are mixed at best [23,24]. Some cross-national studies identify significantly negative effects of income inequality on individual health, thus supporting the IIH [25,26] while others find the opposite and some extreme cases even report significant positive effects [27–29]. Specifically for mental health outcomes, one latest meta-analysis based on 168 individual studies shows that income inequality universally harm neither well-being (positive measure) nor mental health (negative measure) [17], though the meta-analysis does not examine research related to physical or overall health.

One potential reason for this intellectual stagnation is flawed modeling designs, particularly insufficient control for cross-national heterogeneity. Most prior multilevel studies relied on random-effects models without adjusting for crucial national confounders, such as public infrastructure, social regimes, and public health policies, potentially leading to endogeneity bias. In fact, those omitted variables are not merely control variables; they exemplify the neo-materialism mechanism, a competing explanation for IIH. Therefore, in the absence of proper control for relevant national confounders, no single study can completely rule out the neo-liberalism explanation and corroborate the IIH. This research gap thus calls for a new examination using either random-effects models with robust national controls, or much better, fixed-effects models to minimize omitted variable bias stemming from unobservable/uncontrolled heterogeneity.

Another factor accounting for the mixed findings comes from the underdeveloped conceptualization of the temporal structure of the IIH. We notice that this scholarship tends to adopt an essentially static or episodic time frame: most existing literature relies on analyzing synchronous data (i.e., income inequality and health measured at the same time), usually on one time point only. Even among the rare exceptions using alternative specifications, such as time-lagged measures of income inequality [30–33], their income inequality measures are still point-specific (i.e., reflecting inequality at some specific time points rather than over a continuous period), and exceptions using period-based inequality measures (e.g., [34,35]) have been rare. This static and episodic perspective can be problematic in light of the intricate and dynamic nature of both income inequality and health. Given the historically unprecedented world-wide income polarization since the 19th century, followed by a moderate reduction during the 1950s-1970s and then a sharp resurgence after the 1980s globally [20], one can hardly assume that inequality stays the same for each country across historical periods (as is common among cross-sectional international comparisons), or that inequality evolves linearly and monotonically over time (as is common among studies using time-lagged inequality measures). Even if income inequality can be captured by a one-time-point measure, the impact of income inequality on health takes time to unfold, necessitating period-based measure of the IIH effect. In particular, the psychological outcomes of income inequality, including those related to relative deprivation, fierce competition and chronic stress, are found not to damage health

 doi:10.20944/preprints202603.0877.v1

immediately [36]. Instead, psychosocial risks typically take years to manifest as serious health problems [37], thus implying a “latency period” [38]. Therefore, a new conceptual and methodological framework is needed to disentangle distinct temporal mechanisms—immediate exposure, cumulative accumulation, and comparative change—through which income inequality may shape health outcomes.

These research gaps—the underdeveloped modeling strategy and the neglect of inequality’s temporal structure—motivate the present study, which advances a new conceptual and empirical framework to realign tests of the IIH with its underlying theoretical dynamics.

2. Methods

2.1. Data

We address the sample coverage problem in existing research by expanding our geographic scope to include both the Global North and South and by extending the temporal framework to cover more than three decades since the neoliberal surge in income inequality. Accordingly, we use microdata from the 1981–2016 World Values Survey (WVS), comprising 331,738 individuals from 94 countries and regions. The deliberate choice of the WVS is driven by its strength in tracking countries over multiple decades, which allows us to account for national fixed effects. Moreover, the selected WVS waves ensure broad geographic representation across all stages of development, including 9 low-income countries, 19 lower-middle-income countries, 30 upper-middle-income countries, and 36 high-income countries. For a comprehensive overview of countries/regions, please refer to Appendix Table A1. As prior research documents sharp contrasts between the Global North and South [27], between more and less developed European countries [39], and between high-income and less-developed nations [26], our sampling strategy builds on this literature by enabling a unified analysis of these contrasts, which are rarely examined within a single empirical framework.

Our country-level inequality measures and covariates are drawn from the World Income Inequality Database (WIID), a widely used compilation of harmonized income distribution statistics across countries [39,40]. Following common practice in prior research [19,22,41], income inequality is measured by the Gini index. However, although the Gini coefficients are available in the original WIID, their temporal consistency and cross-national comparability are limited due to substantial differences in data sources, income concepts, and estimation methods across countries and years [29,39]. To address these comparability issues, we rely on the Standardized World Income Inequality Database (SWIID) [39], which provides model-based estimates of Gini indices that maximize cross-national and temporal comparability while preserving the information contained in the original WIID. This approach allows us to construct inequality measures that are better suited for longitudinal and cross-country analysis.

2.2. Independent Variables: Three Measures on Time of IIH

Our independent variable centers on the three temporal dimensions of income inequality, namely the immediate, cumulative, and comparative dimension.

The immediate specification aligns with synchronous inequality widely used in the literature, typically measured by the Gini index at the time when health information is collected [19,22,27,41]. Thus, it completely ignores the latency period or naively assuming a constant level of inequality. In practice, the immediate effect is measured by the Gini index for a given country/region in the survey year.

In contrast, the cumulative dimension stresses the accumulated effect of income inequality on health, which is rooted from life course theory [42] and is supported by the literature on health trajectories over time [43,44]. The “wear and tear” process of health deterioration requires an extensive exposure to income polarization to take place. Two studies [34,35] confirm that early-life cumulative exposures to high inequality significantly damage individual health. In practice, we operationalize the cumulative measure as the average Gini index in the previous ten years before the survey year. Previous studies on the time-lagged effects have reported significant findings varying from five, ten, up to 15 years [30,33,34], so that ten years seems to be a reasonable choice. Nevertheless, we are fully aware that this choice is conventional rather than theoretical, and conduct sensitivity analysis by using other intervals. Moreover, this is also the convention of two previous studies on the cumulative exposures [34,35]. We use the average instead of the sum to ensure direct comparability across different time dimensions.

We propose a "comparative" dimension of inequality, to capture the mathematical difference between the current inequality level and that of historical periods for the same country. This measure is partly inspired by the adaptation-level theory in psychology, which argues that individuals typically evaluate current stimuli based on whether they exceed or fall short of their accommodated benchmark [45]. Accordingly, we extend this empirical rule to the perception of income inequality, where individuals also exhibit greater tolerance toward income inequality in a society with a long-lasting history of social injustice, likely due to adaptation [46]. Furthermore, loss aversion, i.e., people react to setbacks more emotionally than progresses, is a common psychological trait [47]. When income inequality soars, the majority of the population will inevitably face status loss and have to deal with the associated negative emotions. Therefore, we expect that the changing trend, rather than level of income inequality per se, kicks off the most psychological processes, which justifies our introduction of comparative effect into this study. Accordingly, we measure the comparative effect as the current Gini index minus its value ten years prior, consistent with the ten-year gap we adopt for the cumulative measurement.

2.3. Other Variables

Our dependent variable is self-rated health, which ranges from very poor (level 1) to very good (level 5) on an ordered scale. This specification follows the exact tradition of various research using the same dataset and outcome [27–29,32]. Although subjective, self-rated health has been consistently demonstrated to be a robust and reliable summary measure of overall health status and a strong predictor of subsequent mortality across diverse populations and social contexts [48]. Importantly, self-rated health remains a significant predictor of mortality even after controlling for objective clinical indicators and physician-assessed health, suggesting that it captures latent dimensions of health not observed in biomedical measures [49,50].

Our choice of control variables at the country level is guided by ruling out the neo-

materialism pathways [19]. Specifically, we include GDP per capita, GDP growth rate, population size, and out-of-pocket health expenditure to control potential confounding due to economic development or public health infrastructure. We also include a period covariate, "time", to capture common temporal trends. Control variables at the individual level include age, sex, education, and individual income. A quadratic form of age is included to allow for the nonlinear ageing process of health trajectory. Individual income is utilized to tease out the compositional effect as claimed by the AIH.

Descriptive statistics for all variables above are shown in the Tables 1 and 2.

Table 1. Descriptive statistics for country-level variables.

Variables	Definition	Obs	Mean	Std. dev.	Min	Max
Immediate Gini	The Gini index in the survey year (rescaled by multiplying 100)	226	37.008	8.686	17.492	59.547
Cumulative Gini	Average Gini index in the past 10 years	226	36.732	8.978	17.703	59.414
Comparative Gini	The current Gini index minus that of 10 years before	190	.466	2.358	-8.981	7.494
Log GDP	Logged GDP per capita measured by comparable US dollars in 2011 adjusting for purchasing power parity	221	9.369	.992	6.596	11.685

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GDP growth	GDP growth rate (annual %)	223	4.168	3.725	-11.615	19.592
Logged population size	Logged population size	226	17.061	1.587	11.201	21.047
Out-of-pocket medical expenditure	Out-of-pocket expenditure as percentage of current health expenditure (%)	205	34.534	17.864	8.1	78.4
Time	The survey year minus 1980	226	21.912	8.088	1	34

Table 2. Descriptive statistics for individual-level variables.

Variables	Definition	Obs	Mean	Std. Dev.	Min	Max
Health	State of subjective health, from 1 (very poor) to 5 (very good)	316,251	3.798	0.889	1	5
Sex	0 = female; 1 = male	311,624	0.481	0.499	0	1
Age	Age at the survey time	312,121	40.982	16.209	13	99
Individual income	Scale of individual income, from 1 (least) to 10 (highest)	285,103	4.602	2.325	1	10
Education	Number of years of schooling	316,251	8.804	5.135	0	16

2.4. Modeling Strategy

The repeated cross-national data structure of the WVS permits complementary modeling strategies that exploit both within- and between-country variations. We begin with two-level random-effects (RE) models, with individuals (the lower level) nested within country–year units (the higher level). Our variance decomposition (available in later regression models) indicates statistically meaningful variance at multiple levels, motivating a multilevel specification. We treat the country–year as the higher-level unit because it increases the number of macro-level clusters and improves statistical power for estimating contextual effects in repeated cross-sections [51]. For inference, we report cluster-robust standard errors with clustering at the country level, allowing arbitrary correlation of errors within countries over time and yielding conservative inference in grouped data settings [52]. Despite the ordered nature of self-rated health, we estimate multilevel linear models for stability and interpretability; this practice is common in cross-national health inequality research [28] and is typically robust in applications where results are substantively similar under ordinal response models [53].

To address concerns about unobserved cross-national heterogeneity, we complement RE models with country fixed-effects (FE) specifications by including country indicators, which is equivalent to a three-level fixed-effects model. This approach differences out all time-invariant country characteristics—observed or unobserved—thereby strengthening causal interpretation under the standard assumption that remaining confounding is time-varying rather than time-constant [54]. Consistent with concerns about cross-population comparability in subjective outcomes, FE models also reduce bias from stable country-specific response tendencies by netting out persistent national differences in reporting styles, which can otherwise confound cross-national comparisons of self-rated health [55].

Prior research suggests that both modeling strategies and national context may condition the observed relationship between income inequality and health. For example, Kragten and Rözer [24] show that the positive association between income inequality and self-rated health under random-effects models becomes negative when fixed-effects models are estimated instead. Similarly, Karlsson et al. [26] report supporting evidence for the income inequality hypothesis among high-income countries, whereas the relationship is weak or absent among less-developed nations. Therefore, these discrepancies indicate that national economic development may moderate the inequality–health relationship. Accordingly, beyond full-sample analyses, we conduct subgroup analyses stratified by levels of national development to explicitly examine this moderating role. Following the World Bank classification, we distinguish high-income, upper-middle-income, and lower-middle/low-income countries, with the latter two groups combined due to their relatively smaller sample sizes. This stratified design allows us to assess whether the magnitude and direction of the inequality–health association vary systematically across stages of economic development, and thus whether the IIH reflects a universal social mechanism or a development-contingent process.

3. Results

3.1. Immediate Effect of Income Inequality on Health

To investigate the IIH, we begin with a two-level RE model as our baseline (i.e., Model 1 in Table 3), where the Gini index is the only predictor. The coefficient is significantly positive, suggesting that income inequality is associated with better self-rated health—contrary to the IIH and other competing theories—yet consistent with prior findings [24,27,28].

Table 3. The Immediate Effect of Income Inequality on Individual Health (All Countries).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Immediate Gini	.007***	.003	.004**	.008***	.007***	.003
	(.002)	(.002)	(.002)	(.002)	(.002)	(.004)
Sex		.112***	.092***	.093***	.092***	.092***
		(.009)	(.009)	(.01)	(.01)	(.01)
Age		-.011***	-.013***	-.013***	-.012***	-.012***
		(.001)	(.001)	(.001)	(.001)	(.001)
Age square		-.006***	-.002	-.002	-.002	-.002
		(.001)	(.001)	(.001)	(.002)	(.002)
Individual income			.051***	.051***	.051***	.051***
			(.002)	(.002)	(.003)	(.003)
Education			.017***	.017***	.017***	.017***
			(.002)	(.002)	(.002)	(.002)
Log GDP				.107***	.110***	.151***
				(.025)	(.029)	(.051)
GDP growth rate					.006**	.005**
					(.003)	(.002)
Log population size					.001	-.155*
					(.018)	(.082)
Out-of-pocket medical expenditure (%)					.000	.004
					(.002)	(.003)
Consider national fixed effects?	No	No	No	No	No	Yes
Constant	3.485***	4.166***	3.731***	2.577***	2.546***	4.812***
	(.106)	(.111)	(.105)	(.276)	(.498)	(1.369)
Individual observations	331738	324125	295472	290414	273368	273368
Number of country*time clusters	232	227	222	217	198	198
Number of countries	94	94	94	91	79	79
Interclass Correlation Coefficient, ρ	.101	.103	.092	.079	.074	.026

Note: Standard errors are in parentheses; *** $p<.01$, ** $p<.05$, * $p<.1$. ρ is the intraclass correlation coefficient (ICC).

Model 2 incorporates respondent's basic demographics. Controlling for age and sex attenuates the Gini coefficient and renders it statistically insignificant; however, once education and individual income are introduced (Model 3), the positive association reappears. This positive relationship remains in Models 4 and 5 after adding country-level time-varying covariates. GDP per capita and GDP growth are both strongly positively related to health, while out-of-pocket medical expenditure—used as a proxy for the neo-materialism pathway—shows essentially no effect once development is accounted for. Moreover, adjusting for these neo-materialism-related factors does not

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weaken the inequality–health association; if anything, the Gini coefficients in Models 4 and 5 are larger than in Model 3. This finding contrasts with the neo-materialism perspective, which emphasizes the role of material resources and public infrastructure in shaping population health [19,41]. In particular, prior work argues that cross-national differences in health primarily reflect variations in economic development and welfare regimes rather than contextual effects of income inequality per se [19,21]. Overall, our results provide no empirical support for the neo-materialism explanation.

We then estimate a three-level FE specification by adding country dummies (Model 6). Compared to the RE models, the much smaller ICC (ϱ) indicates that the FE model more effectively captures between-country differences. Notably, the previously positive Gini coefficient disappears, implying that unobserved cross-national heterogeneity can account for the puzzling positive association observed under RE specifications [24,41].

To further probe between-country differences, we stratify the sample by national development stage and re-estimate the models (Appendix Table A2); Figure 1 plots the estimated coefficients for the immediate Gini measure. As shown, estimates vary substantially between RE and FE models: RE estimates are consistently larger, more positively skewed, and more statistically significant, whereas FE estimates generally do not differ from zero. This pattern aligns with the full-sample results and echoes Kragten and Rözer [24]. Substantively, only one of the six stratified estimates supports the IIH: in the FE model for upper-middle-income countries, immediate inequality is significantly negatively associated with health. In contrast, four estimates are positive. These results reinforce the concern that contradictory findings in the literature reflect differences in modeling strategies and selective national coverage [24,26,27]. At the same time, whether the positive association between immediate inequality and health arises from mis-specifying the temporal structure of the IIH remains an open question.

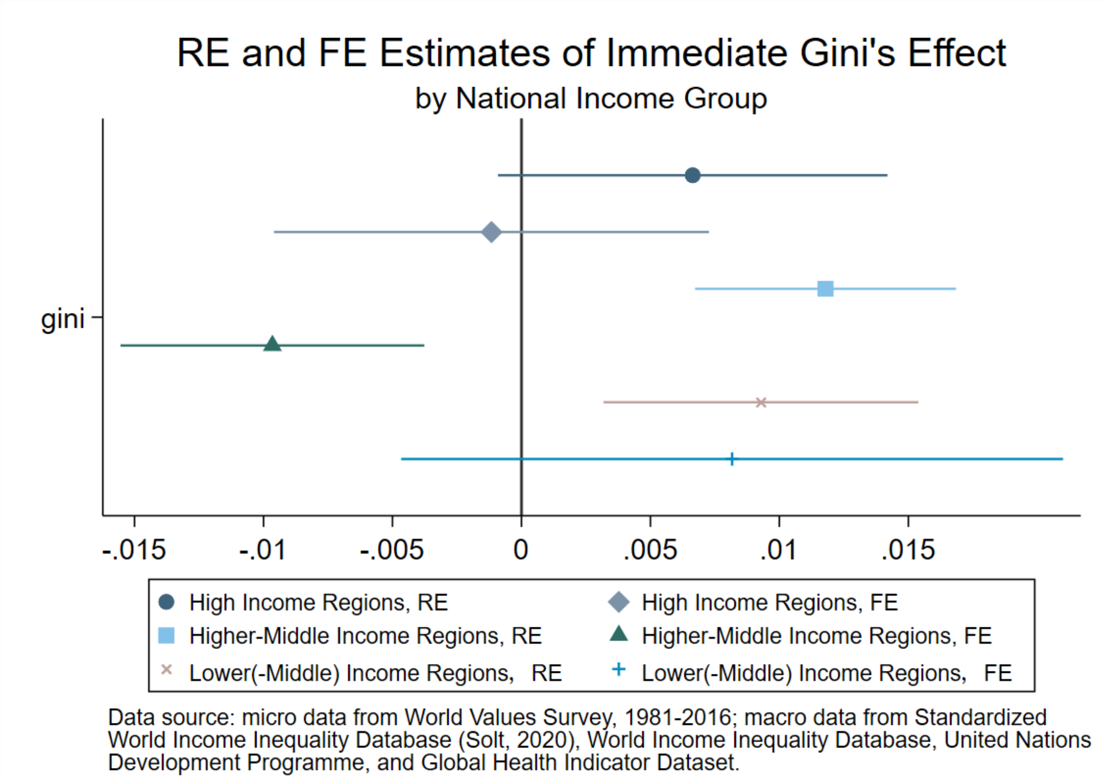

Figure 1. Random-Effects (RE) and Fixed-Effects (FE) Model Estimates for Parameters of the Immediate Gini Index by National Income Groups. Note: Markers represent the point estimates and horizontal bars are the 95% confidence intervals. Full models are shown in the appendix Table A2. In both fixed- and random-effects models, control variables include sex, age, age square, individual income, education, and logged national GDP per capita.

 doi:10.20944/preprints202603.0877.v1

3.2. Cumulative Exposure to Income Inequality and Health

In this section, we move beyond point-in-time inequality and examine income inequality as a cumulative exposure, consistent with life-course perspectives that emphasize the health consequences of sustained structural environments and long-run accumulations rather than episodic contexts [42,43]. We operationalize cumulative inequality as the average Gini index over the decade preceding the survey year, and estimate the same RE and FE specifications described above (Appendix Table A3). We again focus on the coefficient estimates for cumulative Gini, summarized in Figure 2.

Substantively, the cumulative results largely mirror—and in some aspects amplify—the pattern observed for the immediate specification. Consistent with Figure 1, the coefficients of cumulative Gini in Figure 2 skew positive across models and regions. The positive association is even more pronounced under the cumulative specification: seven of eight estimates are positive (six statistically significant at $p < 0.1$), and the remaining estimate—the FE result for upper-middle-income countries—is negative but not statistically significant. One plausible explanation is that averaging Gini over a decade may better capture a country's typical inequality level than does the Gini measured in an arbitrary single year, thereby reducing sensitivity to short-run fluctuations and measurement noise that can affect single-year (or single-lag) specifications [30–33,36].

Methodologically, what most clearly distinguishes Figure 2 from Figure 1 is the close alignment between RE and FE estimates. With the exception of the higher-middle income group, RE and FE point estimates are very similar, although the FE confidence intervals are somewhat wider—an expected pattern given that FE relies on within-country variation and thus uses less information from the data [54]. This convergence contrasts with the immediate specification, where RE and FE diverge more noticeably, and it suggests that cumulative inequality is less sensitive to modeling choices that address unobserved country heterogeneity—a point that aligns with broader methodological concerns in the inequality–health literature regarding how specification and unobserved contextual differences can shape the sign and magnitude of estimated effects [24,41].

Overall, the cumulative perspective yields the same broad conclusion as the immediate specification: the estimated effect of income inequality on self-rated health is largely positive, especially among lower-middle- and low-income countries. At the same time, treating inequality as a sustained exposure sharpens the central puzzle for the IIH: if neither contemporaneous level nor accumulated exposure behaves as the IIH would predict [13–16,22], the remaining possibility is that the relevant psychosocial trigger is not inequality as a level but inequality as a change—a dynamic, comparative process to which we turn next.

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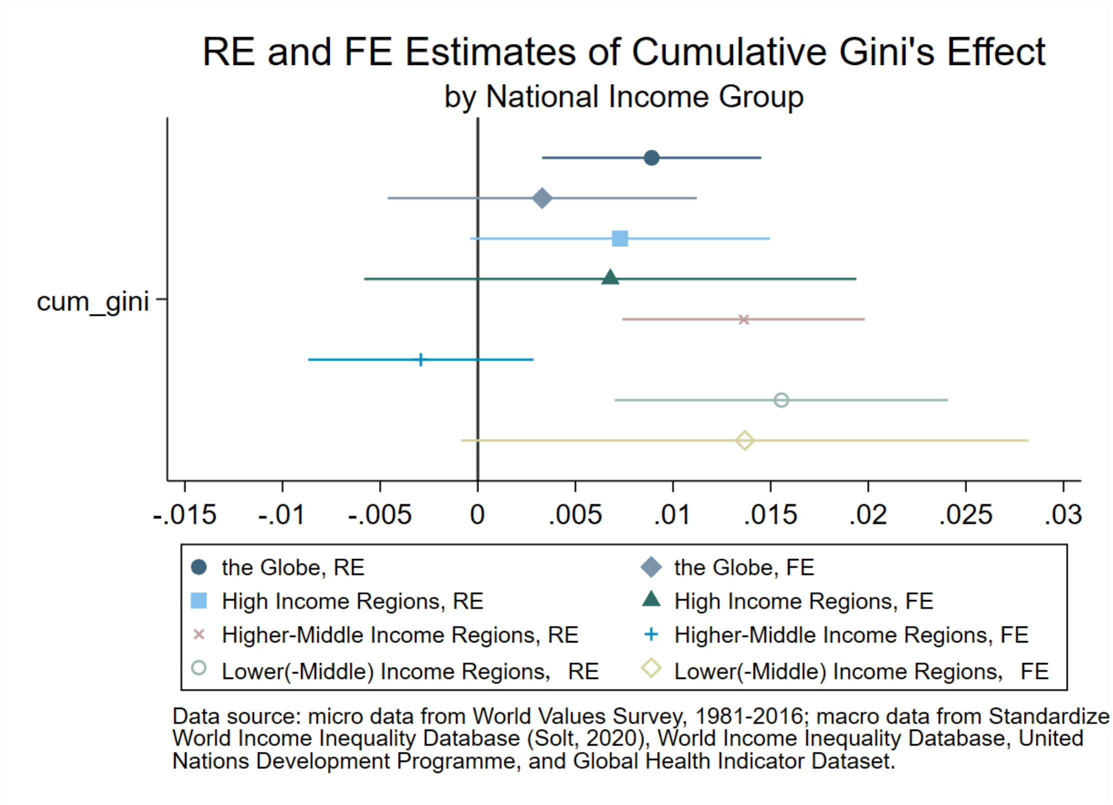

Figure 2. Random-Effects (RE) and Fixed-Effects (FE) Model Estimates for Parameters of the Cumulative Gini Index by National Income Groups. Note: Markers represent the point estimates and horizontal bars are the 95% confidence intervals. Full models are shown in the appendix Table A3. In both fixed- and random-effects models, control variables include sex, age, age square, individual income, education, and logged national GDP per capita. For the full-sample models, we also control for GDP growth rate, logged population size, and percentage of out-of-pocket medical expenditure (%).

3.3. Comparative Trend of Income Inequality and Health

Sections 3.1 and 3.2 expose a central puzzle: treating inequality as a level—either contemporaneous (immediate) or averaged over the prior decade (cumulative)—frequently yields positive estimates, and the results are sensitive to modeling strategy. Because this pattern contradicts the IIH, it raises the possibility that a level-based specification is not capturing the temporal feature of inequality that is most consequential for health. We therefore shift the question from inequality-as-level to inequality-as-change: does worsening inequality predict poorer health net of the contemporaneous level?

To test this possibility, we replace the focal predictor with the comparative inequality measure, defined as the difference between the Gini index in the survey year and its value ten years earlier (current minus prior-decade). Importantly, we retain the immediate Gini index in the model as a control variable, so the comparative coefficient isolates the association of recent change in inequality with health net of the contemporaneous level. Substantively, this specification can be read as follows: among country-years with the same current level of inequality, those that experienced a larger increase in inequality over the preceding decade exhibit worse self-rated health.

We then estimate the same series of RE and FE models as above (Appendix Table A4) and summarize the coefficients for comparative Gini in Figure 3.

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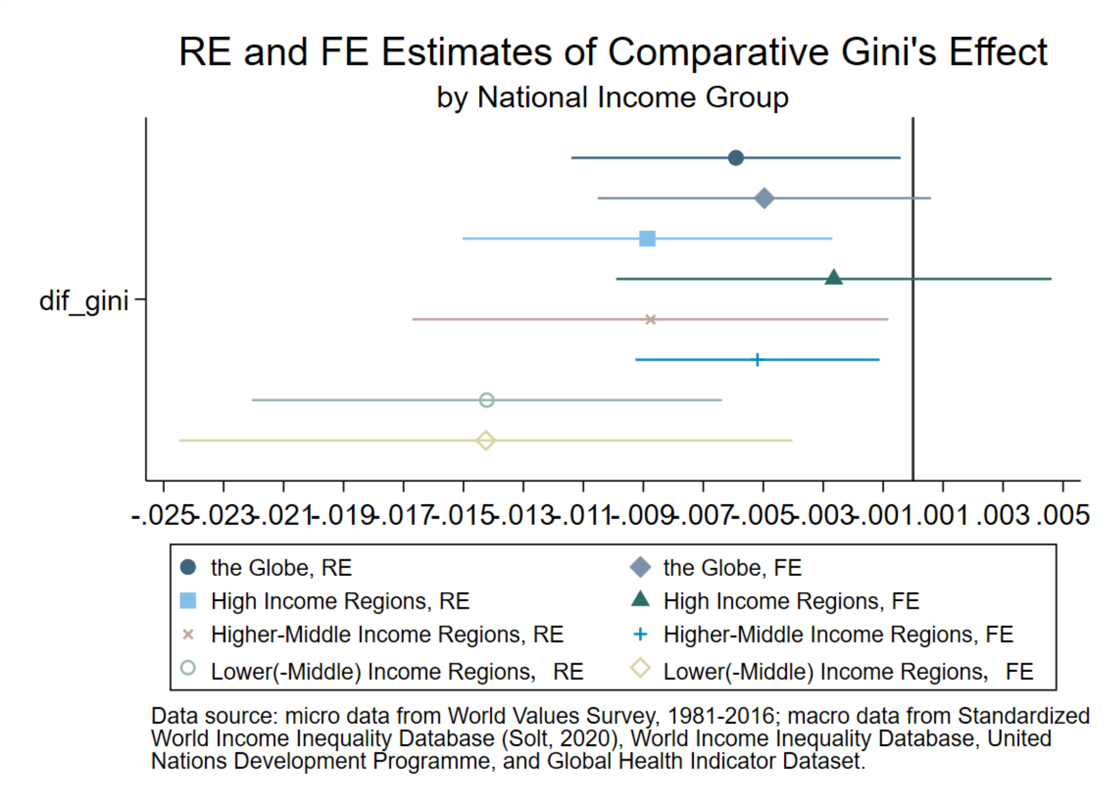

Figure 3. Random-Effects (RE) and Fixed-Effects (FE) Model Estimates for Parameters of the Comparative Gini Index by National Income Groups. Note: Markers represent the point estimates and horizontal bars are the 95% confidence intervals. Full models are shown in the appendix Table A4. In both fixed- and random-effects models, control variables include sex, age, age square, individual income, education, and logged national GDP per capita. For the full-sample models, we also control for GDP growth rate, logged population size, and percentage of out-of-pocket medical expenditure (%).

The key result is a striking sign reversal relative to the immediate and cumulative specifications. As shown in Figure 3, all point estimates for comparative Gini are negative, in sharp contrast to the largely positive estimates obtained when inequality is treated as a level. Despite the somewhat wide confidence intervals, seven out of eight estimates are statistically significant at the $p<0.1$ level, indicating that worsening income inequality has a universally harmful impact on health across the globe. Additional robustness check has been carried out in Appendix Table A4. The estimated coefficient for the immediate Gini index remains largely positive (with the exception of higher-middle-income countries), underscoring that the comparative measure captures information that is not reducible to the contemporaneous level alone.

Notably, the only nonsignificant estimate comes from the FE model for high-income countries, where the point estimate remains negative but is smaller in absolute value and less precisely estimated. One plausible explanation is that inequality may have been relatively stable in many high-income countries during parts of the study period, yielding limited within-country variation in the comparative measure and therefore reduced statistical power under the FE specification. This pattern is consistent with the fact that FE estimates are identified entirely from within-country change; when the relevant within-country variation in the comparative inequality measure is limited, FE estimates become less precise and confidence intervals widen even if the underlying association is similar. This is a standard property of fixed-effects estimation and within-unit identification in panel models [51,54].

Overall, these results suggest that the inequality–health association depends critically on how inequality is conceptualized temporally: inequality as a level (immediate or cumulative) yields patterns that are often inconsistent with IIH, whereas inequality as a decade-scale change produces a consistently negative association. A natural question, then, is why a comparative specification appears to recover the hypothesized harmful effect when level-based measures do not. Wilkinson's psychosocial account implies that inequality is health-relevant not simply as a background structural condition, but insofar as it activates social comparison, status anxiety, and perceived relative deprivation—processes that are inherently relational and experiential rather than purely distributive in a static sense [14–16,22]. From this perspective, increases in inequality should be especially consequential because they signal a deterioration in one's relative standing and a tightening of status competition, with downstream implications for social cohesion, trust, and chronic stress exposure [14–16]. By contrast, a high but stable level of inequality may be more readily normalized within a given society and may also be more entangled with slow-moving institutional and developmental correlates, which can blur the net psychosocial signal in cross-national data even under alternative modeling strategies [19,21,22,41].

This interpretation aligns closely with the reference-dependent framework in behavioral science. In Kahneman's account, evaluations are typically anchored to a reference point, and adverse changes ("losses") tend to weigh more heavily than equivalent improvements [47]. Translating that logic to inequality, the relevant psychological stimulus is not only how unequal a society is at a given moment, but how current inequality compares to what people have recently been accustomed to—here captured by the decade-prior baseline embedded in the comparative Gini measure. Holding the contemporaneous level constant, a larger increase in inequality implies that the social distance between groups has recently widened, making relative losses and heightened status threat more salient, and thus more likely to trigger the psychosocial responses emphasized by the IIH [14–16,47]. In this sense, the comparative specification can be read as a sharper test of the psychosocial pathway than level-based measures: it focuses on dynamic deterioration relative to an implicit reference point, which is precisely the scenario in which loss-averse appraisal and stress-related mechanisms should be most active [47].

In all, our findings suggest that the most health-relevant aspect of inequality is not its contemporaneous level but its recent trajectory—whether inequality has been worsening over a socially meaningful horizon. In the next section, we discuss the policy and research implications of this temporal reframing for population health and mortality, including why monitoring inequality trends may be as consequential as benchmarking inequality levels.

4. Implications for Research and Policy

This study contributes to a growing recognition that social and structural conditions—not only biomedical and behavioral risks—are central to today's mortality crisis. By systematically delineating the temporal structure of the income inequality hypothesis (IIH), we offer a time-sensitive framework to reassess how macro-contextual risks accumulate and translate into population-level health disparities. Our findings underscore that the health consequences of inequality are not merely a function of its level at a single point in time, but also of its trajectory over time. Specifically, we show that decade-scale worsening of income inequality, net of contemporaneous level, is consistently associated with poorer self-rated health across models and regions—supporting a dynamic specification of the IIH that aligns more closely with its theoretical roots in psychosocial stress and social dislocation [14–16,22,41].

This perspective helps explain why previous cross-national findings have appeared inconsistent or stagnant: standard "level-based" approaches may obscure the temporal salience of inequality change. Our comparative-change design reveals more uniform support for the IIH, while our development-stratified analyses clarify how national economic contexts moderate this relationship. These results echo longstanding concerns that inequality-health research must attend not only to modeling strategies and sample coverage [21,24,26], but also to structural heterogeneity in how inequality is experienced and metabolized across different stages of development [26,41].

Although our outcome is self-rated health (SRH), a large body of research treats SRH as a valid summary indicator of underlying health risk with clear relevance to mortality and population health monitoring. Across diverse community samples and national contexts, SRH strongly predicts subsequent all-cause mortality net of extensive covariate adjustment—including baseline sociodemographic factors and, in many settings, measured morbidity and related clinical risks—making it an informative population-level signal rather than a merely subjective perception [48,49]. Conceptually, SRH is often interpreted as an integrative self-assessment that synthesizes multiple dimensions of health (e.g., chronic conditions, functional limitations, subclinical symptoms, and psychosocial strain) into a single, policy-relevant risk indicator; this helps explain why SRH remains predictive even when models adjust for conventional health measures [56]. Moreover, evidence suggests that SRH's predictive validity has remained robust—and in some settings strengthened—over time, reinforcing its usefulness for population surveillance and comparative research that aims to connect macro-structural conditions to downstream mortality risk [49,50,57].

At the population level, the centrality of macro-structural conditions—such as contextual income inequality—becomes especially clear when health is situated within the contemporary mortality crisis. The global burden of disease is increasingly shaped by noncommunicable conditions that unfold over long time horizons, such as cardiovascular disease and metabolic disorders, which now account for the vast majority of deaths worldwide [58,59]. This shift, widely recognized since the early epidemiologic transition literature, highlights that preventable mortality today is largely shaped by cumulative exposure to structural and environmental forces—not isolated or acute shocks [60]. In this perspective, upstream determinants are not contextual background, but formative causes of long-term disparities in morbidity and survival, given their role in shaping access to resources, exposure to chronic stressors, and life-course risk accumulation [9,12]. As a defining structural feature of social organization, income inequality plausibly affects population health through both material and psychosocial pathways central to the IIH debate—making the temporal dynamics of inequality a critical axis for understanding how structural contexts shape health vulnerability [10].

From a public-health perspective, our results imply that policy-relevant inequality is not only the level of dispersion in a given year, but also the trajectory of distributional change that populations experience over time [22,23,41]. If decade-scale inequality worsening is the specification most consistently linked to poorer health net of contemporaneous level, then policies that limit distributional deterioration—and buffer the resulting psychosocial and material consequences [14–16,19]—may be instrumental to chronic-disease prevention and, ultimately, to reversing mortality decline. This includes long-term investments in social protection, institutional cohesion, and infrastructure that mitigate inequality's life-course effects and protect population health in the face of structural risks [9–11,23].

5. Sensitivity Analysis and Study Limitations

The results above may be influenced by several key methodological choices, including model specification, variable selection, and measurement decisions. To assess the robustness of the income inequality effect, we conducted three sets of sensitivity analysis. First, instead of treating self-rated health on the interval scale, we re-estimate all models using multilevel ordered logit specifications. Although these models require substantially more computing time to converge, the results are essentially identical to those from the corresponding linear models. Second, we estimated RE models rather than FE models, incorporating additional country-level factors such as religious composition, communism and colonial history, crude death rate, and public health expenditure. Missing data on these indicators reduce the sample size somewhat, but the main findings remain unchanged: there continues to be perplexing positive links between immediate and cumulative Gini indices and individual health. whereas the comparative version of the IIH receives the strongest empirical support. Third, we examined the time dimension of the income inequality-health link by varying time window used to construct the cumulative and comparative Gini measures. Replacing the baseline 10-year window with 5-, 15-, and 20-year windows did not alter the substantive conclusions; the positive association between inequality and health persisted, especially in the full sample, and the comparative Gini results closely resembled those reported above. Therefore, these checks suggest that the distinctions among the immediate, cumulative, and comparative effects of income inequality are fairly robust to alternative measurement and model choices.

Despite these robustness checks, several limitations are acknowledged. Like most cross-national studies within this field, we rely solely on self-rated health, which may suffer from cross-population comparability problems [55]. Although our modeling strategy helps alleviate this problem somewhat, further analysis using more objective measurements of health is undoubtedly welcomed. In addition, despite the expanded time spans and geographic coverages of the WVS, it does not guarantee global representativeness: high-income and higher-middle-income countries are overrepresented and sample sizes for low-income countries are particularly small. Because the WVS does not follow individuals over time, we also cannot conduct life-course analyses of age-differentiated trajectories, thereby limiting attention to the timing of life events.

6. Conclusions

This study clarifies a key source of inconsistency in cross-national tests of the income inequality hypothesis (IIH): results depend fundamentally on how inequality is conceptualized in time. Using harmonized inequality series linked to repeated cross-sections of the World Values Survey, we show that level-based specifications—whether contemporaneous (immediate) or decade-averaged (cumulative)—often yield mixed or even counterintuitive associations with self-rated health, while a comparative specification capturing decade-scale worsening in inequality produces a consistently negative association across models and regions. These findings suggest that long-run distributional deterioration, rather than static inequality levels, constitutes the temporally salient exposure most aligned with the IIH. We further document meaningful heterogeneity by development level and estimator choice, helping to reconcile past discrepancies in international evidence. More broadly, in a global landscape where mortality burdens increasingly reflect chronic, structural, and socially patterned risks, our results call for renewed attention to inequality as a dynamic macro-structural determinant of population health.

Author Contributions: Conceptualization, Yaqiang Qi and Qianyi Lu; methodology, Yaqiang Qi and Qianyi Lu.; formal analysis, Qianyi Lu; validation, Yaqiang Qi; writing—original draft preparation, Qianyi Lu; writing—review and editing, Yaqiang Qi and Qianyi Lu; supervision, Yaqiang Qi. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The original data presented in the study are openly available in https://www.worldvaluessurvey.org/.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. List of Countries/Regions Included in the Study.

Country/ region	Geographic area	National income group	Year	Gini index	Average health	Sample Size
Albania	Europe	higher-middle	1998	38.04	3.99	995
			2002	38.65	3.96	999
Algeria	Middle East and North Africa	higher-middle	2002	35.75	3.48	1273
Andorra	Europe	high	2005	30.82	4.17	1003
Argentina	Latin America	high	1984	39.83	3.53	974
			1991	42.48	3.67	994
			1995	43.87	3.72	1070
			1999	45.54	3.83	1274

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			2006	43.17	4.09	1001
			2013	38.20	3.95	1024
Armenia	Europe	higher-middle	1997	38.81	3.47	1996
			2011	36.24	3.28	1098
Australia	East and Central Asia	high	1981	28.00	4.03	1227
			1995	30.23	4.10	2047
			2005	31.81	4.00	1412
			2012	32.39	4.04	1465
Azerbaijan	Europe	higher-middle	1997	31.65	3.66	1999
Bangladesh	South Asia	lower-middle	1996	33.73	3.46	1525
			2002	34.91	3.65	1497
Belarus	Europe	higher-middle	1990	23.02	3.15	1003
			1996	23.78	3.03	2084
			2011	23.90	3.27	1514
Bosnia Herzegovina	Europe	higher-middle	2001	38.79	3.83	1196
Brazil	Latin America	higher-middle	1991	53.17	3.91	1779
			1997	52.86	3.93	1143
			2006	48.78	3.99	1499
			2014	45.07	3.91	1485
Bulgaria	Europe	higher-middle	1997	31.82	3.56	1071
			2006	33.50	3.54	998
Burkina Faso	Sahara Africa	low	2007	43.98	3.96	1519
Canada	North America	high	2000	31.01	4.18	1929
			2006	30.98	4.16	2159
Chile	Latin America	high	1990	48.06	3.62	1495
			1996	48.28	3.70	999
			2000	48.69	3.84	1199
			2006	46.13	3.82	1000
			2012	44.60	3.88	999
China	East and Central Asia	higher-middle	1990	32.05	3.82	996
			1995	35.63	3.97	1500
			2001	39.64	3.79	998
			2007	42.65	3.77	1989
			2013	40.71	3.84	2285
Colombia	Latin America	higher-middle	1998	51.79	3.99	2994
			2005	51.11	3.92	3023
			2012	48.65	4.01	1511
Croatia	Europe	high	1996	28.62	3.53	1188
Cyprus	Europe	high	2006	29.87	4.09	1049
			2011	30.42	3.96	999
Czech Rep.	Europe	high	1991	20.52	3.46	924
			1998	24.43	3.54	1145
Dominican	Latin America	higher-middle	1996	45.89	3.91	414
Ecuador	Latin America	higher-middle	2013	42.56	3.96	1202
Egypt	Middle East and North Africa	lower-middle	2001	41.62	3.79	3000
			2008	41.58	3.75	3051
			2012	43.75	3.57	1523
El Salvador	Latin America	lower-middle	1999	46.52	3.83	1254
Estonia	Europe	high	1996	33.91	3.30	1019
			2011	32.57	3.47	1530
Ethiopia	Sahara Africa	low	2007	32.80	3.81	1497
Finland	Europe	high	1981	20.63	4.06	1003

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			1996	22.86	3.94	981
			2005	25.31	3.83	1014
France	Europe	high	2006	28.20	3.96	1001
			1996	36.50	3.47	2007
Georgia	Europe	lower-middle	2009	40.34	3.35	1498
			2014	39.44	3.36	1202
			1997	25.60	3.66	2025
Germany	Europe	high	2006	28.40	3.82	2052
			2013	28.75	3.87	2044
Ghana	Sahara Africa	lower-middle	2007	43.30	4.12	1533
			2012	43.68	4.39	1552
Guatemala	Latin America	higher-middle	2004	48.12	3.83	1000
Hong Kong	East and Central Asia	high	2005	40.51	3.65	1246
			2014	40.83	3.67	997
			1982	21.69	3.27	1461
Hungary	Europe	high	1998	27.43	3.41	650
			2009	27.01	3.71	1006
			1990	39.99	3.73	2455
			1995	41.13	3.67	2027
India	South Asia	lower-middle	2001	43.73	3.73	1986
			2006	46.36	3.84	1997
			2012	47.32	3.91	4068
Indonesia	East and Central Asia	lower-middle	2001	41.92	3.81	999
			2006	43.63	3.93	2001
Iran	Middle East and North Africa	higher-middle	2000	41.52	3.99	2490
			2007	39.71	3.81	2629
Iraq	Middle East and North Africa	higher-middle	2006	31.43	3.72	2670
			2013	31.00	3.75	1195
Israel	Middle East and North Africa	high	2001	34.71		1199
Italy	Europe	high	2005	32.68	3.89	1012
			1981	25.09	3.45	1193
			1990	28.44	3.44	997
Japan	East and Central Asia	high	1995	29.89	3.60	1050
			2000	30.98	3.62	1341
			2005	30.37	3.59	1088
			2010	31.81	3.56	2402
			2001	37.84	4.05	1223
Jordan	Middle East and North Africa	higher-middle	2007	37.04	4.28	1199
			2014	36.90	4.14	1200
			2011	26.90	3.69	1500
Kazakhstan	Europe	higher-middle	2003	35.09	3.67	1043
			2011	33.92	3.91	1498
Latvia	Europe	high	1996	30.56	3.25	1196
Lithuania	Europe	high	1997	31.06	3.35	1007
Macedonia	Europe	higher-middle	1998	31.67	3.86	985
			2001	32.78	3.86	1053
Malaysia	East and Central Asia	higher-middle	2006	42.38	4.16	1201
			2012	41.26	4.24	1300
Mali	Sahara Africa	low	2007	39.99	3.86	1507
			1981	47.30	3.42	1810
Mexico	Latin America	higher-middle	1990	46.69	3.85	1508
			1996	47.61	3.67	1498

			2000	47.33	3.82	1530
			2005	45.49	3.83	1555
			2012	44.03	3.97	1999
Moldova	Europe	lower-middle	1996	37.59	3.03	983
			2002	38.51	3.02	1002
			2006	37.53	3.53	1021
Morocco	Middle East and North Africa	lower-middle	2001	41.01	3.95	1251
			2007	41.51	4.09	1200
			2011	41.10	4.04	1199
Netherlands	Europe	high	2006	26.45	3.91	1048
			2012	25.92	3.88	1889
New Zealand	East and Central Asia	high	1998	32.94	4.10	1197
			2004	32.60	4.16	949
			2011	32.00	4.15	828
Nigeria	Sahara Africa	lower-middle	1990	43.03	4.08	992
			1995	43.48	4.05	1989
			2000	43.48	4.47	2021
Norway	Europe	high	1996	24.09	4.13	1127
			2007	24.43	4.16	1025
Pakistan	South Asia	lower-middle	1997	33.85	3.78	733
			2001	33.84	3.77	2000
			2012	33.92	4.09	1194
Palestine	Middle East and North Africa	lower-middle	2013	36.35	3.97	1000
Peru	Latin America	higher-middle	1996	52.49	3.58	1207
			2001	51.61	3.58	1500
			2006	50.69	3.51	1500
			2012	45.35	3.64	1207
Philippines	East and Central Asia	lower-middle	1996	42.57	3.62	1200
			2001	42.42	3.68	1200
			2012	41.46	3.70	1200
Poland	Europe	high	1989	24.22	3.25	930
			1997	28.70	3.24	1151
			2005	32.01	3.59	998
			2012	30.63	3.72	966
Puerto Rico	Latin America	high	1995	49.72	3.88	1159
			2001	50.45	4.02	719
Qatar	Middle East and North Africa	high	2010	40.09	4.38	1060
Romania	Europe	higher-middle	1998	28.06	3.55	1237
			2005	31.93	3.49	1774
			2012	32.74	3.66	1502
Russia	Europe	higher-middle	1990	25.40	3.10	1914
Russia	Europe	higher-middle	1995	36.32	3.00	2036
			2006	36.85	3.36	2022
			2011	35.51	3.37	2482
Rwanda	Sahara Africa	low	2007	51.09	3.19	1501
			2012	50.52	4.13	1527
Serbia	Europe	higher-middle	2001	33.42	3.55	1194
			2006	34.53	3.61	1210
Singapore	East and Central Asia	high	2002	39.03		1512
			2012	39.00	4.10	1971

Slovakia	Europe	high	1990	17.49	3.35	465
			1998	24.23	3.49	1094
Slovenia	Europe	high	1995	23.77	3.36	1007
			2005	24.03	3.64	1035
			2011	24.93	3.75	1069
South Africa	Sahara Africa	higher-middle	1982	58.25	3.92	1587
			1990	58.80	4.02	2711
			1996	58.77	3.99	2933
			2001	58.92	4.24	2997
			2006	59.55	4.14	2984
			2013	59.47	4.25	3529
South Korea	East and Central Asia	high	1982	30.96	3.15	955
			1990	29.47		1251
			1996	29.33	3.93	1248
			2001	30.63	3.90	1200
			2005	30.92	3.96	1200
			2010	31.20	3.95	1190
Spain	Europe	high	1990	29.76	3.61	1491
			1995	32.58	3.81	1209
			2000	30.88	3.88	1206
			2007	31.32	3.95	1196
			2011	33.58	3.89	1187
Sweden	Europe	high	1981	20.30	4.02	944
			1996	23.56	4.11	1002
			2006	24.50	4.10	1003
			2011	25.65	4.07	1203
Switzerland	Europe	high	1989	30.30	4.11	1398
			1996	29.06	4.17	1211
			2007	29.19	4.13	1241
Taiwan	East and Central Asia	high	1994	28.65	3.57	780
			2006	30.44	4.04	1227
			2012	30.25	4.11	1235
Tanzania	Sahara Africa	low	2001	42.90	3.81	1150
Thailand	East and Central Asia	higher-middle	2007	42.28	3.94	1526
			2013	40.39	4.06	1200
Tunisia	Middle East and North Africa	lower-middle	2013	38.68	3.91	1204
Turkey	Europe	higher-middle	1990	42.55	3.70	1030
			1996	43.11	3.73	1905
			2001	42.64	3.70	3393
			2007	41.21	3.75	1341
			2012	40.30	3.85	1570
Uganda	Sahara Africa	low	2001	44.21	3.93	1002
Ukraine	Europe	lower-middle	1996	29.98	3.02	2791
			2006	28.82	3.43	998
			2011	27.25	3.25	1488
United Kingdom	Europe	high	1998	33.70		1093
			2005	33.42	3.98	1040
United States	North America	high	1981	31.98	4.07	2315
			1995	35.30	4.11	1538
			1999	35.91	4.23	1199
			2006	36.92	4.04	1248
			2011	37.46	4.06	2216

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			1996	38.49	3.97	997
Uruguay	Latin America	high	2006	41.68	3.94	998
			2011	37.89	4.03	999
Venezuela	Latin America	higher-middle	1996	42.31	4.05	1195
			2000	42.28		1200
Vietnam	East and Central Asia	lower-middle	2001	34.34	3.65	999
			2006	35.03	3.61	1495
Yemen	Middle East and North Africa	low	2014	36.78	3.89	1000
Zambia	Sahara Africa	lower-middle	2007	54.97	3.91	1443
Zimbabwe	Sahara Africa	low	2001	47.55	3.88	1000
			2012	46.55	4.31	1500

Table A2. The immediate effect of income inequality on individual health by national income groups.

Variables	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
	High Income Regions		**Higher-Middle Income Regions**		**Lower-Middle / Low Income Regions**	
Immediate Gini	.007*	-.001	.012***	-.010***	.009***	.008
	(.004)	(.004)	(.003)	(.003)	(.003)	(.007)
Sex	.051***	.051***	.126***	.126***	.099***	.099***
	(.014)	(.014)	(.014)	(.014)	(.02)	(.02)
Age	-.014***	-.014***	-.010***	-.010***	-.010***	-.010***
	(.002)	(.003)	(.002)	(.002)	(.003)	(.003)
Age square	.001	.001	-.006***	-.006***	-.006***	-.006***
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Individual income	.05***	.05***	.05***	.05***	.056***	.056***
	(.005)	(.005)	(.004)	(.004)	(.005)	(.005)
Education	.018***	.018***	.018***	.018***	.012***	.012***
	(.002)	(.002)	(.003)	(.003)	(.002)	(.002)
Log GDP	.287***	.248***	-.042	.054	.039	.016
	(.057)	(.073)	(.074)	(.04)	(.06)	(.108)
Consider national fixed effects?	No	Yes	No	Yes	No	Yes
Constant	.825	1.868***	3.644***	4.117***	3.079***	3.173***
	(.591)	(.722)	(.681)	(.437)	(.567)	(1.149)
Individual observations	95998	95998	116035	116035	78381	78381
Number of country*time clusters	86	86	77	77	54	54
Number of countries	34	34	30	30	27	27
ρ	.053	.009	.069	.012	.080	.031

*Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.1.*

Table A3. Cumulative exposure to income inequality and individual health.

Variables	**Model 13**	**Model 14**	**Model 15**	**Model 16**	**Model 17**	**Model 18**	**Model 19**	**Model 20**	**Model 21**
	All	**All**	**All**	**High Income Regions**		**Higher-Middle Income Regions**		**Lower-Middle / Low Income Regions**	
Cumulative Gini	.010***	.009***	.003	.007*	.007	.014***	-.003	.016***	.014*
	(.002)	(.003)	(.004)	(.004)	(.006)	(.003)	(.003)	(.004)	(.007)
Sex	.093***	.092***	.092***	.051***	.051***	.126***	.126***	.099***	.099***
	(.010)	(.010)	(.010)	(.014)	(.014)	(.014)	(.014)	(.020)	(.020)
Age	-.013***	-.012***	-.012***	-.014***	-.014***	-.010***	-.010***	-.010***	-.010***
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)	(.002)	(.003)	(.003)
Age square	-.002	-.002	-.002	.001	.001	-.006***	-.006***	-.006***	-.006***
	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)

Individual income	.051***	.051***	.051***	.05***	.05***	.05***	.05***	.056***	.056***
	(.002)	(.003)	(.003)	(.005)	(.005)	(.004)	(.004)	(.005)	(.005)
Education	.017***	.017***	.017***	.018***	.018***	.018***	.018***	.012***	.012***
	(.002)	(.002)	(.002)	(.002)	(.002)	(.003)	(.003)	(.002)	(.002)
Log GDP	.107***	.11***	.141***	.281***	.214***	-.063	.058	.054	-.004
	(.025)	(.028)	(.045)	(.056)	(.046)	(.076)	(.049)	(.055)	(.110)
GDP growth rate		.005**	.004**						
		(.002)	(.002)						
Log population size		.001	-.150*						
		(.019)	(.079)						
Out-of-pocket medical expenditure (%)		.000	.003						
		(.001)	(.003)						
Consider national fixed effects?	No	No	Yes	No	Yes	No	Yes	No	Yes
Constant	2.501***	2.49***	4.824***	.86	1.809***	3.76***	3.696***	2.674***	3.124***
	(.274)	(.481)	(1.342)	(.583)	(.633)	(.673)	(.506)	(.552)	(1.135)
Individual observations	290414	273368	273368	95998	95998	116035	116035	78381	78381
Number of country*time clusters	217	198	198	86	86	77	77	54	54
Number of countries	91	79	79	34	34	30	29	27	27
ρ	.076	.072	.026	.052	.008	.065	.013	.048	.031

*Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.1.*

Table A4. The comparative effect of Gini index on individual health.

Variables	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
	All	All	All	High Income Regions		Higher-Middle Income Regions		Lower-Middle / Low Income Regions	
Comparative Gini	-.007***	-.006**	-.005*	-.009***	-.003	-.009**	-.005**	-.014***	-.014***
	(.002)	(.003)	(.003)	(.003)	(.004)	(.004)	(.002)	(.004)	(.005)
Immediate Gini	.010***	.009***	.007	.008**	.002	.014***	-.006*	.016***	.018**
	(.002)	(.003)	(.005)	(.004)	(.005)	(.003)	(.003)	(.004)	(.007)
Sex	.093***	.092***	.092***	.051***	.051***	.126***	.126***	.099***	.099***
	(.010)	(.010)	(.010)	(.014)	(.014)	(.014)	(.014)	(.020)	(.020)
Age	-.013***	-.012***	-.012***	-.014***	-.014***	-.010***	-.010***	-.010***	-.010***
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)	(.002)	(.003)	(.003)
Age square	-.002	-.002	-.002	.001	.001	-.006***	-.006***	-.006***	-.006***
	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Individual income	.051***	.051***	.051***	.050***	.050***	.050***	.050***	.056***	.056***
	(.002)	(.003)	(.003)	(.005)	(.005)	(.004)	(.004)	(.005)	(.005)
Education	.017***	.017***	.017***	.018***	.018***	.018***	.018***	.012***	.012***
	(.002)	(.002)	(.002)	(.002)	(.002)	(.003)	(.003)	(.002)	(.002)
Log GDP	.107***	.109***	.121**	.279***	.222***	-.088	-.0775	.055	-.045
	(.025)	(.029)	(.055)	(.053)	(.074)	(.085)	(.043)	(.056)	(.099)
GDP growth rate		.004	.003						
		(.003)	(.002)						
Log population size		.001	-.159**						
		(.019)	(.076)						
Out-of-pocket medical expenditure (%)		0	.004						
		(.002)	(.003)						
Consider national fixed effects?	No	No	Yes	No	Yes	No	Yes	No	Yes
Constant	2.512***	2.518***	4.983***	.872	1.99***	3.985***	4.519***	2.65***	3.258***
	(.281)	(.478)	(1.351)	(.548)	(.694)	(.758)	(.409)	(.551)	(.938)
Individual observations	290414	273368	273368	95998	95998	116035	116035	78381	78381
Number of country*time clusters	217	198	198	86	86	77	77	54	54
Number of countries	91	79	79	34	34	30	30	27	27

 doi:10.20944/preprints202603.0877.v1

ρ	.076	.072	.025	.050	.009	.063	.011	.044	.029

*Standard errors are in parentheses; *** p<.01, ** p<.05, * p<.1.*

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