September 2006

Income Inequality and Health: A Multilevel Analysis Investigating Interactions with (Non)Metropolitan Status, Sex, Income and Race/Ethnicity

Suzanne C. Eichenlaub
Department of Sociology
Center for Studies in Demography and Ecology
University of Washington
Seattle, Washington 98195-3340

* This research was supported by a pre-doctoral fellowship to the author from the Center for Studies in Demography and Ecology at the University of Washington. Direct correspondence to: Suzanne Eichenlaub, Department of Sociology, Box 353340, University of Washington, Seattle, WA 98195; email: eich@u.washington.edu.

Introduction

The relationship between economic inequality and health has become an enormously popular research topic in recent years. For the past decade, researchers from several disciplines have contributed to a growing body of literature addressing and debating the effect of income inequality on health. Despite dozens of studies using data from developing and developed countries, at many different levels of aggregation, employing various methodological techniques and multiple measures of inequality, no clear consensus has emerged. As a whole, prior work fails to establish a universal relationship between inequality and health and suggests a more likely conclusion: Inequality's effect on health varies based on several factors.

Several studies have demonstrated that greater income inequality is associated with higher mortality and worse health (e.g. Soobader and LeClere 1999; Kawachi, Kennedy and Glass 1999; Kennedy et al. 1998). There have also been studies that have found, at best, a tenuous link between income inequality and morbidity or mortality (e.g. Daly et al. 1998; Fiscella and Franks 1997; Deaton and Lubostsky 2003). Many scholars point to confounding factors that, when included in models, lessen or eliminate the effect of income inequality, like individual household income (Fiscella and Franks 1997) or racial composition of an area (Deaton 2003; Deaton and Lubotsky 2003). However, as more conflicting research emerges, the debate over whether income inequality has an independent negative effect on health continues. This paper aims to bring together aspects of prior research in an attempt to illustrate that although the relationship between income inequality and health may not be universal, there may be specific circumstances in which this relationship is significant and important.

In this paper, I use a multilevel model to examine the overall impact of county level income inequality on self-rated health for individual men and women in the U.S. I also examine whether the effect of income inequality on health varies by metropolitan status, sex, income level and race/ethnicity.

Background

For some time, researchers from several disciplines have explored the relationship between income inequality and health. However, the possible mechanisms through which a contextual condition like inequality might affect the health of individuals is not obvious. The suggested pathways through which inequality is hypothesized to negatively affect health generally falls into two main groups: psychosocial and neo-material. The former is based on

psychosocial explanations at both the micro and macro levels. At the micro level, this theory grouping posits that an individual's perceived social environment, including their position within this society, is influenced by income inequality (Macinko et al. 2003; Daly et al. 1998). According to these hypotheses, inequality affects health in several ways. Primarily it is believed that one's relative position in an unequal society generates degrees of stress, which in turn, is related to health outcomes. Perception of relative standing is not related to actual living conditions but rather how people compare themselves with those around them (Wilkinson 1996; Macinko et al. 2003). In a study that examines the mediating factors between neighborhood disorder and poor health, Hill, Ross and Angel (2005) find that psychological and physiological stress associated with neighborhood conditions are associated with worse health outcomes. In a qualitative study, focus groups consisting of lower income individuals discussed how income inequality and social comparisons cause feelings of stress, anxiety and depression (Davidson, Kitzinger and Hunt 2006). Some participants even went so far as to link the stress of living in an high inequality context with their smoking behavior. Taken together, these studies provide some support for the micro-level explanations linking income inequality and health.

At the macro level the psychosocial explanations focus on how income inequality affects the social cohesion and social capital in a community. Proponents of these theories argue that social capital, social cohesion and social trust contribute to environments that are beneficial for health and have been linked to health outcomes (Wilkinson 1996; Subramian, Kim and Kawachi 2002). Income inequality is hypothesized to reduce social capital and civic engagement leading to a disintegration of the community and a corresponding adverse effect on health. Two recent studies explore the proposed link between community social capital and self-reported health. The first finds that social capital, as measured by community trust, has an independent positive effect on health for high-trust individuals but a negative effect for low-trust individuals (Subramanian, Kim and Kawachi 2005)[1]. The second study looks at the effects of neighborhood bonding social capital in England on self-rated health. The author finds that net of individual-level characteristics, including individual social support, social trust and civic participation, community social trust retained a statistically significant positive relationship with health

[1] Poortinga (2006a) also finds an interaction between individual trust and national trust in his recent cross-national, multilevel study. Although his results generally demonstrate no independent effect of national trust once relevant individual controls are included in the model, he finds a significant and positive interaction between high trust individuals and national trust.

(Poortinga 2006b). He also finds that an aggregate measure of individual perception of social capital is a strong predictor of better health net of all controls. However, his third measure of social capital, community civic engagement, does not retain statistical significance when individual-level variables are included.

Psychosocial theories have been criticized for ignoring the essential role that material conditions play in health outcomes. As such, the second group of explanations focuses on the importance of material factors, as measured by income or living conditions, in determining health outcomes. The neomaterial pathway posits that nations/states/communities with higher levels of income inequality suffer from underinvestment in public resources and infrastructure such as schools, medical services, transportation, public spaces and cultural activities (Smith 1996; Lynch et al. 2000). This underinvestment results in communities with fewer resources, which negatively impacts the members, most notably the middle and lower income members who are less able to access private resources. According to neomaterialists, it is the exposure to substandard environmental or structural conditions that adversely impact health. In the qualitative study mentioned above, lower income focus group members point to poor living conditions and lack of access to healthier food choices as contributing factors to health differentials in high inequality areas. (Davidson, Kitzinger and Hunt 2006).

The surge in research investigating links between income inequality and health is largely associated with Richard Wilkinson (1992), whose study of 23 developed nations identifies income distribution as a major correlate of life expectancy and his later work that showed changes in inequality are associated with changes in life expectancy (1996). That is, as the income distribution narrows, life expectancy increases and vice versa. And while cross-national studies continued and debates arose, research extended to within-country examinations. Much of this research has focused on the relationship between income inequality and health within the United States in particular. This is not surprising given the high levels of income inequality within the U.S. compared to other nations.

Many early studies investigating the effect of income inequality on health focused on aggregate level characteristics. While results from these studies have been the most likely to provide support for the income inequality hypothesis, they are hardly consistent. Kaplan et al. (1996) examine the relationship between state level inequality and mortality trends in the U.S. between 1980 and 1990. They report that states whose income distribution is more unequal

experience smaller declines in mortality compared to states with lower levels of inequality. Another study examines the effect of county-level inequality on the risk of mortality (McLaughlin, Stokes and Nonoyama 2001). They report that the effect of inequality on mortality is significant for non-metropolitan, but not metropolitan counties. Not all ecological studies find a negative effect of inequality on health. For example, Deaton and Lubotsky (2003) study the effect of inequality at the state-level and at the MSA-level on mortality but find no negative effect after controlling for proportion black and other relevant covariates.

More recently, researchers have turned their attention toward multilevel methods to examine the effect of income inequality on health while controlling for individual level characteristics. Results from these studies have been mixed. A study by Fiscella and Franks (1997) was the first to use multilevel modeling to investigate the relationship between income inequality and health. Using data from the National Health and Nutrition Examination Survey (NHANES I) and the mortality follow-up, their study examines the association between state-level income inequality, as measured by the percent of income earned by the bottom 50 percent of earners, and individual-level mortality. Although they report a statistically significant bivariate relationship between inequality and mortality, they find that the relationship does not persist when controls for individual level income are included.[2] This publication sparked a series of responses, beginning with Kennedy, Kawachi, Glass and Prothrow-Stith (1998) who looked at the effect of state-level income inequality, as measured by the gini coefficient, on self-rated health for adults. They find that after controlling for individual level income, the effect of inequality is reduced but remains statistically significant. They also report differences by income levels. For low and middle-income individuals, there is a negative effect of inequality on health. There is no statistically significant effect for high income individuals.

Using data from the Current Population Survey (CPS), Blakely and colleagues (2002) examine the effect of inequality at the state, county and metropolitan-level on individual self-rated health in three separate analyses. Their study reveals no association between state-level inequality and worse health for individuals living in metropolitan areas but a significant negative effect for non-metropolitan residents. Non-metropolitan residents in states with high and medium high levels of inequality report fair or poor health at 1.60 and 1.38 the odds of the

[2] Fiscella and Franks (1996) use survey data to calculate their income inequality measure. This practice has been criticized (Wagstaff and van Doorslaer 2000; Deaton 2003) and the validity of these results has been questioned based on this factor.

reference group (metropolitan residents in low inequality states), respectively. They report a negative effect of county-level income inequality on the self-rated health of women but not men. Finally, in their metropolitan-level multilevel analysis, they find that inclusion of individual-level income eliminates the significant negative effect of inequality on health. Using a rather limited sample, Soobader and LeClere (1999) report a significant negative effect of income inequality on self-rated health using the National Health Interview Survey (NHIS) linked to 1990 census data. Their analysis, which includes only working age, employed white males, finds a statistically significant negative association between income inequality and health at both the county and the census tract-level when controls for individual income and median area income are included. They find that the association is strongest for the county-level analysis.

Several studies examined the association of inequality and subsequent mortality by linking mortality files to various surveys. Lochner and colleagues (2001) find an association between income inequality and mortality at the state-level for their sample of white and black (non-hispanic) men and women. When they stratify their analysis by race, they find that the association between income inequality and mortality is greatest for near-poor whites (those respondents whose income falls between 100 and 199% of the poverty threshold). Another study looks at the effect of state-level income inequality on mortality but finds little support (Daly et al. 1998). Using multiple measures of income inequality, the authors find that the only subgroup whose inequality coefficient reaches statistical significance after controlling for family income was non-elderly (ages 25 to 64) middle income respondents.

Although a good portion of the research on this topic focuses on the relationship between income inequality and self-assessed health or mortality, some researchers have expanded the discussion by including other health-related indicators and behaviors. For example, using data from the Behavioral Risk Factor Surveillance System, Diez-Roux, Link and Northridge (2000) investigate the association between income inequality and four cardiovascular disease risk factors: body mass index, hypertension, smoking and sedentarism. Their findings suggest differential effects of inequality by income level and sex. In general, they find that the association between income inequality and cardiovascular disease risk factors is greatest for lower income individuals (household income under $25,000 annually) and for women.

Additionally, considerable research has been conducted in non-U.S. settings over the past several years. As with studies within the U.S., the results are mixed, although those employing

multilevel models generally report no statistically significant relationship between income inequality and worse health or mortality. Using the gini coefficient as their measure of income inequality, Blakely, Atkinson and O'Dea (2003) conduct a multilevel analysis in 35 regions of New Zealand which links census records from 1991 to mortality records through 1994. After controlling for several individual-level demographic factors, including household income, as well as average income of the region, they report no association between income inequality and mortality. A more recent study in Canada (Hou and Myles 2005) investigates the effect of income inequality on self-rated health for respondents living in 25 metropolitan areas and finds that tract-level income inequality is not associated with worse health. However, they do find that high levels of inequality are associated with better self-reported health after controlling for individual factors and median area income. Finally, a study from Scotland reveals an interesting relationship between income inequality and self-assessed health. Craig (2005) finds a positive association between income inequality and health at the local authority level. That is, individuals living in local authorities with higher levels of inequality on average report better health than do individuals living in local authorities whose income distribution is more equitable. He also finds an unusual positive correlation between income inequality and local authority average income. Therefore, areas with high levels of inequality also tend to be areas with higher average incomes in his data.[3]

Although the literature on this subject has grown rapidly, several questions remain. This paper attempts to address some lingering questions about the possibility that the effect of income inequality on health varies by metropolitan status, sex, income level and race/ethnicity. Additionally, the methodology employed, multilevel ordinal regression, is the most appropriate given the nature of the research question (a contextual effect on an individual-level outcome) and the structure of the dependent variable (ordered categorical health measure).

Hypotheses

There are two main questions asked in this paper. First, does the hypothesized relationship between income inequality and health exist, in these data, when the appropriate methodology is employed and the pertinent controls are included in the analysis? Based on the

[3] Like Fiscella and Franks (1997), Craig calculates the inequality measure from survey data. However in this case the gini coefficient is being calculated based on income information from nearly 30,000 respondents in 32 local authorities which is a fairly large sample.

mixed results from prior research, it is difficult to predict with confidence that this study will find an independent effect of income inequality on health net of both individual-level characteristics, including household income, and county-level characteristics, including median county income. In general, studies that have examined self-rated health are more likely to find a significant effect than those that considered the relationship between income inequality and mortality. However, of two multilevel studies that test county-level inequality, one found an effect (Soobader and LeClere 1999) and one did not (Blakely et al. 2002). Given that I am using an ordinal outcome, which allows for maximum variability in the self-rated health measure, and therefore the most sensitivity in detecting a potential relationship, I expect to find a modest effect of income inequality on health after including household income and median county income as well as other controls.

Hypothesis 1 (H1): County level income inequality has an independent negative effect on health net of controls.

Next, I explore whether the effects of income inequality on health vary based on metropolitan status. At least two studies suggest that non-metropolitan residents are impacted by income inequality to a greater extent than are metropolitan residents. For example, in their ecological study examining the relationship between county-level income inequality and mortality, McLaughlin, Stokes and Nonoyama (2001) find a statistically significant negative association for non-metropolitan counties and no relationship for metropolitan counties. Additionally, a multilevel study finds a more pronounced negative effect of state-level income inequality on the self-rated health of non-metroplitan residents compared to those not living in metropolitan areas. (Blakely, Lochner and Kawachi 2002). I expect to find that county-level income inequality will impact the self-rated health of residents of non-metropolitan counties to a greater extent than metropolitan residents.

Hypothesis 2 (H2): The negative effect of inequality will be more pronounced for residents of non-metropolitan than for residents of metropolitan counties.

The third question asked in this paper is: does the relationship between income inequality and health vary by selected individual-level characteristics including sex, race/ethnicity and individual income? That is, do these particular characteristics somehow alter the effects of inequality on health? Based on prior research indicating differential effects of inequality on individual-level health, I expect to find that the health consequences of income inequality are greater for some groups than for others.

Results from several studies suggest that there are sex differences for health outcomes. In a study that looks at the impact of various environmental factors on self-rated health in neighborhoods in the U.K. Stafford et al. (2005) find that women's health is more sensitive to neighborhood factors than is the health of their male counterparts. More specifically, several studies found that the effect of income inequality on health is more pronounced for women than for men. Diez-Roux and colleagues (2000) find a significant relationship between income inequality and cardiovascular disease risk factors for women but not for men. Finally, although Blakely et al. (2002) find no effect of income inequality on men's self-rated health at the county level, they do find a relationship for women. Based on results from prior research, this study expects to find a stronger negative effect of inequality on the health of women then on the health of men.

Hypothesis 3 (H3): The negative effect of income inequality on health will be greater for women than for men.

Several studies have found that the effects of inequality are not constant across categories of individual or household income. Most seem to indicate that income inequality impacts health outcomes of those at the lower end of the economic ladder more profoundly than it does their middle-income or upper-income counterparts (Kennedy et al. 1998; Diez-Roux et al. 2000). One study that divides individuals into several categories based on their income levels, finds that middle-income residents living in lower-income areas are the most negatively impacted by income inequality (Daly et al. 1998). Another study suggests that the effect of inequality is greatest for the near poor rather than the poorest individuals (Lochner et al. 2001). Because evidence seems to support an income gradient for the effect of inequality, I expect to find a

significant interaction between income inequality and household income with decreasing negative effects as incomes increase.

Hypothesis 4 (H4): The negative effect of income inequality is stronger for households with lower incomes.

Finally, research has found racial/ethnic differences in the effects of community characteristics on specific health outcomes. (LeClere, Rogers and Peters 1997). Only a few studies have directly examined racial differences in the effect of inequality. Lochner et al. (2001) find the strongest effects of income inequality on mortality in their multilevel study for lower income whites. However, two other studies (Kennedy et al. 1998; Subramanian and Kawachi 2003) directly examine racial differences for blacks and whites in inequality effects but find none. However, race/ethnicity is related to both absolute levels of income and residential patterns and conditions. The negative correlation between income inequality and median income (-.63 in the NLSY data) suggests that inequality is highest in areas with the lowest income. Prior research indicates that these areas are most likely disproportionately inhabited by racial and ethnic minorities (LeClere, Rogers and Peters 1997). Because of these associations, it is important to test for racial/ethnic differences in the effects of income inequality. Furthermore, no study, to my knowledge, has examined differential effects of inequality on race/ethnicity while including Hispanics. Although prior findings on this topic have been mixed, I expect to find that income inequality operates differently for different racial and ethnic groups. More specifically, I hypothesize that the effect of inequality will be greatest for whites.

Hypothesis 5 (H5): The negative effect of income inequality will be greater for whites than for blacks or Hispanics.

Data

To investigate the effect of county-level income inequality on individual health, two data sources are required. First, at the individual level, data come from the National Longitudinal Survey of Youth 1979 (NLSY) year 2000 survey. The NLSY is a nationally representative sample of men and women who were first interviewed in 1979 when they were between ages 14

and 22 years. The survey asks respondents a wide range of questions about their labor market experience, income, health, education, marital and fertility histories as well as other topics. The key individual-level characteristics in this paper include race/ethnicity, sex, income, educational attainment and the dependent variable, self-rated health.

The 2000 U.S. Census provides the county-level data for the analysis. These files are used to construct the key independent variable, a county-level measure of income inequality. Additionally, at the county level, the census data provide information on median county income and metropolitan status. Although there is hardly consensus as to the appropriate level of aggregation for this type of examination, Soobader and LeClere (1995) posit that the effect of income inequality on health is best observed at the county level. They argue that the census tract level does not provide enough variability in terms of income inequality. Smaller levels of aggregation, like census tracts and neighborhoods, do not provide enough within group contrast to provide substantive inequality information (Wilkinson 1997; Soobader and LeClere 1995). Economic residential segregation leads to more homogenous communities at the tract-level and therefore communities have lower levels of inequality, leaving researchers with little variation in contextual inequality to explain individual-level variation in health. State-level analyses, on the other hand, are better suited to capture differences in policies, rather than potential effects of the mechanisms through which inequality is hypothesized to impact health (Wagstaff and van Dooslaer 2000).

Dependent Variable. Self-rated health is the outcome of interest in this paper. Self-rated health is a commonly used indicator of health and is a strong predictor of mortality (see Idler and Benyamini 1997 for a comprehensive review). In the NLSY year 2000 survey, a health module that includes a self-rated health item was asked of all respondents ages 40 and older. Respondents are asked to rate their general health by selecting from five responses ranging from *poor* to *excellent*. Although self-rated health is a categorical variable, it is almost universally collapsed into a dichotomous variable in the health literature, where respondents reporting good health are distinguished from those reporting less than good health.[4] In the case where there are five categories, as in the NLSY, the variable would be dichotomized such that those reporting excellent, very good or good health would be differentiated from those reporting fair or poor

[4] I know of only one study in the income inequality and health literature that treats self-rated health as an ordinal variable (Hou and Myles 2005).

health. Despite being a common practice, this method, which results in lost information, has not been thoroughly justified. Manor and colleagues (2000) test the validity of dichotomizing self-rated health. In their study, which examines the relationship between social class and health, they find that using logistic regression to predict a dichotomized self-rated health measure provides similar results to using methods that incorporate the ordered categorical nature of the variable. However, they note that their large sample size and the robust effect of social class on health enable the analysis to have sufficient power to overcome the loss in efficiency. In cases where the effect is less pronounced or the sample size is smaller, the information lost by not incorporating the ordered categorical nature of the variable may provide inaccurate results. That is, the results from a logistic regression in these cases may underestimate effects that would be correctly specified by using methods that incorporate self-rated health's ordered nature. Because of these limitations, coupled with the seeming fragility of the effect of income inequality on health, allowing the dependent variable to vary over five categories rather than two maximizes the variance to be explained and provides the most sensitive test of the relationship. Therefore, this paper treats the dependent variable as an ordinal scale from one to five where poor health is coded as 1 and excellent health is coded as 5.

Independent Variables: Individual Level. In addition to the dependent variable, self-rated health, there are several important independent variables at the individual level in the analysis. Income measured at the individual level is critical to this analysis since it is widely reported that individual income is a strong predictor of health. The income variable used in this paper combines income from wages, salary, farms and from own businesses for both the respondent and their spouse into one household income variable. I use the log transformation of household income to account for its skewed distribution. To control for potential differences between respondents who report spouse's income and those who do not, I include a dummy variable in the analysis that indicates if a respondent reports income from a spouse.

In addition to household income, I include a dummy variable that indicates whether the respondent or their spouse report receipt of other income since the time of the last interview (usually about two years). Respondents who report that they or their spouse has received welfare payments, food stamps, disability and child support are included in this category.

In my sample of 1,774, more than one in ten respondents report zero dollars of household income (from self and spouse). Exploratory analysis reveals that the 205 respondents who report

zero income are compositionally different from those who report some family income. Nearly half of those reporting no household income (101) are black and over a quarter (55) are Hispanic. In general, these respondents reported significantly worse health than did their counterparts who reported any household income. Finally, more than half (129) of these respondents report that they or their spouse received other income (from welfare, disability, etc.) since the time of their last interview. In the analysis, these respondents are included with a household income of zero.[5]

Another important individual level variable included in the analysis is race/ethnicity. Respondents fall into one of three categories, black, Hispanic and white. Whites serve as the reference group in all of the presented analyses. Because of racial/ethnic disparities in health outcomes, including controls for race/ethnicity is imperative. Moreover, a main question asked in this paper is whether the effects of inequality on health vary by racial/ethnic group.

The final two individual level variables that I include in my analysis are sex and education. Sex is a dichotomous variable that is coded at 1 for females and 0 for males. Again, previous research has often inferred significant health differences for males and females. Additionally, one of the main questions in this paper is how does the effect of inequality on self-rated health vary by sex. Education is a continuous variable that measures years of schooling completed and ranges from 0 to 20 with a median of 12 and a mean of 13.08. Because this sample only includes respondents over age 40 (ages 40-43 with a mean of 40.6), controls for age are not included.

Independent Variables: County Level. In addition to the individual level variables, there are three primary county-level variables included in the analysis. The key independent variable is county-level income inequality as measured by the gini coefficient. The gini coefficient of inequality is a commonly used indicator of income inequality that is calculated from the Lorenz curve. The Lorenz curve is a summary of inequality based on the income distribution in a defined area. It graphically represents the percent of total income that is earned by the population. Figure 1 illustrates a hypothetical Lorenz curve. In areas with very low levels of inequality, the Lorenz curve approaches the line of equality, where every household shares an equivalent proportion of income. The gini coefficient of inequality is a ratio of the area between the Lorenz Curve and the line of equality to the entire area under the line of equality. The gini

[5] Before transforming household income by taking the natural logarithm, I add one to each household's income value.

coefficient ranges from zero to one where zero represents perfect equality and one represents complete inequality. In these data, the average gini coefficient is .41 and ranges from .32 in the county with the lowest level of income inequality to .51 in the county with the most inequality.

[FIGURE 1 ABOUT HERE]

Given that (non)metropolitan status is of central interest in this paper, I included a county-level indicator of whether a county falls within a Metropolitan Statistical Area boundary. Two prior studies have found evidence of a greater impact of inequality on the health and mortality of non-metropolitan residents (Blakely, Lochner and Kawachi 2002 ; McLauglin, Stokes and Nonoyama 2001). This finding will be explored in the analysis to follow. Counties that are non-metropolitan are coded as one and metropolitan counties are zero.

The third county-level predictor included in my analysis is county median income. Including median county income allows me to account for the absolute level of income in the county as well as the inequality in the distribution of income. Median income is expressed in thousands of dollars in the analysis.

Table 1 provides a descriptive statistics for the variables used in the analysis. The means for categorical and dummy variables are interpreted as the proportion of the sample that falls into a particular group or category. I also include the standard deviation and the range of scores for each variable. The dependent variable, self-rated health, includes five possible response categories. The vast majority of the sample (86%) report excellent (22%), very good (37%), or good health (27%). Only about one in seven (14%) report either fair of poor health. Half of the sample is white, 32% is black and 18% is Hispanic. Females make up slightly more than half of the sample (52%). The average level of educational attainment is about one year beyond high school. Forty-six percent of respondents reported some spousal income. This income is included in the calculation of household income. Finally, 22% of respondents reported receipt of some sort of supplementary income (e.g., welfare, food stamps, disability, etc.).

Table 1 also includes descriptive statistics for the county-level variables. The average level of income inequality, as measured by the gini coefficient, is .41. Median county income ranges from $16,931 annually to nearly $83,000. Thirty percent of counties included in the analysis are non-metropolitan. However, only 17 percent of the respondents in the sample reside in these counties.

[TABLE 1 ABOUT HERE]

Method

In this paper I use a multilevel model to investigate, primarily, if a relationship between income inequality and health exists when the appropriate controls are included. I also explore whether the effect of inequality on health varies by metropolitan status, sex of respondent, household income and race/ethnicity. My hypotheses are tested using a multilevel model to predict individual self-rated health as an ordinal outcome. Ordinal regression assumes parallel regression slopes at each level of the dependent variable. To test the parallel regressions assumption, I used the Brant test in STATA on an ordered logit model that includes all of my covariates and is clustered by county. The slope for logged household income violates the parallel regression assumptions with a chi-squared of 11.17 and a p-value of .01. The slopes for logged household income decrease with increasing levels of health, suggesting that household income is strongly related to health. The slopes were as follows: for y>1 (poor) = .21; y>2 (fair) =.13; y>3 (good) = .09; y>4 (very good) = .06. Because the relationship is consistently decreasing, and does not change directions, the violation can be ignored in favor of the efficiency gained from an ordinal versus a multinomial model (Pampel 2006). The slope for the indicator that a spouse made a contribution to household income was also significant at the .05 level. However, like household income, the slope consistently decreases.

Using a multilevel approach allows for modeling the effect of county-level attributes on health while controlling for individual-level characteristics, such as sex, race/ethnicity, income and educational attainment. All models include a random intercept, which allows the intercept to vary across counties. Restricted maximum likelihood estimation is employed in the HLM software for the analysis. All results are reported using robust standard errors to account for possible variance in the error term or heteroskedasticity.

In the first part of my analysis, I examine the relationship between income inequality and health by estimating a series of models with various control variables. In the first model, I estimate the bivariate association between income inequality and health. The second model adds the remaining two county-level predictors: non-metropolitan status and median income. In the third model, I estimate the effect of inequality net of three individual-level characteristics: race/ethnicity, sex and education level. This model is a simple test of the robustness of any relationship between income inequality and health. Next, I add to the third model by including the three individual level household income variables: logged household income, the spouse

income flag and the dummy variable indicating receipt of welfare or other income. This model is a more stringent test of the robustness of the effect of income inequality. Finally, the fifth model estimates the effect of inequality net of all control variables. This model tests my first hypothesis (H1) that income inequality negatively effects health when the appropriate controls are included.

In the second part of the analysis, I relax the assumption that the effect of income inequality is the same for all respondents in my sample. The first model tests my second hypothesis (H2) that inequality negatively impacts the health of non-metropolitan residents more strongly than it effects metropolitan residents. In this model, I include a multiplicative interaction term between income inequality and the non-metropolitan dummy. I next turn my attention to the cross-level interactions between county-level inequality and individual level covariates. The second model in this part of the analysis examines whether the effect of inequality is greater for women than for men. In this model, I include a cross-level interaction between income inequality and sex in addition to all of the other relevant individual and county-level controls. Next, I estimate a model that tests my hypothesis that the effect of inequality will vary by household income (H4). In this model, I include a cross level interaction between income inequality and logged household income. Finally, I test my hypothesis of differential effects of income inequality by race/ethnicity (H5). In this model, I include cross-level interactions between income inequality and the two race/ethnicity dummies: black and Hispanic.

Findings

The first set of estimations tests the hypothesis that income inequality impacts health. Higher values of the dependent variable are associated with better health since self-rated health ranges from 1 = poor to 5 = excellent. Model 1 of Table 2 shows the bivariate relationship between income inequality and health. The negative and significant coefficient (-4.02) confirms an association between inequality and health in the absence of any controls. Next, I examine the relationship between income inequality and health when county median income and metropolitan status are included as predictors. The coefficient for inequality remains negative (-1.74) but does not retain statistical significance. Supplementary analysis reveals that median income is primarily responsible for the change in the effect of income inequality on self-rated health from significant in Model 1 to non-significant in Model 2. Model 3 shows the effect of inequality on heath when basic demographic characteristics (not including income) are included. Here, I

estimate the effects of inequality net of sex, race/ethnicity and years of education. The results demonstrate that the effect of inequality on health disappears when individual-level controls are added. In this case, the coefficient for inequality remains negative (-.93) but is less than three-fifths it's standard error. Supplementary analysis reveals that the racial/ethnic dummy variables, black and Hispanic, are primarily responsible for the loss of significance of income inequality in Model 3 compared to Model 1. When individual income variables are added to the model, as is done in Model 4, the association between inequality and health remains non-significant. Model 5 adds to Model 4 by including the remaining two county-level variables back into the model. This full model is the main test of H1 that inequality negatively impacts health net of all relevant individual and county level controls. Consistent with the evidence for Model 2 through 4, these results provide no support for this hypothesis. The coefficient for income inequality is non-significant in this model demonstrating that inequality has no independent effect on self-rated health net of these controls. Although inequality is statistically related to health in the bivariate model (Model 1), the association is not robust when any additional set of controls are included (Models 2 – 5).

[TABLE 2 ABOUT HERE]

The other findings that emerge from the results of the full model are not unexpected. Self-rated health for women is significantly lower than men's (the reference category) and black respondents report significantly worse health than do whites (the reference category). Stated another way, at average levels of inequality net of all appropriate controls, women report worse health compared with men (-.20). The same is true for black respondents compared to whites (-.33). The coefficient for Hispanic is negative (-.22) and while not significant according to conventional standards, is worthy of note given that it is more than one and a half times its standard error. The results for the other individual-level characteristics in the model are, like sex and race/ethnicity, in the expected direction. The coefficient for education (.11) indicates that as education rises, health improves. Likewise, the household income coefficient (.12) demonstrates that as income rises, the predicted value on the health scale also improves. Not surprisingly, respondents who report receipt of welfare, disability or other income are considerably more likely to report worse health than are those who did not receive other income (-.63). Neither the coefficients for county-level median income nor metropolitan status reach statistical significance in Model 5.

Although I find no effect for inequality net of the appropriate individual and county-level controls, it remains possible that the effect of inequality may vary by certain factors. If, for example there is an effect of inequality for residents of non-metropolitan counties but not for residents of metropolitan counties, then Model 5 in Table 2 may not detect any income inequality effect when in fact it exists for respondents living in non-metropolitan counties. Table 3 shows the results from four inequality interaction models. In order to test my second hypothesis (H2) that income inequality impacts the health of non-metropolitan residents more so than metropolitan residents, I estimate a model with a multiplicative interaction between income inequality and non-metropolitan status. Results from this analysis are reported in Model 1 of Table 3. The coefficient for the interaction term (-3.15) is negative, as predicted, but not significant. Therefore, I find no support for my hypothesis (H2) that predicts differences in the effect of inequality on health for non-metropolitan residents in these data.

[TABLE 3 ABOUT HERE]

Model 2 in Table 3 relaxes the assumption that the effect of inequality on health operates the same both men and women by including a cross-level interaction between inequality and sex. The results for Model 2 demonstrate that the effect of being female is negative and significant (-.19), similar to the finding in Model 5 of Table 2. However, neither the coefficient for the interaction term (-1.96) nor the main effect of inequality (1.70) is significant. This indicates that the effect of inequality for men (1.70) is not statistically significant and that the difference in the effect of inequality for women versus men (-1.96) is also non-significant. The effect of inequality for women (-.26), also non-significant, is calculated by adding the coefficients for income inequality and the interaction term.[6] This model tests my third hypothesis (H3) that the effect of inequality on health will be stronger for women than for men. Although the difference in the effect of inequality is negative, as expected, the coefficient is not significant. Therefore, I find no support for my hypothesis that the effect of inequality is greater for women than for men.

To estimate differential effects of income inequality on health by income levels, I estimate Model 3 in Table 3, which includes a cross-level interaction between logged household income and income inequality. The coefficient for this interaction is not significant, suggesting

[6] Supplementary analysis that changes the reference category from men to women reveals that the effect of inequality on women's health is non-significant.

no differential effects by individual income. Therefore, I fail to find support for my hypothesis (H4) that income inequality impacts health differently at different levels of individual income.[7]

My final hypothesis (H5) that the effect of inequality varies by race/ethnicity is tested in Model 4 of Table 3. This model includes cross-level interactions between income inequality and both race/ethnicity dummy variables, black and Hispanic. The results indicate that in fact there are racial/ethnic differences in inequality's impact onhealth. The effect of income inequality for whites, the reference group, is the main effect of inequality reported in Model 4. The coefficient for income inequality is -3.64 and is not significant. The coefficient for income inequality for blacks is 2.85 (6.49 – 3.64). Supplementary analysis that changes the reference group from whites to blacks reveals that this coefficient is not significant (p-value = .31). The coefficient for income inequality for Hispanics is 6.56 (10.20 – 3.64) and also is not statistically significant (p-value = .11). However, the significant interaction terms, for blacks and for Hispanics, indicate that the differences in the effect of inequality between blacks and whites and between Hispanics and whites are significant.[8] This is an interesting finding given that the effect of being black or Hispanic is significant and negative (-.37 and -.31, respectively). That is, while blacks and Hispanics report worse health than whites at the average level of inequality, the health differentials between blacks/Hispanics and whites decrease as income inequality increases. In fact, at higher levels of inequality, there is no statistically significant difference between the health of blacks, Hispanics and white, net of all other covariates.[9] These results are supportive of my final hypothesis (H5) that the effect of income inequality on health varies by race/ethnicity. However, despite significant differences between whites and blacks and whites and Hispanics, the effect of inequality on individual-level self-rated health is not statistically significant for any of the three racial/ethnic groups.

Given the interesting interaction between inequality and race/ethnicity revealed in Model 4 of Table 3, a more detailed investigation seemed warranted. In order to better understand this

[7] It is common for researchers to perform analysis where income is divided into several categories. I estimated a series of models where household income was transformed into five categories: income greater than one standard deviation above the mean; income between the mean and one standard deviation above the mean; income between one standard deviation below the mean and the mean; income less than one standard deviation below the mean; and those who report no household income. Supplementary analysis that rotates the reference group and includes interactions between each income category and income inequality confirms my finding above of no statistically significant interaction between income inequality and household income.

[8] Supplementary analysis reveals no statistical difference in the effect of inequality between blacks and Hispanics.

[9] Supplementary analysis that is not displayed in this paper indicated that the differences between blacks and whites and between Hispanics and whites were not significant at higher levels of income inequality.

relationship, I calculate a series of predicted probabilities of reporting fair or poor health for whites, blacks and Hispanics separately, while holding all other variables constant at their mean level. Figure 2 illustrates the differential effects of inequality by race/ethnicity on the probability of reporting fair or poor health. The derived predicted probabilities are shown at the first through ninth deciles of income inequality for each racial/ethnic group. In other words, ten percent of each racial/ethnic group live in counties with income inequality that fall below the first point on their respective line and ten percent live in counties with higher levels of inequality than the last point on their line. Therefore, figure 2 depicts the range of inequality where the vast majority – 80% – of each racial/ethnic group live. Note that the line for white respondents begins and ends at lower levels of inequality than do the lines for blacks and Hispanics. This indicates that on average, whites are living in counties that have lower levels of inequality than do blacks or Hispanics.

[FIGURE 2 ABOUT HERE]

The evidence in Figure 2 clearly shows that as income inequality increases the health gap between blacks/Hispanics and whites narrows. At high levels of inequality, there is no statistical difference among the three racial/ethnic groups. Although the line for whites gently slopes upward as inequality increases, indicating that health worsens as inequality rises, this effect is not statistically significant, as reported above. Consistent with the findings reported in Table 3, the effect of inequality on health for both blacks and Hispanics is negative although not statistically significant. However, at low levels of income inequality blacks and Hispanics are statistically more likely to report fair or poor health then are whites. As inequality increases, the differences between blacks/Hispanics and whites decreases and at high levels of inequality, the differences in the probability of reporting fair or poor health between whites and other groups is no longer statistically significant.[10]

Given the finding of differential effects of race/ethnicity in low, but not in high, inequality counties, I was concerned that low inequality counties were compositionally different for blacks and Hispanics than for whites. That is, for whites, low levels of income inequality might be associated with relative affluence but for blacks and Hispanics low levels of inequality might be associated with concentrated poverty and disadvantage. Descriptive statistics on the residents of counties with the highest and lowest levels of inequality and on the characteristics of

[10] See footnote 9 earlier in paper.

the counties, themselves, reveal that low inequality counties have relatively similar makeup for all racial/ethnic groups. Panel A of Table 4 illustrates that counties that have the highest levels of inequality are relatively similar for blacks, Hispanics and whites. Not surprisingly, blacks and Hispanics in the sample are overrepresented in counties that fall in the higher quartile of inequality. Panel B of Table 4 shows the same descriptive statistics for counties with the lowest levels of inequality. While whites are overrepresented in low inequality counties (over 37% of all whites in the sample), they do not appear to be living in areas that are substantively different from those occupied by blacks and Hispanics residing in low inequality counties. For example, there are no real differences by race among low inequality counties in terms of median income. The average median income for low inequality counties is above 50,000 for all three racial/ethnic groups. Clearly, low inequality counties are indicative of greater levels of affluence for blacks and Hispanics, as well as for whites.

[TABLE 4 ABOUT HERE]

Discussion

In general, this study fails to find an independent effect of income inequality on health, net of other relevant individual and county-level characteristics. Nor was there a significant interaction between metropolitan residence, sex or income and inequality. However, the results from the race/ethnicity and inequality interaction provide scholars with an important next step for research. That is, the health benefits derived from living in areas of relative income equality are not equally shared across racial and ethnic groups. White residents of counties with low levels of inequality report significantly better self-rated health than do the racial/ethnic minority groups controlling for education, family income and other relevant factors. Blacks and Hispanics who live in counties with low levels of inequality not only report worse health than whites in low inequality counties, they also report worse health than their same race/ethnicity counterparts living in counties with higher levels of inequality.[11] The negative association between income inequality and health therefore does not hold for any of our racial/ethnic groups. In fact, blacks and Hispanics actually report better health as income inequality rises, though, again, the relationship is not statistically significant for either group.

[11] The latter relationship is not statistically significant (difference between health for blacks at average levels of inequality versus blacks at high levels of inequality AND difference for Hispanics at average versus high levels of inequality.).

Given these rather unexpected findings, I now consider some rationale for the apparent racial/ethnic differences under different inequality conditions. In light of the mechanisms discussed earlier in this paper, it seems that there are a few possibilities. It is feasible that the psychosocial explanations linking income inequality and health might account for the health advantage for whites in low inequality areas. At the macro level, we might consider that whites are able to take advantage of the benefits of social capital and social cohesion in low inequality areas better than blacks and Hispanics. Although social capital has become a catchall phrase, researchers are choosing characteristics that are consistent with the concept of social capital (social trust, civic participation, community bonding etc.) to study potential contextual effects. Subramanian, Kim and Kawachi (2002) find that community social capital, as measured by social trust, promotes better health in individuals who are themselves more trusting. They also report a high correlation between being black and being low trusting. Therefore, it seems reasonable to ask if whites are more trusting in low inequality areas than blacks and Hispanics. It is also worth considering how racial/ethnic prejudices and discrimination might affect levels of trust for minority groups even (or especially) in areas with low levels of income inequality. A follow-up to the 2000 Subramanian, Kim and Kawachi study might include racial/ethnic interactions to get at differential effects of social capital by race/ethnicity.

Poortinga (2006b) finds that community trust is an independent predictor of health net of individual social ties and trust. Again, exploring potential racial/ethnic interactions seems like a logical next step for researchers. Poortinga also finds that individual relationships/networks are an important contributor to good health. It seems plausible that the network structures for minority residents in largely more affluent areas are different from, and less dense than, those for whites. Examining differences in the density of social ties and networks may also provide interesting information on why blacks and Hispanics do not experience the same health advantage of whites in low inequality areas. Finally, it is argued that only those who are both willing and able to access resources, like social capital, are rewarded with its benefits (Poortinga 2006b). Studying racial/ethnic differences in community trust may get at willingness to access social capital. Ability to access social capital may be harder to address. Focus groups similar to those conducted by Davidson, Kitzinger and Hunt (2006) may be a good place to start.

Explaining why health disparities between whites and blacks and whites and Hispanics decrease as inequality rises is a more difficult task and requires additional attention. Perhaps

blacks and Hispanics in low inequality areas face stress associated with being a member of a minority group in an area that may be largely inhabited by non-minorities. This same stress may not be present as inequality increases because neighborhoods may become increasingly heterogeneous. Also, in high inequality counties, which tend to be less affluent, blacks and Hispanics may be comparing themselves to different groups than they were in low inequality, more affluent, areas. The comparison to these folks might raise the bar for what is considered "fair" or "poor" health by the respondent. There may also be racial/ethnic differences in how people rate their health or compare themselves to others. Of course, this is merely speculation and requires further investigation. Researchers could build on the study by Hill, Ross and Angel (2005) that examines the relationship between neighborhood disorder and psychological and physiological stress. Perhaps researchers could look for racial/ethnic differences in stress responses in low and high inequality areas.

These findings provide an interesting avenue through which health disparities can be explored. Future health research that examines both racial/ethnic differences in low inequality areas and racial/ethnic similarities in high inequality areas would likely contribute to the field. Inclusion of additional racial/ethnic minorities in the analysis may also prove interesting. Furthermore, confirmation of these findings by using alternate data and testing multilevel models at different units of aggregation (e.g. census tract, metropolitan area, state) would be useful.

REFERENCES

Beckfield, Jason. (2004). Does Income Inequality Harm Health? New Cross-National Evidence. *Journal of Health and Social Behavior,* 45(September): 231-248.

Boardman, Jason D., Brian Karl Finch, Christopher G. Ellison, David R. Williams and James S. Jackson. (2001). Neighborhood Disadvantage, Stress and Drug Use among Adults. *Journal of Health and Social Behavior*, 42(June): 151-165.

Blakely, Tony A., J. Atkinson, D. O'Dea. (2003). No Association of Income Inequality with Adult Mortality within New Zealand: A Multilevel Study of 1.4 Million 25-64 Year Olds. *Journal of Epidemiology and Community Health,* 57: 279-284.

Blakely, Tony A., Kimberly Lochner and Ichiro Kawachi. (2002). Metropolitan Area Income Inequality and Self-Rated Health: A Multi-level Study. *Social Science and Medicine,* 54: 65- 77.

Craig, Neil. (2005). Exploring the Generalisability of the Association between Income Inequality and Self-assessed Health. *Social Science and Medicine,* 60: 2477-2488.

Daly, Mary C., Greg J. Duncan, George A. Kaplan and John W. Lynch. (1998). Macro-to-micro Links in the Relation between Income Inequality and Mortality. *The Millbank Quarterly,* 76(3): 315-339.

Davidson, Rosemary, Jenny Kitzinger and Kate Hunt. (2006). The Wealthy Get Healthy, the Poor Get Poorly? Lay Perceptions of Health Inequalities. *Social Science and Medicine,* 62: 2171-2182.

Deaton, Angus. (2003). Health, Inequality and Economic Development. *Journal of Economic Literature,* 41: 113-158.

Deaton, Angus and Darren Lubotsky. (2003). Mortality, Inequality and Race in American Cities and States. *Social Science and Medicine, 56: 1139-1153.*

Diez-Rouz, Ana V., Bruce G. Link and Mary E. Northridge. (2000). A Multilevel Analysis of Income Inequality and Cardiovascular Disease Risk Factors. *Social Science and Medicine,* 50: 673-687.

Fiscella, Kevin and Peter Franks. (1997). Poverty or Income Inequality as Predictor of Mortality: Longitudinal Cohort Study. *British Medical Journal,* 314(7096): 1724-1727.

Hill, Terrence D., Catherine E. Ross and Ronald J. Angel. (2005). Neighborhood Disorder, Psyhophysiological Distress, and Health. *Journal of Health and Social Behavior,* 46(June): 170-186.

Hou, Feng and John Myles. (2005). Neighbourhood Inequality, Neighborhood Affluence and Population Health. *Social Science and Medicine,* 60: 1557-1569.

Idler, Ellen L. and Yael Benyamini. (1997). Self-rated Health and Mortality: A Review of Twenty-seven Community Studies. *Journal of Health and Social Behavior,* 38(1): 21-37.

Kaplan, George A., Elise R. Pamuk, John W. Lynch, Richard D. Cohen, Jennifer L. Balfour. (1996). Inequality in Income and Mortality in the United States: Analysis of Mortality and Potential Pathways. *British Medical Journal,* 312(7037): 999-1003.

Kawachi, Ichiro, Bruce P. Kennedy and Roberta Glass. (1999). Social Capital and Self-rated Health: A Contextual Analysis. *American Journal of Public Health,* 89: 1187-93.

Kennedy, Bruce P., Ichiro Kawachi, Roberta Glass and Deborah Prothrow-Stith. (1998). Income Distribution, Socioeconomic Status and Self-rated Health in the United States: Multilevel Analysis. *British Medical Journal,* 317(7163): 917-921.

LeClere, Felicia B., Richard G. Rogers and Kimberley D. Peters. (1997). Ethnicity and Mortality in the United States: Individual and Community Correlates. *Social Forces,* 76(1): 169-199.

Lochner, Kim, Elsie Pamuk, Diane Makuc, Bruce P. Kennedy and Ichiro Kawachi. (2001). State Level Income Inequality and Individual Mortality Risk: A Prospective, Multilevel Study. *American Journal of Public Health,* 91(3):385-91.

Long, J. Scott and Jeremy Freese. (2003) Regression Models for Categorical Dependent Variables Using Stata. College Station, Texas: Stata Press.

Lynch, John W., George Davey Smith, George A. Kaplan, James S. House (2000). Income Inequality and Mortality: Importance to Health of Individual Income, Psychosocial Environment, or Material Conditions. *British Medical Journal*. 320(7243):1200-1204.

Macinko, James A., Leiyu Shi, Barbara Starfield and John T. Wulu, Jr. (2003). Income Inequality and Health: A Critical Review of the Literature. *Medical Care Research and Review,* 60(4): 407-452.

Manor, Orly, Sharon Matthews and Chris Power. (2000). Dichotomous or Categorical Response? Analysing Self-rated Health and Lifetime Social Class. *International Journal of Epidemiology*, 29: 149-157.

McLaughlin, Diane K., C. Shannon Stokes and Nonoyama, Atsuko. (2001). Residence and Income Inequality: Effects on Mortality among U.S. Counties. *Rural Sociology*, 66 (4): 579-598.

Pampel, Fred C. (2006). Socioeconomic Distinction, Cultural Tastes, and Cigarette Smoking. *Social Science Quarterly,* 87(1):19-35.

Poortinga, Wouter. (2006a). Social Capital: An Individual or Collective Resource for Health? *Social Science and Medicine,* 62: 292-302.

_____. (2006b). Social Relations or Social Capital? Individual and Community Health Effects of Bonding Social Capital. *Social Science and Medicine*, 63: 255-270.

Soobader, Mah-Jabeen and Felicia B. LeClere. (1999). Aggregation and the Measurement of Income Inequality: Effects on Morbidity. *Social Science and Medicine,* 48: 733-744.

Stafford, M., S. Cummins, S. Macintyre, A. Ellaway and M. Marmot. (2005). Gender Differences in the Associations between Health and Neighborhood Environment. *Social Science and Medicine,* 60: 1681-1692.

Smith, George Davey. (1996) Income Inequality and Mortality: Why are they Related? *British Medical Journal*, 312(7037): 987-389.

Subramanian, SV and Ichiro Kawachi. (2003). The Association between State Income Inequality and Worse Health is not Confounded by Race. *International Journal of Epidemiology,* 32: 1022-1028

Subramanian, SV, Daniel J. Kim and Ichiro Kawachi. (2002). Social Trust and Self-rated Health in US Communities: A Multilevel Analysis. *Journal of Urban Health*, 79(4): s21-s34.

Wagstaff, Adam and Eddy van Doorslaer. (2000). Income Inequality and Health: What does the Literature Tell Us? *Annual Review of Public Health*, 21: 543-567.

Wilkinson, Richard G. (1992). Income Distribution and Life Expectancy. *British Medical Journal,* 304: 165-168.

_____. (1996). *Unhealthy Societies: Afflictions of Inequality.* London: Routlage.

_____. (1997). Commentary: Income Inequality Summarises the Health Burden of Individual Relative Deprivation. *British Medical Journal*, 314(7096):1727-8.

Figure 1. The Lorenz Curve used to Calculate the Gini Coefficient of Inequality

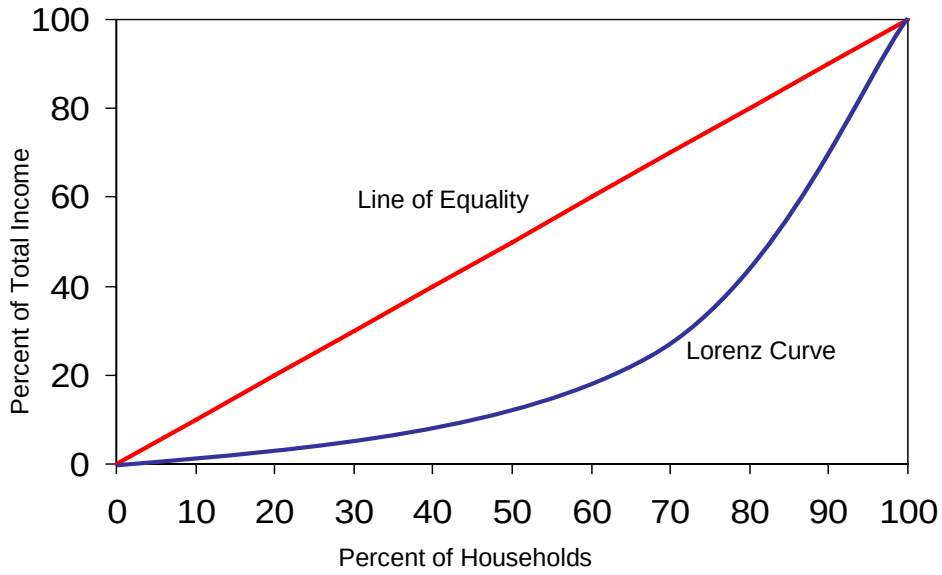
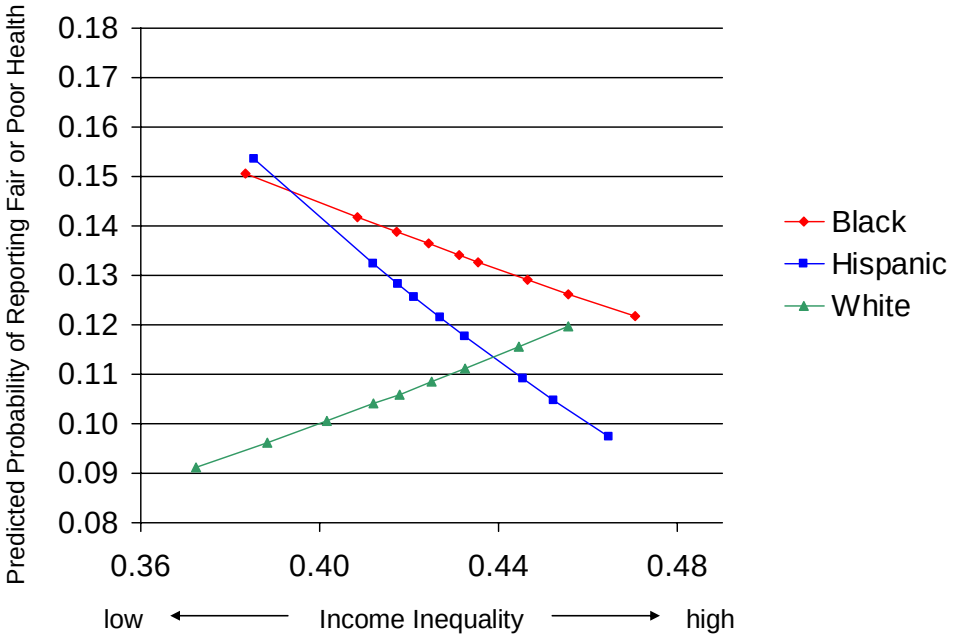


Figure 2. Predicted Probabilities of Reporting Fair or Poor Health by Race/Ethnicity and by Income Inequality[a]



[a] Income inequality deciles calculated for each racial/ethnic group separately.

Table 1. Descriptive Statistics and Descriptions of Variables Used in the Analysis

Variable	Mean	SD	Score Range
Individual Level Variables[a]			
Self-Rated Health			
Excellent	0.22	0.41	0 or 1
Very Good	0.37	0.48	0 or 1
Good	0.27	0.45	0 or 1
Fair	0.11	0.31	0 or 1
Poor	0.03	0.16	0 or 1
Race/Ethnic Group			
White	0.50	0.50	0 or 1
Black	0.32	0.47	0 or 1
Hispanic	0.18	0.39	0 or 1
Sex = Female	0.52	0.50	0 or 1
Education Level	13.08	2.51	0 to 20
Family Income (logged)	9.35	3.50	0 to 12.9
Spouse Income Flag	0.46	0.50	0 or 1
Other Income Dummy	0.22	0.42	0 or 1
County Level Variables			
Gini Coefficient	0.41	0.03	0.32 to 0.51
Median Income	41,759	11,067	16,931 to 82,929
Non-metropolitan	0.30	0.46	0 or 1

Note: the sample used in this analysis includes 1,774 individuals and 538 counties.
[a] Since only respondents who were 40 years and older were asked the health module, Age is not included in the analysis. The mean age for respondents in the sample used is 40.62 with a standard deviation of .69 and a range from 40 to 43.

Table 2. Results from Multilevel Models Predicting Self-Rated Health as and an Ordinal Outcome

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Sex (1=Female)			-.38***	-.20*	-.20*
			(.09)	(.09)	(.09)
Black			-.48***	-.32**	-.33**
			(.11)	(.11)	(.12)
Hispanic			-.24	-.20	-.22
			(.15)	(.14)	(.14)
Education			.17***	.11***	.11 ***
			(.02)	(.02)	(.02)
Log of Household Income				.12***	.12***
				(.02)	(.02)
Income from Spouse - Dummy				-.13	-.13
				(.10)	(.10)
Welfare/Other Income - Dummy				-.63***	-.63***
				(.12)	(.12)
Intercept	-1.27***	-1.30***	-3.16***	-3.60***	-3.57***
	(.06)	(.07)	(.27)	(.29)	(.29)
Level 2 Variables					
Income Inequality	-4.02**	-1.74	-.93	.24	.74
	(1.45)	(2.05)	(1.56)	(1.55)	(2.17)
Non-Metro		.02			-.05
		(.14)			(.15)
Median Income/1000		.01			.00
		(.01)			(.01)
Threshold 2	1.66***	1.67***	1.75***	1.80***	1.80***
	(.05)	(.05)	(.06)	(.06)	(.06)
Threshold 3	3.17***	3.17***	3.33***	3.48***	3.48***
	(.08)	(.08)	(.09)	(.09)	(.09)
Threshold 4	4.94***	4.95***	5.14***	5.40***	5.40***
	(.16)	(.16)	(.16)	(.16)	(.16)

Note: Standard errors are in parentheses; Number of individuals = 1,774; number of counties = 538. *** p < .001 ** p < .01 * p < .05 † p < .10 (two-tailed tests)

Table 3. Results from Multilevel Interaction Models Predicting Self-Rated Health as and an Ordinal Outcome

Independent Variables	Model 1	Model 2	Model 3	Model 4
Sex (1 = Female)	-.20*	-.19*	-.20*	-.20*
	(.09)	(.09)	(.09)	(.09)
Income Inequality		-1.96		
	(2.76)			
Black	-.33**	-.33**	-.34**	-.37**
	(.12)	(.12)	(.12)	(.13)
Income Inequality				6.49*
				(3.28)
Hispanic	-.22	-.22	-.19	-.31*
	(.14)	(.14)	(.15)	(.15)
Income Inequality				10.20*
				(4.73)
Education	.11***	.11***	.11***	.11***
	(.02)	(.02)	(.02)	(.02)
Log of Household Income	.12***	.12***	.14***	.12***
	(.02)	(.02)	(.02)	(.02)
Income Inequality			-.35	
		(.43)		
Income from Spouse - Dummy	-.13	-.13	-.14	-.13
	(.10)	(.10)	(.10)	(.10)
Welfare/Other Income - Dummy	-.63***	-.63***	-.61***	-.65***
	(.12)	(.12)	(.12)	(.12)
Intercept	-3.57***	-3.58***	-3.77***	-3.61***
	(.29)	(.29)	(.32)	(.30)
Level 2 Variables				
Income Inequality	1.26	1.70	3.80	-3.64
	(2.31)	(2.69)	(4.53)	(2.85)
Median Income/1000	.00	.00	.00	.00
	(.01)	(.01)	(.01)	(.01)
Non-Metropolitan Dummy	1.28	-.04	-.05	-.06
	(1.56)	(.15)	(.15)	(.15)
Non-Metro * Income Inequality	-3.15			
	(3.70)			
Threshold 2	1.80***	1.80***	1.80***	1.82***
	(.06)	(.06)	(.06)	(.06)
Threshold 3	3.48***	3.49***	3.51***	3.51***
	(.09)	(.09)	(.09)	(.09)
Threshold 4	5.40***	5.41***	5.52***	5.45***
	(.16)	(.16)	(.17)	(.16)

Note: Standard errors are in parentheses; Number of individuals = 1,774; number of counties = 538. *** p < .001 ** p < .01 * p < .05 † p < .10 (two-tailed tests)

Table 4: Desciptive Statistics on Counties and Residents of Counties with the Highest and Lowest Levels of Income Inequality, by Racial/Ethnic Group

Panel A: Counties with Income Inequality in the Highest Quartile (Gini above .436)

	Hispanic (N=116)		Black (N=225)		White (N=103)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Individual Level						
Household Income	41,948	41,681	27,712	35,921	56,399	60,322
Welfare Dummy	.14	.35	.23	.42	.08	.27
Education	12.28	3.33	12.60	2.02	13.50	2.92
Health Score	3.62	1.07	3.44	1.03	3.64	1.16
Proportion by Category						
Excellent (5)	.22	.41	.16	.37	.27	.45
Very Good (4)	.37	.49	.34	.47	.34	.48
Good (3)	.28	.45	.32	.47	.18	.39
Fair (2)	.08	.27	.15	.36	.17	.37
Poor (1)	.05	.22	.03	.17	.04	.19
County Level						
Median Income	35,131	7,183	34,593	6,562	35,880	6,657
Average Education	11.54	0.98	12.40	0.73	12.47	0.88
Proportion Black	.11	.12	.36	.14	.24	.16

Note: 35.6% of Hispanics, 39.9% of Blacks, and 11.7% of Whites in this sample live in counties that are in the highest quartile of inequality.

Panel B: Counties with Income Inequality in the Lowest Quartile (Gini below .395)

	Hispanic (N=41)		Black (N=76)		White (N=329)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Individual Level						
Household Income	40,416	40,889	42,183	35,707	65,373	53,346
Welfare Dummy	.15	.36	.08	.27	.03	.18
Education	12.34	3.01	13.28	2.36	13.45	2.16
Health Score	3.24	1.18	3.42	1.00	3.88	.92
Proportion by Category						
Excellent (5)	.20	.40	.14	.35	.27	.44
Very Good (4)	.15	.36	.33	.47	.43	.50
Good (3)	.46	.50	.36	.48	.23	.42
Fair (2)	.10	.30	.14	.35	.04	.20
Poor (1)	.10	.30	.03	.16	.02	.14
County Level						
Median Income	56,642	12,662	53,400	9,300	52,422	10,759
Average Education	13.30	.56	13.11	.63	13.15	.57
Proportion Black	.05	.05	.18	.17	.05	.05

Note: 12.6% of Hispanics, 13.5% of Blacks, and 37.2% of Whites in this sample live in counties that are in the lowest quartile of inequality.