The Spirit Level at 15 – Technical Appendix

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This appendix contains information to supplement the report: Pickett, K., Gauhar, A., Wilkinson, R. & Sahni-Nicholas, P. (2024). The Spirit Level at 15. London: The Equality Trust. DOI: https://doi.org/10.15124/yao-de9s-7k93

Table of Contents

Economic and Social Research Council
A Health Partnership for Northern England

Choice of Countries

In *The Spirit Level* we analysed data for a set of rich developed market democracies, chosen using criteria that included country size, GNI per capita and availability of income inequality data.

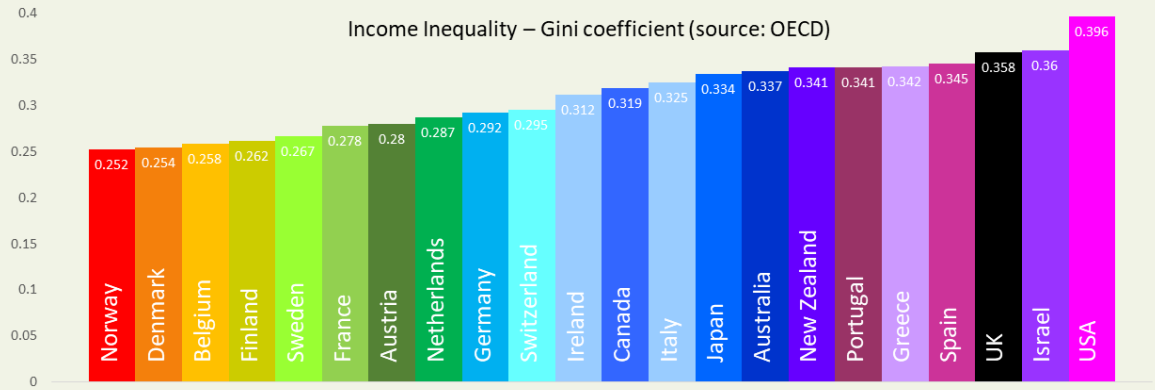
This updated analysis is designed to be as comparable as possible with exceptions and modifications noted in the text below.

Our dataset includes 22 countries:

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA

Choice of Income Inequality Measure

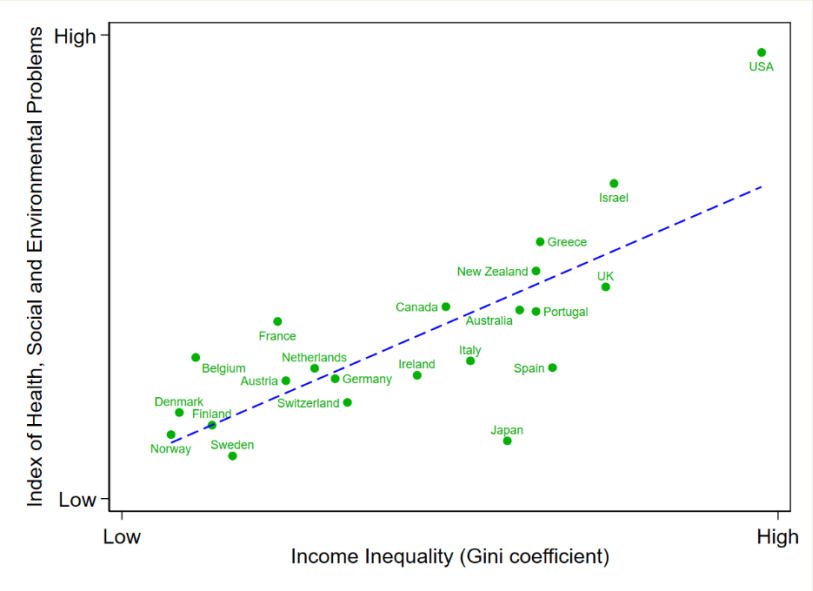
In *The Spirit Level* we used the inter-decile 80:20 ratio for income inequality because we felt it was easy for people to understand. Most research on inequality uses the Gini coefficient. Both are available from the OECD. In all the charts in this report we use the Gini coefficient, but for direct comparison with the original analyses, we also give the correlations for the 80:20 ratio in Table 1. As Singapore is not in the OECD it is not included in this report. Income inequality data from 2013 is used for this update. In *The Spirit Level*, we used the average reported between 2003-2006 (measured between 1992-2001) and correlated that with the most up to date outcomes data we could access (1999-2004). For the update, we needed income inequality that precedes the outcome data with sufficient lag time to have had an impact, and 2013 allows up to a decade of lag, although most outcome data will have closer to a six year lag, as most outcomes are reported between 2019-2022.



There have been some changes in rank among our 22 countries. Japan ranks as much more unequal than before, while the Scandinavian countries are still amongst the most equal. Portugal and Spain used to be quite far apart, now they are very like one another in terms of income inequality because Spain has become more unequal and Portugal less so. However, the USA and Israel are still very unequal.

We should also note that between-country global income inequality has, since Covid, risen for the first time in a generation.

Table 1 shows that it makes little difference which measure of income inequality is used. Throughout the report we use the Gini coefficient for consistency, rather than picking the measure with the strongest correlation with each indicator. For comparison, here is our Index of Health, Social and Environmental problems in relation to first the Gini and then the 80:20 index.



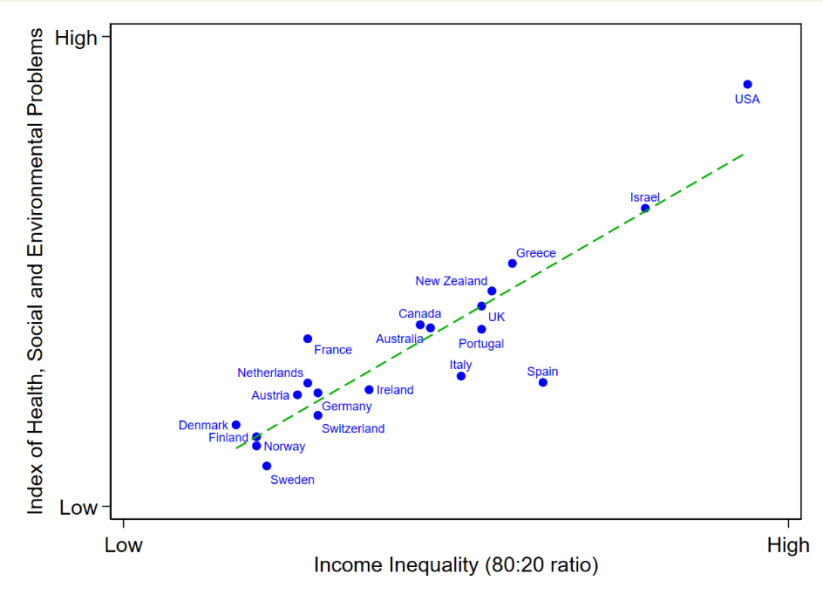


Table 1: Pearson correlation coefficients and their statistical significance

Indicator or index	**Gini coefficient 2013**		**80:20 income ratio 2013**	
	r	*p-value*	*r*	*p-value*
Summary				
Index of Health, Social & Environmental Problems	**0.77**	**<0.01**	**0.90**	**<0.01**
Unicef Dimensions of Child Wellbeing	**0.78**	**<0.01**	**-0.77**	**<0.01**
WEF Social Mobility Index	**-0.79**	**<0.01**	**-0.80**	**<0.01**
WEF Global Gender Gap Index	**-0.50**	**0.02**	**-0.50**	**0.03**
The Economist Democracy Index	**-0.48**	**0.02**	**-0.64**	**<0.01**
Wellbeing-adjusted-lifeyears (WELLBYs)	**-0.47**	**0.03**	**-0.53**	**0.02**
Environmental Performance Index	**-0.54**	**<0.01**	**-0.65**	**<0.01**
Chapter 1 - Environment				
Index of Environmental Problems	0.74	<0.01	0.84	<0.01
Carbon emissions of the top 10%	0.67	<0.01	0.75	<0.01
Progress towards the SDGs	-0.73	<0.01	-0.78	<0.01
Multilateralism	-0.60	<0.01	-0.78	<0.01
Recycling	-0.58	<0.01	-0.61	<0.01
Air pollution	0.32	0.15	0.40	0.08
Protecting environment vs economic growth	-0.48	0.04	-0.53	0.02
Biodiversity financing	-0.56	0.01	-0.59	0.01
Chapter 2 – Social cohesion				
Trust	-0.57	<0.01	-0.62	<0.01
Racial Equality Index	0.63	<0.01	0.77	<0.01
Homicides	0.49	0.02	0.63	<0.01
Imprisonment	0.65	<0.01	0.77	<0.01
Stigma (see page 20 for inequality measure used here)	0.60	<0.01		
Lack of equal opportunity	0.70	<0.01	0.67	0.02
Chapter 3 – Life chances				
Education scores				
Maths	-0.53	0.01	-0.71	<0.01
Reading	-0.14	0.53	-0.24	0.31
Science	-0.17	0.45	-0.34	0.14
Maths & Reading average (inc. in Index)	-0.40	0.06	-0.55	0.01
Maths & Science average	-0.37	0.09	-0.55	0.01
Maths, Reading & Science average	-0.32	0.14	-0.48	0.03
Lacking basic maths & reading	-0.50	0.02	0.62	0.01
Maths inequality between rich and poor children	-0.43	<0.05	-0.67	<0.01
Reading inequality between rich and poor children	-0.18	0.43	-0.35	0.13
Early Childhood Parity Score	-0.48	0.03	-0.59	<0.01
Teenage births	0.70	<0.01	0.73	<0.01

Chapter 4 – Health & wellbeing				
Wellbeing	-0.47	0.03	-0.51	0.03
Infant mortality	0.51	0.01	0.55	0.01
Obesity	0.40	0.06	0.68	<0.01
Child overweight	0.63	<0.01	0.87	<0.01
Diabetes	0.74	<0.01	0.78	<0.01
Excess deaths during Covid-19 pandemic	0.50	0.02	0.54	0.02
Life expectancy	-0.19	0.39	-0.37	0.11
Multiple chronic health conditions	0.57	0.06	0.66	0.03
Skipped needed medical care	0.69	0.02	0.77	<0.01
Mental illness (see page 43 for inequality measure used here)			0.70	<0.01
Drug use	0.41	0.06	0.51	0.02
Original Spirit Level Index of Health & Social Problems updated	**0.59**	**<0.01**	**0.76**	**<0.01**

Constructing the Indices

Index of Health and Social Problems

The Index of Health & Social Problems has ten indicators: trust, life expectancy, infant mortality, obesity, mental illness, educational scores, teenage births, homicides, imprisonment, social mobility. Four are reverse coded: trust, life expectancy, education, social mobility. Seventeen countries have all ten indicators, five have no data on mental illness. The index was created by taking the mean of the z-scores for each indicator, averaged over the number of indicators available.

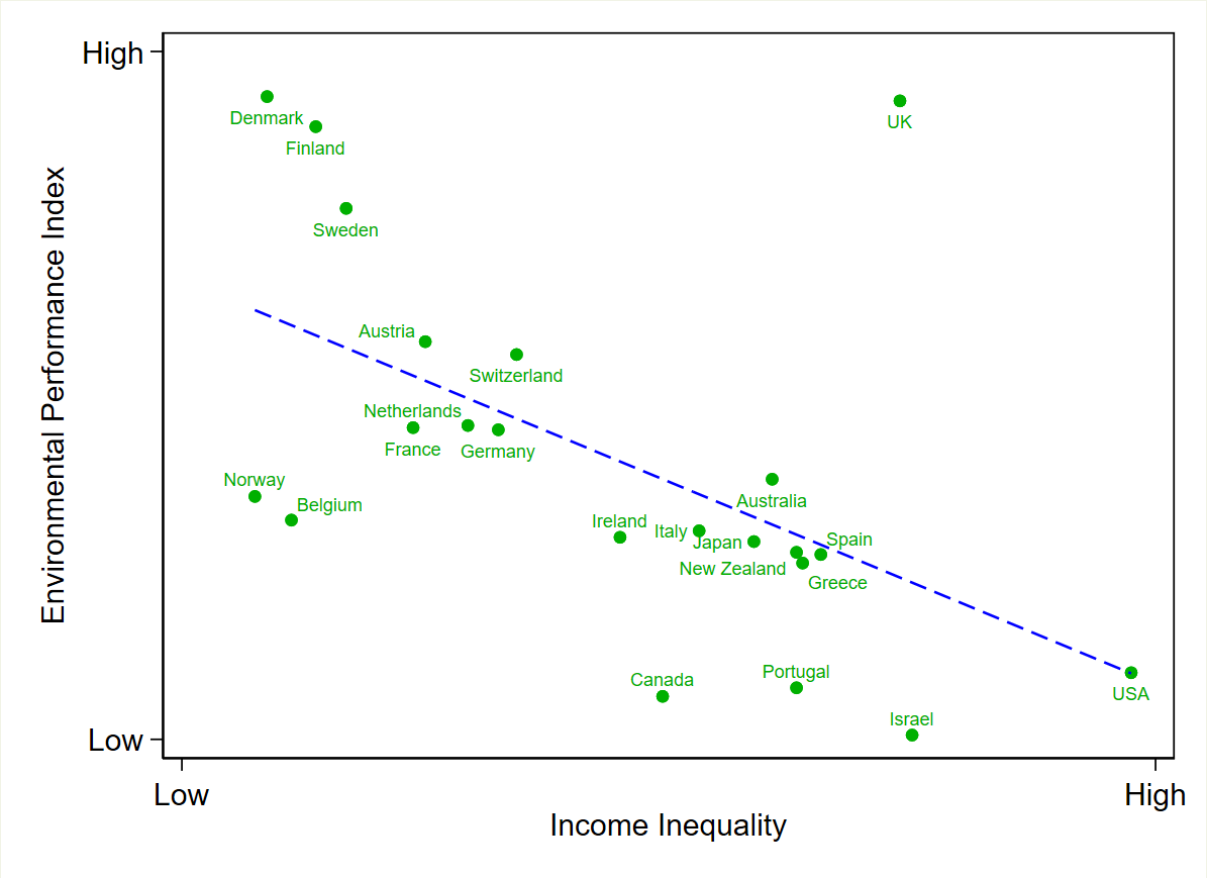
Index of Health, Social and Environmental Problems

The Index of Health, Social and Environmental Problems has fifteen indicators, the ten indicators included in the Index of Health and Social problems and the five indicators included in the Index of Environmental Problems (carbon emissions of the top 10%, progress towards the SDGs, multilateralism, recycling, air pollution). The index was created by taking the mean of the z-scores for each indicator, averaged over the number of indicators available.

Additional Graphs, Charts and Resources

Environmental Performance Index 2022

The Environmental Performance Index is a joint project of the Yale Center for Environmental Law & Policy and The Center for International Earth Science Information Network (CIESIN) at Columbia University's Earth Institute. The 2022 Environmental Performance Index (EPI) uses 40 performance indicators across 11 issue categories, ranking countries on climate change performance, environmental health, and ecosystem vitality, providing a measure of how close countries are to established environmental policy targets.



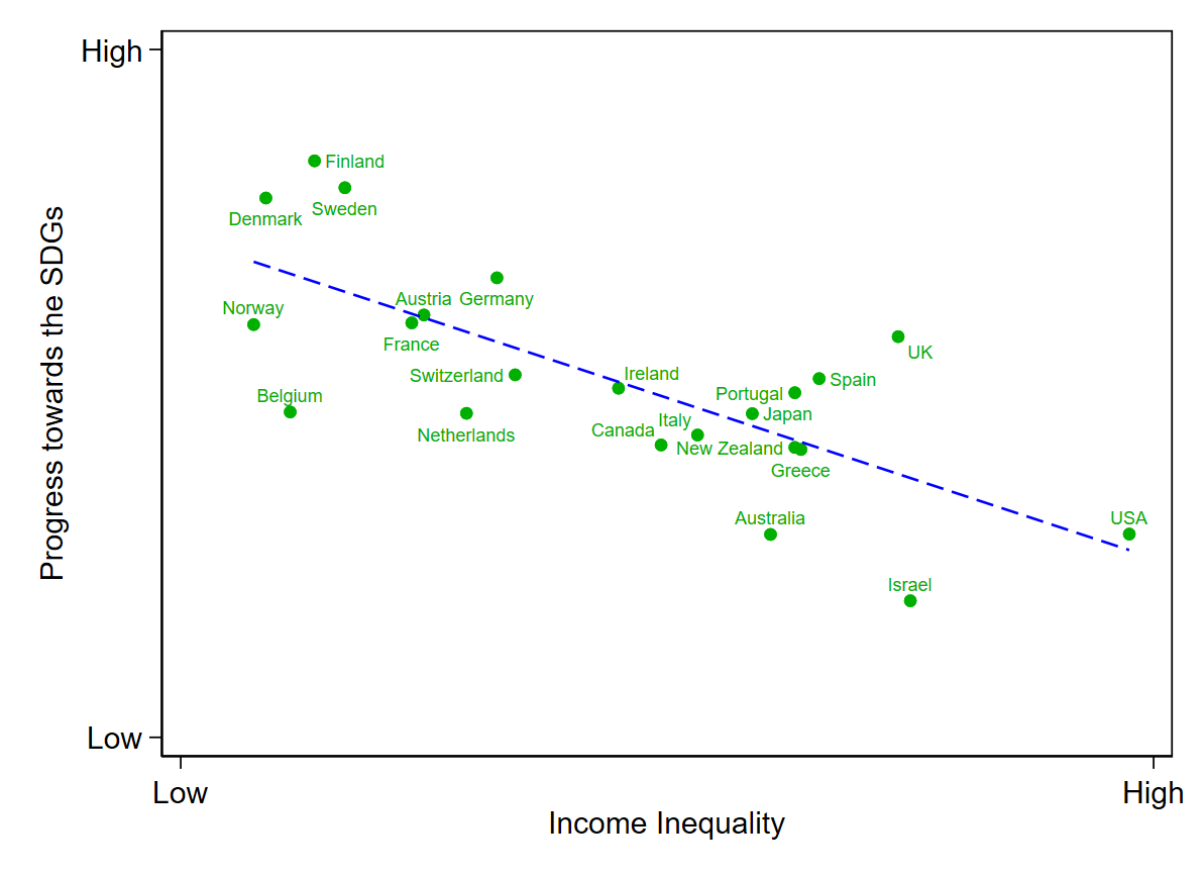
Inequality is significantly associated with performance on 40 environmental protection indicators

Data: https://epi.yale.edu/epi-results/2022/component/epi

Source: Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. (2022). 2022 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy. epi.yale.edu

Progress Towards the Sustainable Development Goals

The Sustainable Development Report 2023 gives a ranking of all UN member states on their progress towards the 17 Sustainable Development Goals at the halfway point of the 2030 Agenda. Countries are ranked by an overall score across the goals which can be interpreted as a percentage of SDG achievement. There is a slight degree of circularity in correlating income inequality with this ranking, as reducing income inequality is Goal 17 – however, this effect will be very small as the Gini coefficient is only 1 of 97 indicators.



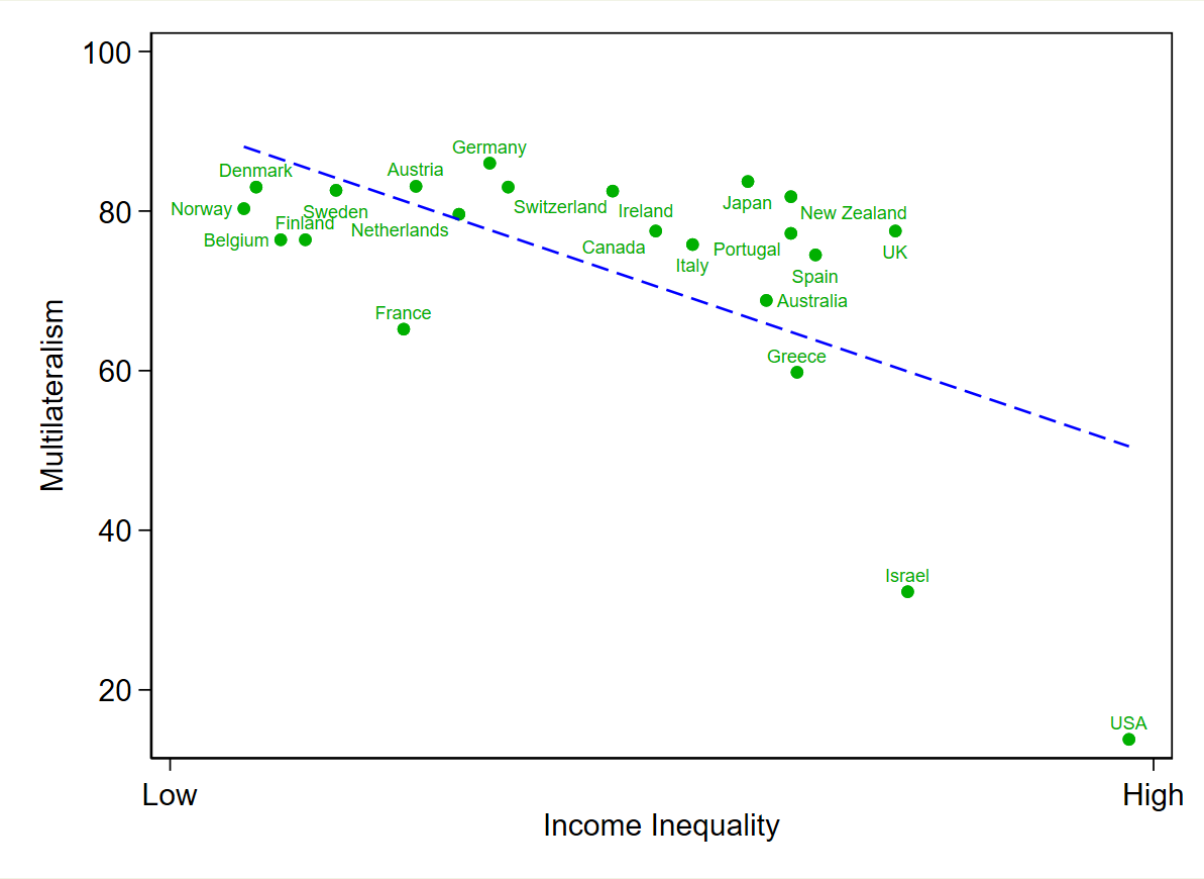
Source: https://dashboards.sdgindex.org/rankings

Sachs, J.D., Lafortune, G., Fuller, G., Drumm, E. (2023). Implementing the SDG Stimulus. Sustainable Development Report 2023. Paris: SDSN, Dublin: Dublin University Press, 2023. 10.25546/102924.

Multilateralism

In November 2023, Jeffrey Sachs and Guillaume Lafortune published a Multilateralism Index, a measure of the extent to which UN member states adhere to the UN Charter and UN-backed goals such as the Sustainable Development Goals. The Multilateralism Index is based on five indicators:

- the proportion of UN treaties between 1946 and 2022 that each country has ratified
- deployment of unilateral economic sanctions (sometimes called "unilateral coercive measures") not approved by the UN
- membership in major UN organizations
- militarization and resort to war (based on the Global Peace Index, which we showed in The Spirit Level was related to inequality)
- economic solidarity with poorer nations, according to its Official Development Assistance (ODA) as a percent of the Gross National Income (GNI) – again, we showed that foreign aid was related to inequality in The Spirit Level.



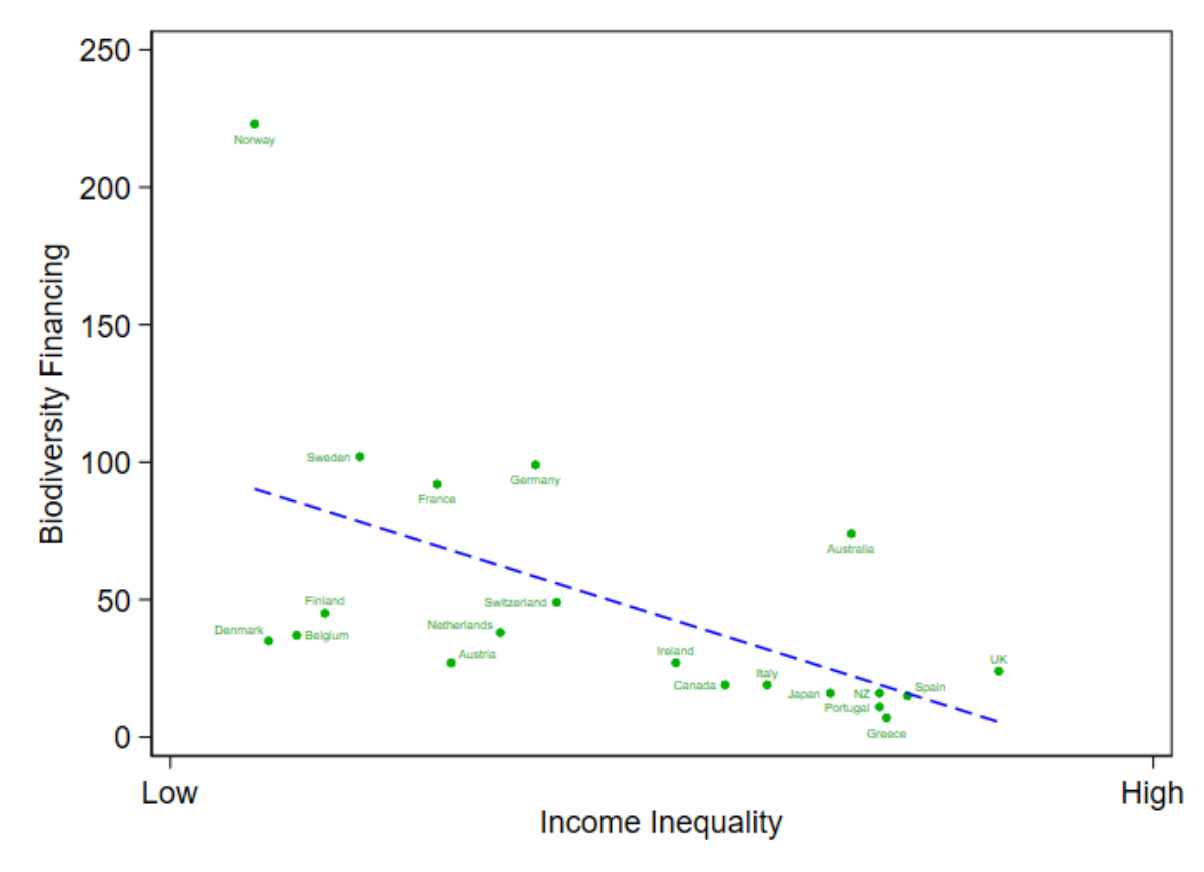
Source: https://sdgtransformationcenter.org/static/docs/methodologies/11-03-2023-Multilateralism_Index.pdf (not for citation without permission)

Biodiversity & Habitat

With colleagues within the Leverhulme Centre for Anthropocene Biodiversity at the University of York we have conducted a review of studies of income inequality and biodiversity. The majority of studies found evidence to suggest that more unequal regions had lower levels of biodiversity.

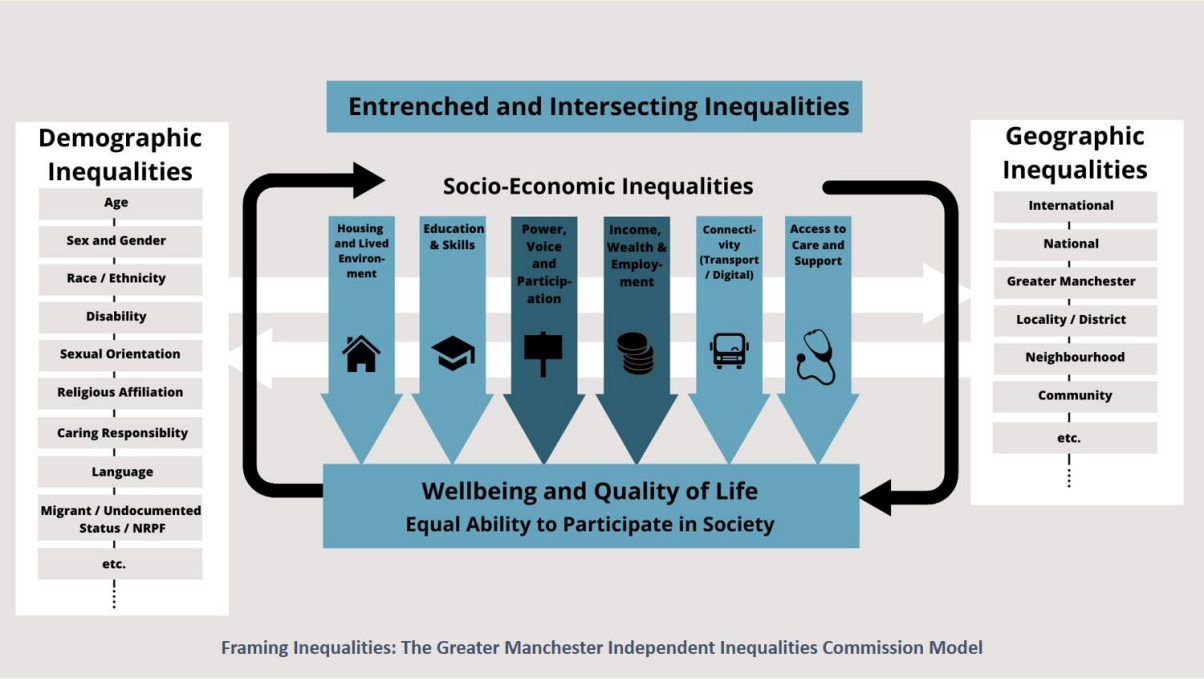
Kubiszewski, I., Ward C, Costanza R, Pickett KE. (2023). "The complex relationships between economic inequality and biodiversity: A scoping review." The Anthropocene Review: 20530196231158080

The Overseas Development Institute estimated the 'fair share' that countries should be paying towards the $20 billion that developed nations have agreed to contribute to nature restoration in low and middle income countries by 2015. Only two countries pay that 'fair share', Norway and Sweden, whilst many rich countries, including the UK, Canada, New Zealand, Italy and Spain, pay less than half of what they should to compensate for biodiversity loss.



Source: https://odi.org/en/publications/a-fair-share-of-biodiversity-finance-apportioning-responsibility-for-the-20-billion-target-by-2025/

Intersectionality



Framing Inequalities: The Greater Manchester Independent Inequalities Commission Model

Different dimensions of inequality interact and intersect to constrain people's wellbeing and life chances. There are many kinds of inequalities, including inequalities between ethnic groups and inequalities in people's education or opportunities and services. The framework above was developed by Kate Pickett for the Greater Manchester Independent Inequalities Commission.

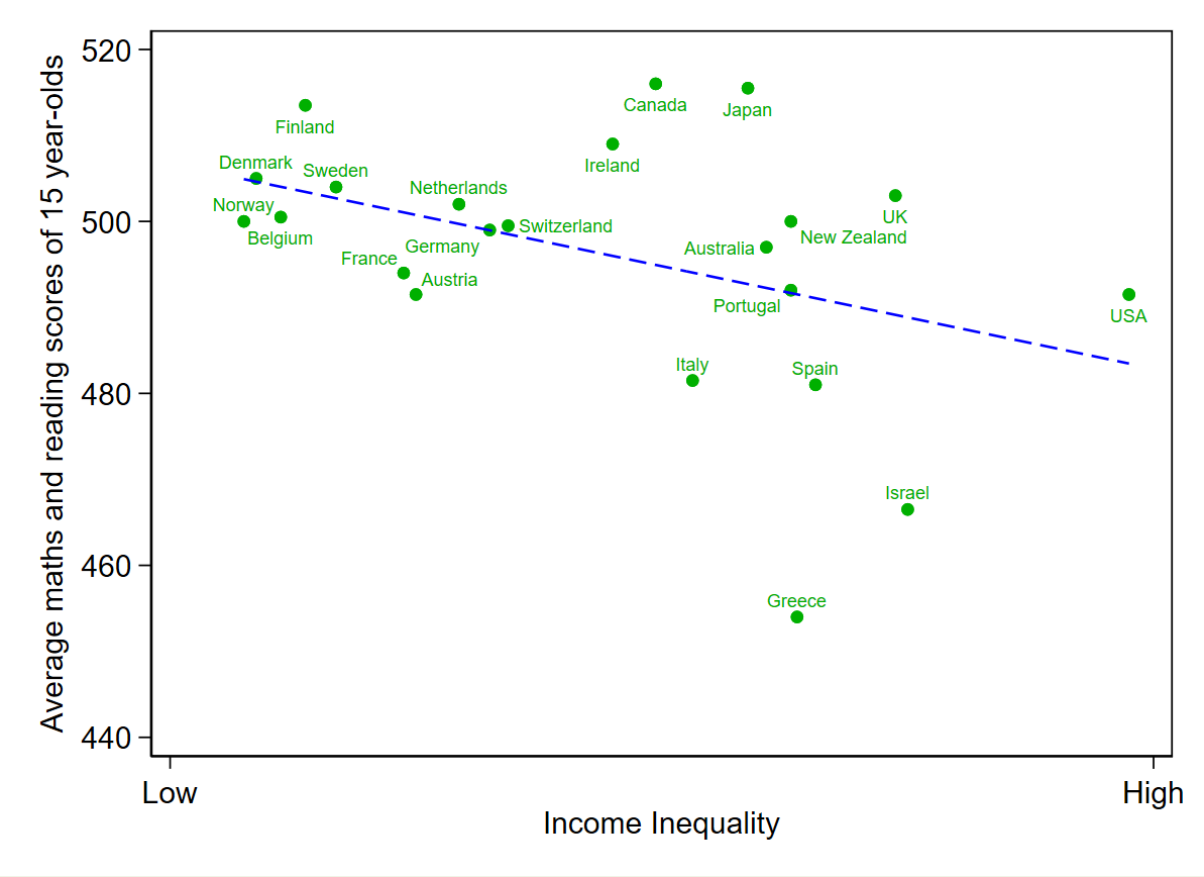
There are inequalities related to different identities: inequalities between men and women, between ethnic groups, between those with disabilities and those without; inequalities related to sexual orientation, gender identification language, religion, migration status, and more. There are also deep inequalities between places: between neighbourhoods, for example, or between regions. Inequalities between countries are the focus of this report, but within all the countries covered in this report there are also inequalities of place and identity. We can think of these as '*horizontal inequalities*', inequalities between groups of people with different characteristics or who live in different places. The inequalities running across society from top to bottom are what we can call the '*vertical inequalities*': the inequalities of income (the focus of this report) and wealth, the disparities in access to resources and power. The scale of these vertical inequalities is a measure of the social hierarchy, which presses down and exacerbates all the horizontal inequalities.

We can see these intersections exemplified by the chart relating income inequality to gender inequalities and the chart relating income inequality to racial equality in the main report.

Source: https://www.greatermanchester-ca.gov.uk/media/4337/gmca_independent-inequalities-commission_v15.pdf

Educational attainment

Comparable statistics on educational competence are produced by the Program for International Student Assessment (PISA) of the OECD. PISA assessments are tests of 15 year-old students in schools sampled to give representative population samples in OECD countries. OECD cautions that the latest (2022) estimates for 8 of our countries were based on samples that did not meet PISA standards. When we conducted the original Spirit Level analyses, the same problem was reported only for the UK, which we consequently omitted from analyses. Rather than omitting 8 countries, we are using the 2018 PISA scores, where there is only a data problem for reading scores for Spain. The graph below is for maths & reading combined, as in The Spirit Level, see the Technical Supplement for other attainment scores.



Full reports and data are available at: https://pisadataexplorer-pp.oecd.org/ide/idepisa

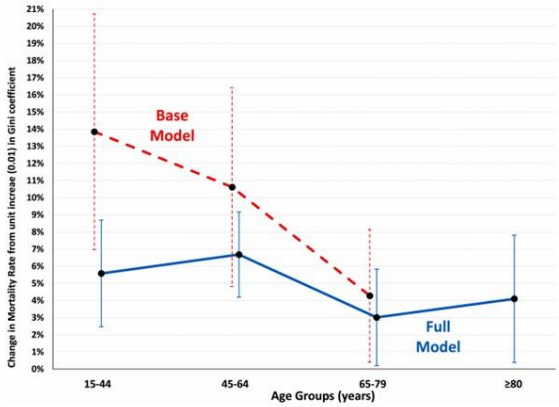
Source: Organisation for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2018 Reading, Mathematics and Science Assessment.

Life expectancy

Life expectancy is the only one of the indicators that we looked at in *The Spirit Level* that is not statistically significantly related to income inequality in this update. Some of this change is due to the influence of small countries in unweighted analyses – if we weight the correlation by population size as other researchers have done [1], there is a strong association (r= -0.72, p<0.01).

It has, however, happened before, the correlation between life expectancy and inequality has come and gone, most likely due to lag times and changing associations between inequality and health at different ages. Evidence suggests that people's health and wellbeing may be most strongly affected by the inequality they experienced in early life [2 3]. And in two recent studies, income inequality was strongly related to health in younger groups but weakly if at all at older ages (when, in rich countries, most deaths now occur). In a longitudinal analysis of 21 developed countries over 30 years, income inequality was positively associated with male and female mortality at ages 1–14 years and 15–49 years, and with the mortality of females at ages 65–89 (less strongly than at younger ages) but not for males over age 65 [4]. This age-specific pattern is also seen in an analysis of deaths from Covid-19 [5] – figure below.

The association of inequality with health declines with age



Sepulveda, E. R., & Brooker, A.-S. (2021). Income inequality and COVID-19 mortality: Age-stratified analysis of 22 OECD countries. *SSM - Population Health, 16, 100904. doi:https://doi.org/10.1016/j.ssmph.2021.100904*

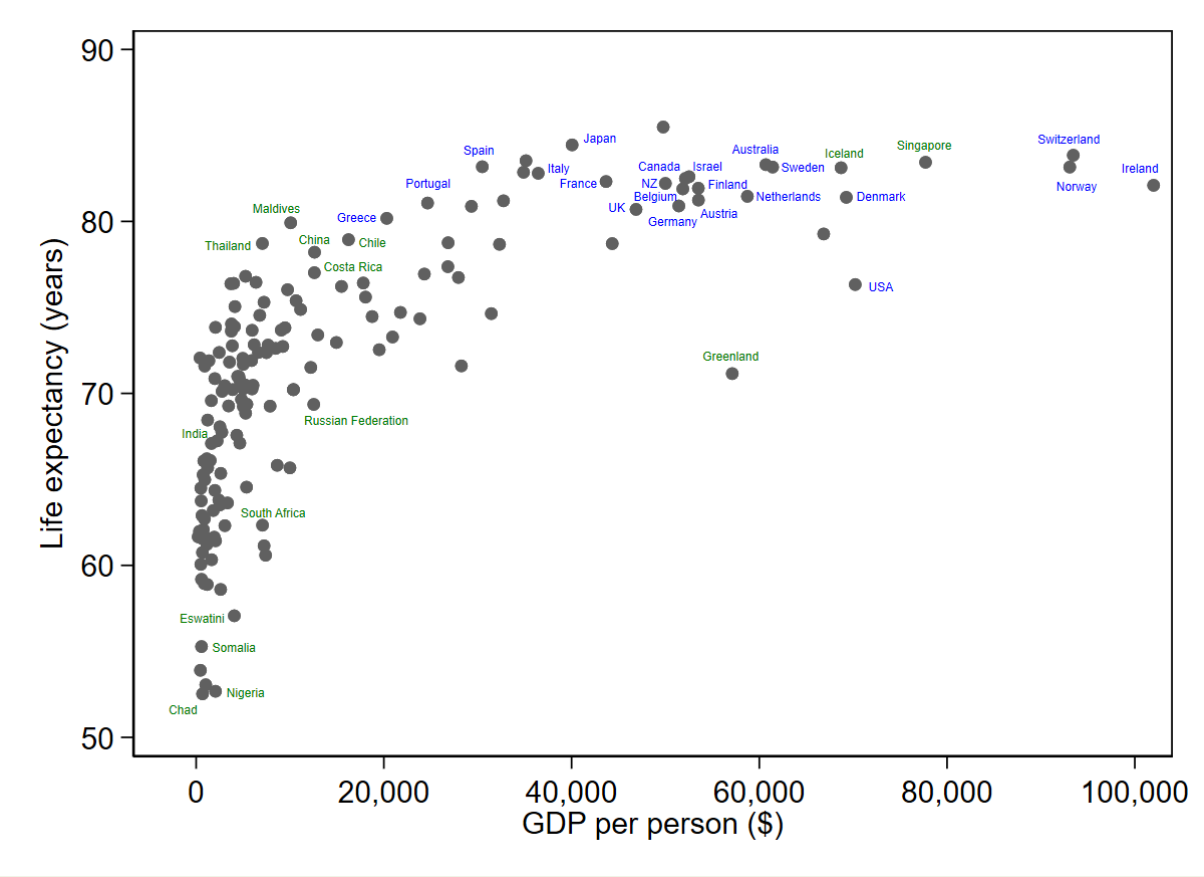
Importantly, a significant new study using robust methods finds strong worldwide correlations between income inequality and all of: life expectancy, infant mortality, neonatal mortality, under-5 mortality and maternal mortality [6].

Other analyses presented in this report, for infant mortality, obesity, prevalence of diabetes, and illicit drug use, suggest that the association between income inequality and life expectancy will emerge again. Further analyses corroborate this view. The Commonwealth Fund's 2020 International Health Policy (IHP) collected data from representative samples of adults in 11 high-income countries: Australia, Canada,

France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, UK, USA. Using data from that survey, we find that inequality is related to having multiple chronic health conditions (r=0.66, p=0.03), and to skipping needed medical care (r=0.82, p<0.01) although it must be said that those very high correlations are strongly influenced by the exceptionally poor performance of the USA on these measures. [7]

Other researchers continue to show effects of income inequality on health across different settings, including for life expectancy across US states [8], for Covid-19 deaths [9] [10], among low and middle income countries [11], illicit drug mortality and so-called 'deaths of despair' in US states [12] [13], hospitalizations and 'deaths of despair' among Canadian youth [14] [15] and adults [16], prevalence of tuberculosis internationally [17], self-rated health in China [18], and much more.

It is worth remembering that life expectancy is no longer related to GDP per capita in rich countries – above a threshold of around $20-25,000 per capita, further economic growth does not lead to longer life expectancies. Tackling inequality is a better economic strategy for population health than pursuit of GDP growth. In the graph below, *The Spirit Level* countries are labelled in blue, with some other selected countries labelled in green.

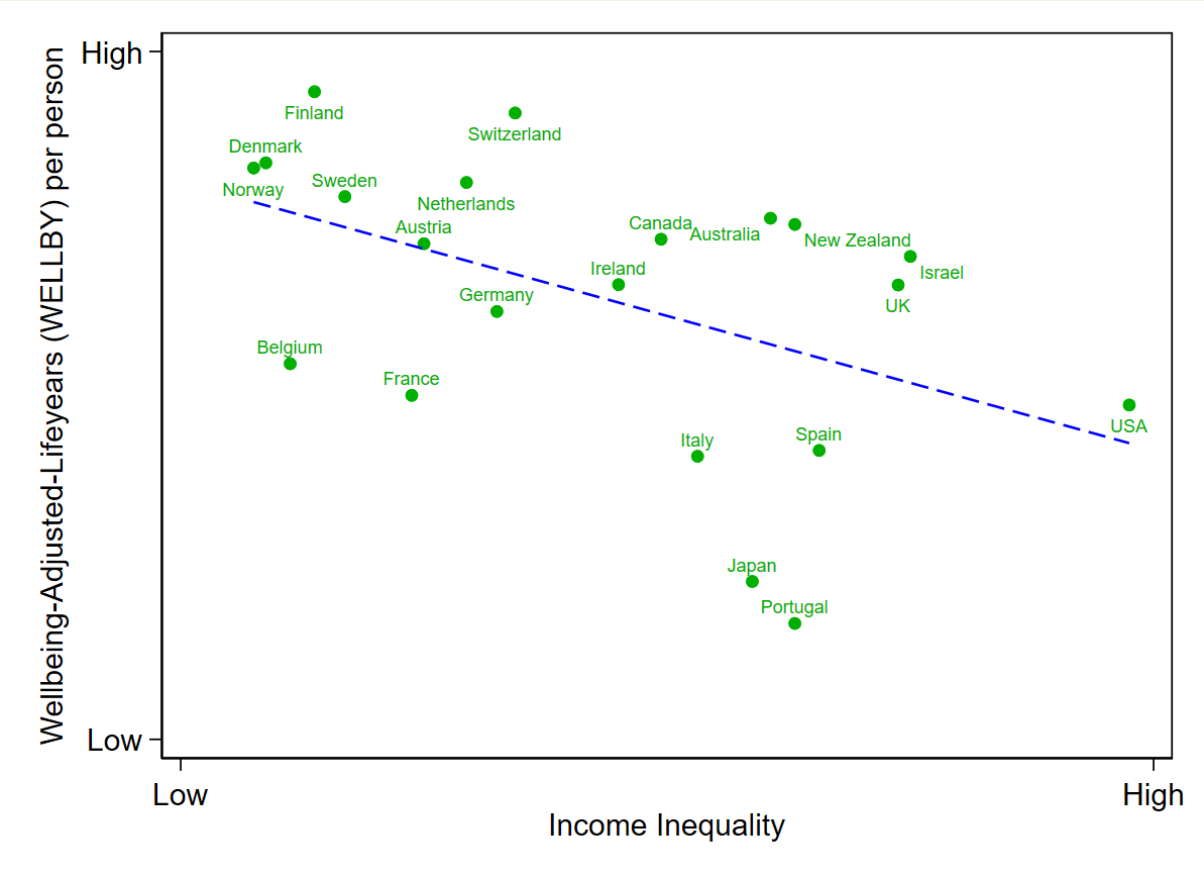


Life expectancy data: https://data.worldbank.org/indicator/SP.DYN.LE00.IN

GDP per capita data: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

WELLBY – Wellbeing-Adjusted-Lifeyears

WELLBYs were developed to indicate how well different societies enable people to live long and happy lives. It combines life satisfaction and life expectancy into a single measure.



Inequality is significantly associated with a country's level of wellbeing-adjusted life years

Data: https://worldhappiness.report/ed/2021/living-long-and-living-well-the-wellby-approach/

Source: De Neve, J.-E., Clark, A., Krekel, C., Layard, R., & O'Donnell, G. (2020). Taking a well-being years approach to policy choice. The British Medical Journal. 371:m3853

A Note on US Income Inequality

In The Spirit Level, we analysed state level income inequality in relation to health and social outcomes and created an Index of Health & Social problems similar to our international index.

We have not updated those US state level analyses, in part because there is now much less variation in inequality between states. The range of state-level Gini coefficients has halved between then and now and all US states now have levels of income inequality above all the other countries in our dataset.

In the American Community Survey 2021 data, Wisconsin and Iowa have the lowest Gini coefficients at 0.45 and New York (0.51) and Delaware (0.53) have the highest.

For recent research on the impact of state level income inequality see:

Oronce, C. I. A., Scannell, C. A., Kawachi, I., & Tsugawa, Y. (2020). Association Between State-Level Income Inequality and COVID-19 Cases and Mortality in the USA. *Journal of general internal medicine, 35*(9), 2791-2793. doi:10.1007/s11606-020-05971-3

Tibber, M. S., Walji, F., Kirkbride, J. B., & Huddy, V. (2022). The association between income inequality and adult mental health at the subnational level—a systematic review. *Social Psychiatry and Psychiatric Epidemiology, 57*(1), 1-24. doi:10.1007/s00127-021-02159-w

Kuo, C.-T., & Kawachi, I. (2023). County-Level Income Inequality, Social Mobility, and Deaths of Despair in the US, 2000-2019. *JAMA Network Open, 6*(7), e2323030-e2323030. doi:10.1001/jamanetworkopen.2023.23030

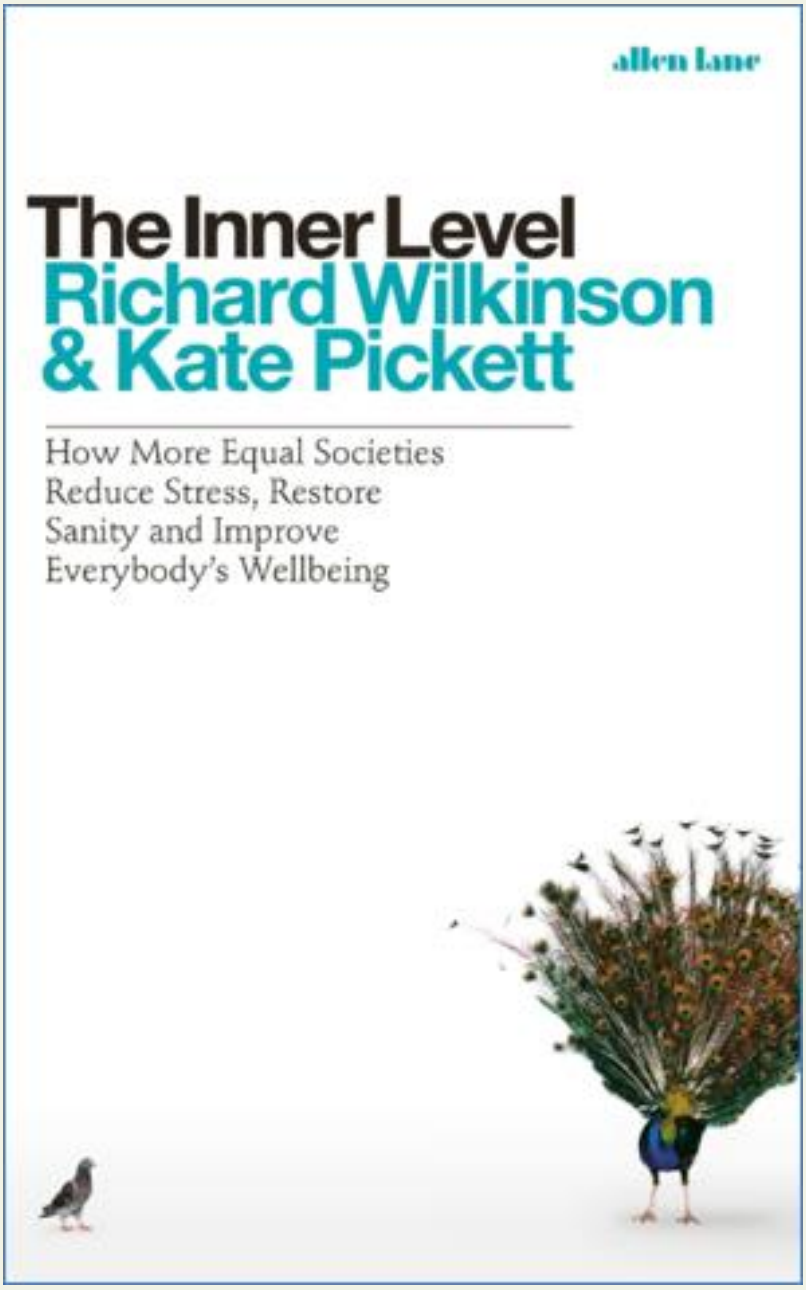
Hill, T. D., & Jorgenson, A. (2018). Bring out your dead!: A study of income inequality and life expectancy in the United States, 2000–2010. *Health Place, 49*, 1-6. doi:https://doi.org/10.1016/j.healthplace.2017.11.001

Thombs, R. P., Thombs, D. L., Jorgenson, A. K., & Harris Braswell, T. (2020). What Is Driving the Drug Overdose Epidemic in the United States? *Journal of Health and Social Behavior, 61*(3), 275-289. doi:10.1177/0022146520939514

Post-Spirit Level Publications

The analyses we included in *The Spirit Level* had all been peer-reviewed and published previously in academic journals. We have continued to publish new studies of income inequality in peer reviewed journals, many referenced throughout in the main report, including: a causal review using an epidemiological framework of the vast literature on income inequality and health; longitudinal studies of income inequality in relation to crime and to child wellbeing; studies of new outcomes, such as asthma, intimate partner violence, mental health stigma; reviews of studies of income inequality in relation to consumption, and to biodiversity. We have contributed a 'deep dive' paper on inequality in relation to the climate emergency for the Club of Rome. In 2018, we published a new book, The Inner Level, focused on the psychosocial pathways that lead from greater income inequality to poor health and social outcomes.

All new and forthcoming analyses and reports are at: https://wilkinsonpickett.com/



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