

Author's response
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1 Response to Editor

Dear Professor Estes,

Thank you for the opportunity to submit a revised draft. I list below in inline format my brief responses to reviewers' comments and attach at the end tracked changes that show precisely the additions and deletions.

Best,
Author

2 Response to Reviewer #1

This paper is basically sound and makes a useful contribution to knowledge. There are a few points listed below where it needs to provide more information.

>>> n/a

It also needs a little attention to style which is at times too informal.

>>> made it more formal

First, the point made at the bottom of p.1 about why the results differ from some other papers - that "there used to be less inequality": this only makes sense in relation to a concept of some threshold level of inequality which is not mentioned.

>>> added a footnote with explanation

The reference low on p.3 on the health benefits of social support should be supplemented by adding Holt-Lunstad J, Smith TB, Bradley Layton J. Social Relationships and Mortality Risk: A Meta-analytic Review. PLoS Medicine 2010; 7(7):— e1000316.

>>> added

In Table 1: PYLL - before what age?

>>> <75; clarified in the table

% uninsured - is that health insurance?

>>> yes; clarified in the table

% smokers - smoking 100 cigarettes in what time period? A life time?

>>> yes; clarified in the table

The second panel from Table 2 seems to be missing.

>>> It was a typo—now clarified—i changed "10" to "5"—i meant that there are 5 counties in each panel, that is 10 total...

On p.9 Controlling for no social-emotional support, violent crime and obesity: although it may be worth showing the effect of using these as controls, it should be pointed out that they may all be on the causal pathway between inequality and health.

>>> added a footnote

Finally, the second reference (in the references to Wilkinson and Pickett) is wrong. It should be either "Wilkinson RG, Pickett KE. The Spirit Level: why more equal societies almost always do better. Allen Lane 2009", or preferably: Wilkinson RG, Pickett KE. The Spirit Level: why equality is better for everyone. Penguin 2010.)

>>> fixed this and few other references

3 Response to Reviewer #3

This is a potentially good article on an important topic. At the moment, though, there are two serious flaws that need to be corrected. The first is substantive. The article reviews the literature on the links between inequality and health outcomes without reporting any of the serious challenges to those claims, most notably from Angus Deaton. This is a serious omission and the counter-arguments need to be addressed in a paper that then goes on to establish further evidence of that linkage.

>>> I reported some in the first version...e.g.:

Yet some scholars remain unconvinced that inequality is bad for health (Fiscella and Franks, 1997, Lynch et al., 2001, Muller, 2002, Sturm and Gresenz, 2002, Lynch et al., 2004). They usually argue it is insufficient income (poverty) that produces poor health. That poverty results in poor health is as uncontroversial as saying that smoking is not healthy.

And now I have added substantial critique by Deaton in a new paragraph.

The second problem is methodological. It is not clear until the very end that it is not really individual analysis and rather an eco-analysis based on state-level results. The reasons for that, the exact methods employed, and the potential drawbacks of the approach need to be made clear to the reader up front rather than tossed in as a last minute caveat. Individual level data, for example, would make more sense but it is not clear from the write up if it is panel data; nor is that clear in the appendix.

>>> I have clarified in the abstract and in the literature review while discussing Deaton that it is an ecological study and that causal relationship cannot be claimed. To be clear, I repeat this caveat at the end.

Smaller points - in the discussion of the level of analysis and city/county size being important, the authors should explain why. One plausible reason, of course, is that inequality in smaller scale places may provide positive signaling effects while comparison effects seem to dominate in larger areas. This should be discussed further. Senik (2002) discusses these two channels in a paper on inequality in Russia, as do Graham and Felton (2006) for Latin America.

>>> added discussion

Also there is a burgeoning literature on inequality in China that makes similar points - see, for example, the work of John Knight.

>>> added brief reference

The basic data and questions asked are good ones, but the approach and where it fits into the literature should be spelled out in greater detail.

>>> n/a

4 Text Changes

Income Inequality and Wellbeing

Draft: Sunday 5th January, 2014

Abstract

I study the effect of income inequality (gini) on health outcomes across U.S. counties over the last few years. Health outcomes are both subjective and objective: mentally and physically unhealthy days, years of potential life lost and low birth weight. I control for many county-level characteristics: county size, per capita income, persistent poverty, percent uninsured, percent unemployed, percent college, and percent Black. I also include state dummies to account for state-level differences. I find inequality to be associated with worse health in terms of all the above measures. The magnitude of the effect is comparable to, or even higher than that of the per capita income. The reason may be that, as suggested in the literature, the level of contextual income does not matter for health in the rich countries, such as the United States. What matters is the distribution of income. This is an ecological study, and hence, it does not claim causal relationship.

KEYWORDS: PUBLIC HEALTH, MENTAL HEALTH, QUALITY OF LIFE, U.S. COUNTIES, INCOME INEQUALITY, GINI

Introduction

The 400 wealthiest Americans have a greater combined net worth than the bottom 150 million (Kristof 2011). On the other hand, the middle quintile of Americans does not pay any effective tax—they receive about as much from the government as they pay in taxes. The bottom quintile receives from the government even as much as \$3 for every \$1 they make (Mankiw 2012).

Inequality is a ~~hot topic~~these dayswidely debated topic. One outcome to consider is health. The question that I am trying to answer in this study is whether inequality makes communities less healthy. I am investigating here whether inequality depresses population (county-level) health. I argue that inequality makes us less healthy. To paraphrase Jeremy Bentham, if the goal is “the greatest health for the greatest number,” then we should become more equal.

There is a disagreement about whether income inequality affects health. This study adds evidence that there is a negative relationship between inequality and county-level health. I am using recent data about objective and subjective health outcomes and control for many county characteristics. I find a robust effect of income inequality on health. The reasons that some studies failed to find a significant relationship at the county level may be following: There used to be less inequality.¹ The data were less precise or not available at all. Many studies did not control for as many relevant characteristics as I do.

¹As explained later, inequality has been on the rise in the US over several decades. The assumption is that some inequality is not harmful to human wellbeing. It will be shown later that the disproportionately largest harm happens at high levels of inequality.

~~What predicts poor health? Poverty or income inequality?~~

What predicts poor health? Poverty or income inequality?

How can inequality affect health (e.g. Zimmerman and Bell 2006)?

- income inequality reduces social capital (interactions with other people), and social capital predicts better health
- income inequality causes the rich to withdraw support for public services, which in turn leads to poorer health
- income inequality increases individual comparisons, which increase stress and frustration leading to poor health

These mechanisms are reasonable, and the underlying theme is social capital. Social capital is about connecting with others: You want to connect with people like you—if you drive a Toyota Corolla, you ~~don't~~ do not have many friends who drive a Porsche (or ride the Greyhound). ~~So, the~~ The more inequality, the less social capital. ~~And there~~ There is plenty of evidence that social isolation and stress predict worse health. In addition, human beings compare among themselves. If you see other people driving better cars, wearing better clothes, or having better houses, it does not make you happy—you're missing out.

Yet some ~~people~~ scholars remain unconvinced that inequality is bad for health (Fiscella and Franks 1997, Lynch et al. 2001, Muller 2002, Sturm and Gresenz 2002, Lynch et al. 2004). They usually argue it is insufficient income (poverty) that produces poor health. That poverty results in poor health is as uncontroversial as saying that smoking is not healthy.

Poverty may be defined as a form of inequality, and ~~if you decrease poverty, you will also decrease~~ by eliminating poverty, we also eliminate inequality. Even if only poverty were related to poor health, it is still inequality (in broad sense) that relates to health. The question remains whether it is only poverty or only narrowly defined inequality (discrepancies in incomes above poverty) that results in poor health.

Because poverty and inequality are a similar condition, then, by definition, they are correlated. When analyzing inequality and health at the aggregate level, poverty may result in a so-called “artifact effect”: If a disproportionate number of poor people live in unequal areas, then the relationship between inequality and health would be spurious. I will test for it. ~~And~~ Also, there is an intriguing twist on this—a person benefits from living among people like her—they face similar obstacles and share collective knowledge for overcoming those obstacles, hence it is actually rich people living in a predominantly poor areas that may be disadvantaged in terms of health care (Kirby 2008).

A staunch proponent of no relationship between income inequality and health is Angus Deaton. However, he has investigated this topic at country-level (e.g., Deaton 1999, 2001), and this study explores variation at much less aggregated

level than country. This resolves Deaton's criticism about income inequality data quality (Deaton 2001)—data quality in the US is better than elsewhere. Also studying only one country helps with consistency of measurement across units of analysis. In a study at city and state levels, Deaton and Lubotsky (2003) argue that the link between inequality and health is confounded by race, especially by Blacks. I will control for % Black in this study. Still, not all skepticism of Deaton is irrelevant for this study—I am also not able to show that inequality causes poor health because I use ecological design. I study counties, not persons. I am only claiming here that there is a relationship between inequality and health controlling for many predictors of health and confounders.

How do we define health? Many studies use either subjective/self-reported measures, or objective measures. There is a correlation between the two, but they are not the same. Inequality may have an effect on subjective health: People may be upset or feel bad about inequality, but otherwise be in a good (objective) health. I will measure health using both objective and subjective outcomes.

That poverty results in poor health is obvious/widely recognized, but it is less obvious-clear that increasing income for people not in poverty results in better health. The relationship between income and health is quadratic—there are diminishing returns in health from income (Lynch et al. (2004) shows many examples). At some point you may not need any more income to have better health. Wilkinson (2006, 2010) finds that among the rich countries there is no relationship between PCGDP (Per Capita Gross Domestic Product) and health, and so it is not absolute but relative income that matters:

If absolute living standards were overwhelmingly important, it would be difficult to understand why, despite having a median income four times as high, life expectancy among Black men in the USA was 9 years shorter than for men in Costa Rica.

Overall (for all races) life expectancy differs, too: Greece with half of the per capita income of the U.S. has a longer life expectancy; and Cuba with less than a third of U.S. per capita income has about the same life expectancy as the U.S. (Marmot 2005a). The famous Whitehall studies (Marmot 2005b) showed that people of higher status have better health. But social status is a result of inequality. The more inequality, the more gradation in social status. That may be another mechanism through which inequality affects health (here it actually improves health of those of high-rank).

The question is who is the comparison group? People tend to compare to those of similar status (near equals) (Wilkinson and Pickett 2006). ~~So what-~~To most of us it does not matter that Bill Gates or Warren Buffet makes a lot or that a homeless person doesn't make any money. It ~~s-~~is a really big problem, though, that my wife's sister's husband is making more than me, or that there are those-people at my workplace that ~~don't-~~do not deserve their salary, not to

mention my high-school friends or my rich cousin who is a physician. Is it fair that physicians make about \$500,000 a year, while social scientists make about \$50,000 a year? The bottom line is that we compare to others all the time. We compare in space (to others) and over time (ourselves in the past)(Michalos 1985). And in addition to poor health, inequality can have other ~~bad~~-negative consequences like loss of dignity (Marmot 2004), loss of freedom, social exclusion and ultimately loss of economic development (Mackenbach 2002, Wilkinson and Pickett 2010).

A relevant concept in the study of the effect of inequality on health is social capital. I define social capital simply as 'connectedness with others' that takes many forms: time with friends, church attendance, marriage, civic engagement, and so forth. Social capital does produce better health: "Socially isolated people die at two or three times the rate of people with a network of social relationships and sources of emotional and instrumental support" (Kawachi and Kennedy 1997). ~~And there~~-There is less social capital when there is more inequality. Kawachi et al. (1997) and Subramanian et al. (2002) found that low social capital is associated with poor health. [For a recent review of a relationship between social capital and health see](#) Holt-Lunstad et al. (2010). The effects from inequality to health ~~would~~ happen with a lag. The lag length depends on the measurement of health outcome (Lynch et al. 2004). Subramanian and Kawachi (2004) suggest that income inequality would have the strongest effects on health up to 15 years later.

What about the inequality-health relationship hypotheses? There are many (Subramanian and Kawachi 2004, Lynch et al. 2004, Zimmerman and Bell 2006, Wilkinson and Pickett 2006, 2010), but they can be subsumed under two or three concepts:

- All (Absolute Income Hypothesis): absolute level of income→health
- RII/IIH (Relative Income Hypothesis/Income Inequality Hypothesis): relative level of income→health
 - strong IIH: income inequality→worse health for everybody
 - weak IIH: income inequality→worse health for the poor/disadvantaged

Several other variables are thought to predict health. Education predicts better physical and mental health (Zimmerman and Bell 2006, Muller 2002). Crime and income inequality are correlated and high crime predicts low health (Zimmerman and Bell 2006). Income and employment improves health (Zimmerman and Bell 2006). Also, racial composition, and regional effects matter, e.g. the uniqueness of the U.S. South (Subramanian and Kawachi 2004). I control for all of these factors using recent data.

The level of analysis is important. The bigger the area, the bigger the effect, even among the counties. In Texas, for instance, no relationship was found in counties < 150,000 people, but there was a relationship in counties with

> 150,000 people (Franzini et.al, cited in Chen and Crawford (2012)). One explanation is that income inequality in small areas is affected by the degree of residential segregation and the health of people in small areas is not poorer because of the inequality within a small area but because of the inequality in a larger area (Wilkinson and Pickett 2006). [Another explanation is that in smaller areas inequality may provide a positive signaling effect \(Hirschman's "tunnel effect" \(Hirschman, quoted in Ravallion and Lokshin 2000, p. 88\)\), while in bigger areas there may be more social comparison.](#) Senik (2002) [and](#) Graham and Felton (2006) [discuss these two channels with respect to inequality in Russia and in Latin America. Also, see work by John Knight about inequality in China.](#)² I will focus on counties. Why county-level? Census tracts are designed to be homogeneous. Hence, they are too small. State, on the other hand, is too big: You are more likely to be affected by incomes of other people in your county, not state. ~~And as~~ [As](#) McLaughlin and Stokes (2002) point out, county is a level at which local services are provided and organized. What are the major findings at the county-level?

Income inequality and minority racial concentration predict higher mortality (McLaughlin and Stokes 2002). Income inequality increases depression levels among old people (>70 years) (Muramatsu 2003). Blakely et al. (2002) used a multilevel model and found weak association between inequality and self-reported health. Fiscella and Franks (1997) argued that it is individual income, not county level inequality, that affects health. Muramatsu (2003), on the other hand, found a robust relationship between gini and depression, and argued that inequality is especially bad for mental health. Wilkinson and Pickett (2006) in their review reported that among 40 studies at county or tract level, 12 were wholly supportive, 14 partially, and 14 unsupportive of the link between inequality and public health, and there is more support at higher levels of aggregation. In a recent study, [Cheng and Kindig \(2012\)](#) found that income inequality predicts mortality. In another recent study, Chen and Crawford (2012) found a rather inconclusive relationship between gini and health outcomes. Their models are multilevel and at the county level they control for percentage of population in poverty and median household income.

Methods

I am using the County Health Rankings dataset and supplement it with data from ICPSR Study No. 20660. Both datasets are described in the data appendices A and B. The variables that I use are defined in table 1. Many variables are measured over time interval, which makes them more reliable, because these measures are estimates, not the actual values, and so they have a confidence interval.

²[I am grateful for these points to an anonymous reviewer.](#)

Table 1: Outcome and explanatory variables.

name	description
mentally unhealthy days	average number of reported mentally unhealthy days per month, for adults, Behavioral Risk Factor Surveillance System (BRFSS), 2002-2008
physically unhealthy days	average number of reported physically unhealthy days per month for adults, Behavioral Risk Factor Surveillance System (BRFSS), 2002-2008
years lost	age-adjusted years of potential life lost (YPLL) rate per 1000 persons, 2004-2006 (before the age of 75)
% low birthweight	percent of births with low birth weight (<2500g), 2000-2006
% uninsured	percent of adults 18-64 without health insurance, Census/Current Population Survey (CPS) Small Area Health Insurance Estimates (SAHIE), 2005
% college	percent of population age 25+ with 4-year college degree or higher, American Community Survey (ACS), 2005-2007
gini	gini coefficient, decennial census, 2000
% unemployed	percent of population age 16+ unemployed and looking for work, Local Area Unemployment Statistics, Bureau of Labor Statistics, 2008
violent crime rate	violent crimes / aggregate population * 100,000 (2005-2007)
% obese	percent of adults that report BMI ≥ 30 , 2006-2008; CDC
% smokers	Percent of adults that report smoking at least 100 cigarettes in their lifetime and that they currently smoke BRFSS, 2002-2008
persistent poverty	20 percent or more of residents were poor as measured by each of the last 4 censuses, 1970, 1980, 1990, and 2000
population	census 2000 total resident population
per capita personal income (USD 1,000)	per capita personal income (USD 1,000), 2005
violent crime rate	violent crimes / aggregate population * 100,000 (2005-2007)
% black	percent black, 2005
no social-emotional support	percent of adults that report not getting social/emotional support (2005-2008); BRFSS

The first panel shows measures of the health outcomes. There are two subjective/self-reported measures: MENTALLY UNHEALTHY DAYS and PHYSICALLY UNHEALTHY DAYS. And there are two objective measures: YEARS LOST and % LOW BIRTHWEIGHT. The second panel shows the explanatory variables. The choice of variables is motivated by previous studies; however, not a single study has used all of them. This is a contribution of this study—to show that the relationship between inequality and multiple health outcomes holds after controlling for all hypothesized predictors of health. Health insurance measures access to health care (Chen and Crawford 2012). Crime predicts health (Lynch et al. 2004). Social context affects health: social capital, unemployment, social status and quality of social environment (Wilkinson and Pickett 2006). Ethnicity/race is another predictor of health outcomes (Zahran et al. 2005, McLaughlin and Stokes 2002). Educational attainment matters, too (Subramanian and Kawachi 2004). Table 2 shows health measures for the 10 most equal and unequal counties.

Table 2: Health outcomes in 5 most equal (first panel) and 5 most unequal (second panel) counties.

County name	state	gini	per capita income (1,000)	mentally unhealthy days	physically unhealthy days	years lost	% low birthweight
Tooele County	Utah	32.6	22.2	3.6	3.8	73	6.8
Kendall County	Illinois	32.6	31.0	2.0	2.0	49	6.7
Paulding County	Georgia	32.9	25.1	4.5	4.9	76	7.0
Bristol Bay Borough	Alaska	33.3	44.0	2.4	3.2		
Manassas Park city	Virginia	33.3				51	5.4
Boone County	Indiana	55.1	42.9	2.3	3.3	53	6.4
Kenedy County	Texas	56.6	33.1				
Bolivar County	Mississippi	56.9	20.6	4.1	4.0	136	12.8
Lee County	Kentucky	58.6	18.6	5.0	6.9	124	9.4
New York County	New York	60.1	93.4	3.6	3.6	55	8.3

Interestingly, among equal and unequal counties there are both poor and rich counties, but overall health is worse for the unequal counties. The equal counties are located near big cities: Kendall County Illinois close to Chicago; Tooele County Utah close to Salt Lake City; Paulding County Georgia close to Atlanta; Chisago County Minnesota close to Minneapolis; Columbia County Oregon close to Portland. Unequal counties, on the other hand, tend to be either cities or rural areas. The following counties are rural: Lee County Kentucky; Bolivar County ~~Mississippi~~; Owsley County ~~Kentucky~~.

Results

~~Let's look at descriptive statistics.~~ Figure 1 (below) shows health outcomes against quartiles of gini. Advancing from one quartile to another results in worse health on all measures and the effect happens all along, so there ~~doesn't~~ does not appear to be a threshold effect at which inequality starts to matter—it matters all along. Results are similar if gini is broken down into deciles instead of quartiles. If anything, there is a more dramatic increase between the 3rd and 4th quartiles, meaning that extreme inequality is much worse than some inequality. It is a big effect: Advancing from the 1st to 3rd quartile produces about half a day more of physical or mental unhealthiness per month per person—a lot of public sickness, indeed. A county has about 100,000 people, so it has 50,000 unhealthy days more per one county per one month. Of course, there may be other ~~things~~ factors correlated with income inequality such as poverty or state-level policies. I will control for ~~that~~ them later. Because self-reported/subjective health measures may be sensitive to income inequality, let's have a look at objective measures. Years potentially lost is a visual measure: Advancing from one to another quartile of gini results in about 10 years lost for 1,000 people—this is a lot of time !

As mentioned in the introduction, there is one important relationship between the two explanatory variables—gini and poverty are likely to be correlated. Do poor people live in more unequal areas? Yes, gini correlates with percent in poverty at 0.43 as shown in figure 2 (below). Again, there is a big increase between the third and fourth quartile.

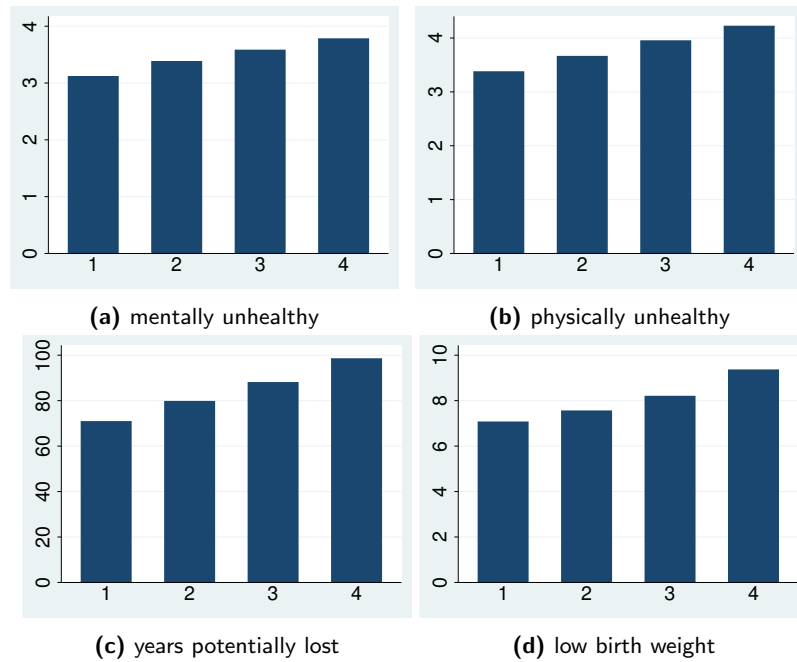


Figure 1: Health outcomes against quartiles of gini.

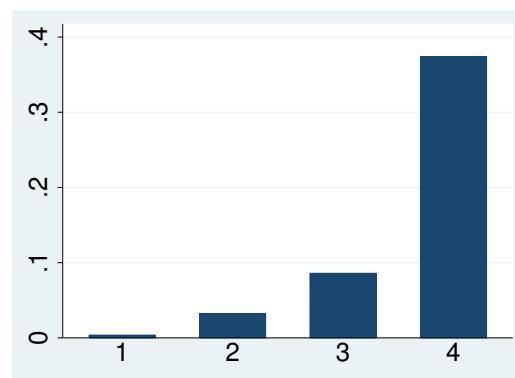


Figure 2: persistent poverty against gini

Regression results are shown in the two following tables (3 and 4). In addition to the usual predictors of health, I am controlling for county population, because some literature suggests that income inequality depresses health in big counties only. I also include state dummies, as it is important to control for administrative regions. Welfare policies/generosity of state-level spending and regional effects (e.g. the uniqueness of the South) are likely to affect the link between inequality and health.

Table 4 shows standardized coefficients—let's compare income with income inequality. Income correlates with persistent poverty and hence the coefficient on both is lower, but still ~~note that~~ the effect of gini is higher than that of income.

Table 3: OLS regressions of health measures.

	mentally un- healthy days	physically unhealthy days	years lost	% low birth- weight
gini	0.048***	0.055***	1.478***	0.068***
per capita personal income (USD 1,000)	-0.013***	-0.019***	-0.204*	0.005
persistent poverty	0.024	0.346***	8.546***	0.229**
% uninsured	-0.043***	-0.044***	-0.795***	-0.039***
% unemployed	0.029*	0.026	1.302***	-0.012
% college	-0.023***	-0.038***	-1.036***	-0.035***
% black	-0.015***	-0.017***	0.168***	0.066***
population	0.000**	0.000*	-0.000	0.000*
state dummies	yes	yes	yes	yes
constant	3.551***	4.107***	60.383***	6.156***
N	2861	2860	2987	2861

*** p<0.01, ** p<0.05, * p<0.1; robust std err

Table 4: OLS regression of health measures. Standardized coefficients reported.

	mentally un- healthy days	physically unhealthy days	years lost	% low birth- weight
gini	0.163***	0.169***	0.211***	0.125***
per capita personal income (USD 1,000)	-0.085***	-0.114***	-0.055*	0.018
persistent poverty	0.008	0.099***	0.116***	0.040**
% uninsured	-0.230***	-0.219***	-0.189***	-0.112***
% unemployed	0.060*	0.049	0.112***	-0.014
% college	-0.183***	-0.283***	-0.349***	-0.155***
% black	-0.204***	-0.215***	0.100***	0.511***
population	0.044**	0.030*	-0.002	0.014*
state dummies	yes	yes	yes	yes
constant	***	***	***	***
N	2861	2860	2987	2861

*** p<0.01, ** p<0.05, * p<0.1; robust std err

Discussion

What do these coefficients really mean? Adding more variables to the right hand side of the model cuts the magnitude of the gini coefficient at most by two or three times as compared to a bivariate model (the interpretations given above for the bar charts in figure 1). For instance, instead of 50,000 unhealthy days per month per county by advancing from first to third quartile we would end up with 20,000-30,000 unhealthy days—still a big effect. Gini ranges in this data from 32 to 60, so say 60. Say it goes up by $6 \times .05$ gini coefficient = $.3 \times 100,000$ people in an average county makes results in 30,000 unhealthy days. If quartiles of gini are included instead of gini, the coefficient on the dummy for the third quartile (first quartile being the base) is .3. Similarly, the YEARS LOST effect decreased by about half as compared to the bivariate model: Advancing from one to another quartile of gini results in 5 more years lost per 1,000 people. Again, this is a big effect—for a typical county it would be 500 years lost. % LOW BIRTHWEIGHT is also both statistically and practically significant.

Let's have a look at the other coefficients. Per capita income, percent unemployed and percent college have hypothesized signs. But percent uninsured and percent Black have unexpected signs—the reason is correlations between right-hand side variables—the bivariate correlations are as expected. I do not worry about the unexpected signs and do not explore interrelationships between these variables here because they are just used as controls. I am solely focused on gini.

Finally, ~~why the causality may be present~~does inequality cause poor health? First, I excluded alternative explanations: It is not poverty, state-level peculiarities, social capital or income. It is unlikely that causality goes the other way round: ~~Poorer~~Poor health causes more inequality. If anything, inequality in health could cause inequality in income, but I use here the level of health. ~~On the other hand,~~Hence, causality may be present, but I am not able to answer it definitely. Again, because it is ecological study at county level, it does not claim causal relationship. I merely suggest that causality may be present because results are quite robust and there are theoretical reasons to ~~believe that inequality causes worse health~~these expect causality (these mechanisms were discussed at the beginning). I have done several robustness checks. Model estimates are shown in the appendix (tables 5 and 6). I added 4 variables. NO SOCIAL-EMOTIONAL SUPPORT, VIOLENT CRIME RATE, % OBESE³ and % SMOKERS were not available for many counties, but they are thought to predict health, and need to be controlled for. Gini remains significant and the magnitude of the effect is similar to that in the tables reported above. In addition, counties within states may be correlated—a model with clustered standard errors was estimated. Finally, most measures of health are not normally distributed and models were reestimated using logged dependent variables. Again, the results are similar.

Limitations

Limitations

I do not control for person-level characteristics: e.g., socio-demographics, and personal/household income. All measures used here are estimates themselves, so there is added uncertainty. It would be a problem if the measurements were erroneous in different directions by the inequality measure: e.g., health outcomes would be shown to be worse than they are in unequal counties and better than they are in equal counties, but I do not see why that could be the case.

Finally, this is an ecological study, that is, it is done at county-level. Hence, ~~there is likely to be different~~ results at person-level may be different. Still, ecological relationships are of interest in themselves. But these results should not be interpreted as causal at person-level.

Appendix A: County Health Rankings

The following comes from <http://www.countyhealthrankings.org/ranking-methods/data-sources-and-measures> (and there is more information available).

³In addition, these variables may be on the causal pathway between inequality and health—I am grateful for this point to an anonymous reviewer.

The County Health Rankings team synthesizes health information from a variety of national data sources to create the Rankings. Most of the data we use are public data available at no charge. Measures based on vital statistics data, sexually transmitted disease rates, and Behavioral Risk Factor Surveillance System (BRFSS) survey data were calculated for us by staff at the National Center for Health Statistics and other units of the Centers for Disease Control and Prevention (CDC). The same is true for our health care quality measures, which were calculated for us by the authors of the Dartmouth Atlas of Healthcare, using Medicare claims data. Another key data source, primarily for social and economic variables, is the American Community Survey. We download these data sets and, where needed, calculate the estimates ourselves. Similarly, we downloaded publicly available data on violent crime and some built environment measures, and calculated point estimates.

Appendix B: ICPSR County Health characteristics

The following comes from <http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/20660/detail>.

This file contains an array of county characteristics by which researchers can investigate contextual influences at the county level. Included are population size and the components of population change during 2000-2005 and a wide range of characteristics on or about 2005: (1) population by age, sex, race, and Hispanic origin, (2) labor force size and unemployment, (3) personal income, (4) earnings and employment by industry, (5) land surface form typography, (6) climate, (7) government revenue and expenditures, (8) crimes reported to police, (9) presidential election results (10) housing authorized by building permits, (11) Medicare enrollment, and (12) health profession shortage areas.

Subject Terms: age, arson, assault, auto theft, birth rates, burglary, climate, counties, crime, demographic characteristics, disabled persons, economic conditions, election returns, employee benefits, employment, gender, geography, government expenditures, government revenues, group homes, Hispanic or Latino origins, housing, housing construction, income, labor force, larceny, manufacturing industry, Medicare, migration, mortality rates, murder, natural environment, occupations, older adults, pensions, physician availability, poverty, public assistance programs, race, rape, retail trade, robbery, taxes, unemployment, wages and salaries, weather data, workers

Appendix C: Robustness Checks

Table 5: OLS regression of health measures. Clustered standard errors on state

	mentally un- healthy days	physically unhealthy days	years lost	% low birth- weight
gini	0.047**	0.058***	1.810***	0.076***
per capita personal income (USD 1,000)	-0.010	-0.012	0.040	0.017*
persistent poverty	-0.259*	0.351*	3.190	-0.024
% uninsured	-0.001	-0.001	0.237	-0.008
% unemployed	0.023	0.031	-0.809	-0.100*
% college	-0.001	-0.018*	-0.993***	-0.035**
no social-emotional support	0.048***	0.023**	0.086	0.008
violent crime rate	-0.000	-0.000	0.010**	0.001**
% black	-0.006*	-0.007	0.387***	0.080***
population	0.000	0.000	-0.000**	-0.000*
% obese	0.012	0.022	0.776*	0.018
% smokers	0.051***	0.039***	1.010***	0.055***
state dummies	yes	yes	yes	yes
constant	-0.571	-0.042	-30.648	2.557
N	860	860	860	856

*** p<0.01, ** p<0.05, * p<0.1; robust std err

Table 6: OLS regression of health measures. Logs of dependent variables

	mentally un- healthy days	physically unhealthy days	years lost	% low birth- weight
gini	0.012***	0.013***	0.021***	0.009***
per capita personal income (USD 1,000)	-0.004**	-0.005**	-0.002*	-0.000
persistent poverty	-0.063*	0.083*	-0.018	-0.021
% uninsured	-0.007**	-0.008***	-0.005**	-0.004***
% unemployed	0.012*	0.013**	0.004	-0.004
% college	0.000	-0.005**	-0.012***	-0.003**
no social-emotional support	0.010***	0.005**	-0.001	0.001
violent crime rate	0.000	0.000	0.000***	0.000***
% black	-0.004***	-0.004***	0.003***	0.006***
population	0.000	0.000	-0.000	0.000*
% obese	0.001	0.004	0.007**	0.002
% smokers	0.014***	0.008***	0.009***	0.003*
state dummies	yes	yes	yes	yes
constant	0.537***	0.803***	3.478***	1.670***
N	860	860	860	856

*** p<0.01, ** p<0.05, * p<0.1; robust std err

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