Income Inequality, Population Aging, and Racial/Ethnic Health Disparities, 1990 – 2010

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Abstract Hundreds of studies examine the relationship between income inequality and population health. The Income Inequality Hypothesis argues that macro-level income inequality undermines individuals' health, regardless of individuals' own income. Empirical evidence for the hypothesis is mixed, but recent growth in income inequality within the U.S. may have substantial consequences for health if the hypothesis holds. Additionally, population aging increases the size of the at-risk population for many health problems, and may exacerbate any impact of income inequality. Disproportionately poor health among racial/ethnic minorities, combined with stratified access to health-promoting resources, suggests income inequality may also worsen already substantial racial/ethnic health disparities. This study tests the Income Inequality Hypothesis, and the potential moderating effect of population aging, on racial/ethnic differences in disability and self-rated health among U.S. metropolitan areas. Multilevel and fixed-effects regressions analyze the 1990 and 2000 5% Census samples, the 2010 American Community Survey (ACS), and the 1999–2001 and 2009–2011 Current Population Surveys (CPS). Results yield no support for the Income Inequality Hypothesis, or for any moderating effect of population aging. Moreover, there is some indication that rising income inequality is associated with narrowing racial/ethnic disparities. The conclusions emphasize the importance of considering multiple geographic scales and time points to test the Income Inequality Hypothesis more rigorously, and the applicability of this analytic approach to studies of other structural determinants of health.

Keywords: Racial and ethnic stratification; Homeownership; Housing markets; Urban inequality.

Introduction

The relationship between income inequality and negative outcomes for individuals is a prominent topic within social science, and increasingly in the public discourse (Wilkinson and Pickett 2009a,b). The potential impact of income inequality on health, the Income Inequality Hypothesis, is perhaps the most frequently studied and debated aspect of the broader topic (Kawachi and Kennedy 1999, 2002; Lynch et al. 2004; Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). The Income Inequality Hypothesis posits that income inequality undermines health for all individuals in a society, regardless one's position within it. As a result, even the most socioeconomically advantaged in a highly unequal society will have worse health than comparable members of a more equal society.

This hypothesis is particularly salient in light of recent surges in income inequality, particularly within the U.S. Income for the top percentiles of the distribution rapidly increases while wages and income for the bottom of the distribution stagnate (Piketty and Saez 2006; Volscho and Kelly 2012). Despite recent attention to the disproportionate income of the top one percent, there is a decades-long trend toward inequality for the the entire income distribution of individuals and families in the U.S. (McCall and Percheski 2010; Morris and Western 1999). The growth in inequality motivates renewed examination of its potential impact on health. However, recent changes also highlight the importance of analyzing trends in income inequality and health over time, rather than simply levels at a single point. If the Income Inequality Hypothesis holds for trends within the U.S., recent increases in inequality may lead to deteriorating population health for Americans in subsequent decades (Zheng 2012; Zheng and George 2012).

Aside from growth in inequality, the age distribution of the population rapidly grows older (Frey and DeVol 2000), with serious consequences for both population health (Martin and Preston 1994) and inequality (Pampel 1994). Negative health outcomes are concentrated among older adults. Increasing the size of the at-risk population for poor health outcomes may increase vulnerability to any negative impact of simultaneously increasing income inequality. However, the potential moderating impact of structural factors like population aging are left unexamined by current research on inequality and health.

Perhaps most notably, the implications of the Income Inequality Hypothesis for racial/ethnic health disparities also remain unclear. Health disparities, particularly between racial/ethnic groups, reflect the impact of stratification on individuals' and groups' physical and psychological well-being (Williams and Collins 1995). The magnitude and durability of health disparities make them especially relevant for evaluations of the Income Inequality Hypothesis within the U.S. context. Moreover, aging and health across the life course follow distinct patterns for different racial/ethnic groups (Martin and Soldo 1997). Then there is strong potential for stratified impacts of income inequality, and differential moderating effects of population aging.

This chapter of the dissertation empirically investigates the relationships between income inequality, population aging, and racial/ethnic health disparities. The chapter analyzes data from the 5% micro-data samples of the 1990 and 2000 decennial Census, the 2010 American Community Survey (ACS), and the 1999–2001 and 2009–2011 March Current Population Survey (CPS). I rigorously test the Income Inequality Hypothesis with multiple measures of inequality at the metropolitan level, and its potential impact on disability and self-rated health at the individual level. I also test for an interactive effect of local levels of population aging with income inequality.

Though basic aggregate patterns are consistent with the Income Inequality Hypothesis, results from detailed descriptive patterns and regression results provide no evidence for the hypothesis. There is also no empirical support for a significant moderating effect of population aging. Results from fixed-effects regression models suggest average health outcomes and some racial/ethnic disparities may actually improve as income inequality increases within metropolitan areas over time. Ultimately, the chapter's findings suggest the Income Inequality Hypothesis does not hold at the metropolitan level, but this analytic approach may be fruitfully applied to other structural determinants of health.

Theoretical Background

Hundreds of studies have empirically tested the Income Inequality Hypothesis (Lynch et al. 2004; Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). Theoretical debates center around what aggregate income inequality truly measures, and the potential mechanisms leading to worse health (Eberstadt and Satel 2004; Kawachi and Kennedy 1997, 1999). Reflecting the heterogeneity of potential mechanisms linking inequality to health, the geographic scale of comparison has a large influence on the proportion of studies supporting the hypothesis (Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). Despite numerous debates surrounding the theoretical and empirical underpinnings of the Income Inequality Hypothesis, its potential extension to racial/ethnic health disparities is notably absent. The methodology of past studies also faces serious critique (Beckfield 2004; Mellor and Milyo 2002). Finally, the potential for moderating structural processes like substantial increases in population aging warrant further modification and scrutiny of the classical formulation of the Income Inequality Hypothesis.

Along with considerable contributions by Ichiro Kawachi and Bruce Kennedy (Kawachi and Kennedy 1997, 1999, 2002), Richard Wilkinson (Wilkinson 1996, 2005; Wilkinson and Pickett 2006, 2009b) is perhaps the most vocal proponent of the Income Inequality Hypothesis. Wilkinson's articulation of the hypothesis argues that income inequality reflects a society's level of class stratification, and lack of social cohesion. Indeed, Wilkinson (2006) frames the Income Inequality Hypothesis as a re-interpretation of classic and well established literature on the social gradient in health.

Income inequality is most frequently measured with the Gini index, and compared between developed countries (Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). However, recent growth in income inequality within the U.S. (McCall and Percheski 2010; Piketty and Saez 2006; Volscho and Kelly 2012) may have serious consequences for population health if the hypothesis holds. Then, the Income Inequality Hypothesis is the first and primary hypothesis of this dissertation chapter:

Hypothesis 1 (Income Inequality Hypothesis): Individuals in metropolitan areas with greater income inequality have worse average health.

An array of studies documents a significant positive relationship between the Gini index of income inequality and several health outcomes: higher mortality, lower life expectancy, more disability and chronic conditions, higher mental distress and disorder, and worse self-rated health (Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). In what may be the most popularized articulation of the Income Inequality Hypothesis, Wilkinson and Pickett's *The Spirit Level* (2009b) emphasizes the similarity of this relationship between countries and between states within the U.S. Additionally, this literature highlights that negative health outcomes are *not* significantly related the overall level of income at the state or country level.

In their comprehensive review, Subramanian and Kawachi (2004) highlight three specific theoretical mechanisms or pathways for an emergent effect of income inequality on individual health. First, income inequality may have a causal effect on residential segregation, and the concentration of poverty and deprivation subsequently has deleterious effects on residents' health (Entwisle 2007; Kawachi and Berkman 2003; Macintyre and Ellaway 2003). Second, income inequality may hinder social cohesion and aggregate social capital, depriving individuals of health-promoting support networks (Browning and Cagney 2002; Sampson 2003). Finally, income inequality may undermine progressive social policies, and the provision of public goods such as welfare, child care, disability assistance, and unemployment insurance (Kawachi and Kennedy 1999; Subramanian and Kawachi 2004). A lack of adequate public provision increases deprivation among the disadvantaged, ultimately causing negative health outcomes.

The geographic scale of the studies has important implications for the strength of the estimated relationship between inequality and health. Income inequality is most strongly related to health when comparing societies at the country level, and the strength of the relationship is weaker the smaller the region (Subramanian and Kawachi 2004). Some studies find significant relationships between metropolitan-level income inequality and mortality (Lynch et al. 1998; Shi and Starfield 2001; Wilkinson and Pickett 2006), but many find no support for the Income Inequality Hypothesis at the metropolitan-level (Deaton and Lubotsky 2003; Mellor and Milyo 2002; Sturm and Gresenz 2002). However, the theoretical pathways for the hypothesis may be particularly relevant within metropolitan areas. The spatial division of poverty and affluence largely occurs within metropolitan areas (Massey 1996; Massey and Fischer 2000), and the instrumental value of individuals' social capital and social networks for health is primarily contained within neighborhoods or cities (Kawachi and Berkman 2003; Sampson 2003). The mixture of empirical results despite these theoretical arguments motivate further scrutiny.

Inequality in the urban context also raises the question of racial/ethnic stratification. The spatial segregation of poverty and disadvantage is inextricable from racial/ethnic segregation (Massey and Denton 1993; Massey and Fischer 2000). Deaton and Lubotsky (2003), among others, criticize research on the Income Inequality Hypothesis for confounding overall income inequality and health outcomes with racial stratification. Their study finds no effect of income inequality when controlling for the proportion of the local black population in the metropolitan area. Another of the few studies to explicitly examine racial stratification in the Income Inequality Hypothesis is Shi and Starfield's (2001) analysis of metropolitan-level income inequality and mortality. The study's results find a stronger positive relationship between the Gini coefficient in income inequality and the black mortality rate than the white mortality rate in 1990. However, the study lacks individual-level data, includes a limited number of control variables, and examines mortality as the only measure of health. A rigorous examination of the Income Inequality Hypothesis and racial/ethnic health disparities remains notably absent in the literature, motivating this chapter's second hypothesis:

Hypothesis 2: Greater metropolitan-level income inequality is significantly associated with larger racial/ethnic health disparities.

Aside from evaluating the potential for racial and ethnic stratification, this chapter addresses two additional extensions of past research. First, the methodology of many studies on the Income Inequality Hypothesis is subject to critique (Beckfield 2004; Eberstadt and Satel 2004; Gravelle et al. 2002; Judge et al. 1998; Mellor and Milyo 2002). Perhaps the most significant empirical limitation is reliance on single cross sections of data. The literature tends to support the hypothesis that societies with high levels of income inequality tend to have lower levels of health. However, the relationship between changes or trends in income inequality and health over time is less well established. Beckfield (2004) finds no significant effect of income inequality on health cross-nationally when controlling for fixed characteristics of countries. Similarly, Mellor and Milyo (2002) find no significant effect at the state or metropolitan level when controlling for fixed effects of these regions. This chapter incorporates this critique in its evaluation of the Income Inequality Hypothesis, and examines the role of temporal variation in the relationships at hand.

The chapter's second extension of past research considers potentially moderating contextual effect of local levels and rates of population aging. The rate of population aging within the U.S. has accelerated in recent decades (Martin and Preston 1994). The youngest members of the Baby Boomer generation turned 40 years old in the mid 2000s, and the proportion of the population over this age reached the highest point in U.S. history (Suzman 2010). Morbidity and disability are concentrated among middle-aged and older adults, implying that the at-risk population for such conditions is growing alongside increasing economic inequality. When considering that public goods and service provision is one of the potential pathways for inequality's negative effect on population health (Kawachi and Kennedy 1999), the increasing demand for health services among an aging population suggests that economic inequality may be even more salient for population health than before (Pampel 1994). Rates of population aging are also unevenly distributed between metropolitan areas. For example, the rate of growth for the over-65 population in cities like Las Vegas, NV, and Anchorage, AK were more than double the rates in Austin, TX, and Flagstaff, AZ in the 1990s (Frey and DeVol 2000). The geographic variation in rates of population aging make the metropolitan level particularly interesting to test its relationship to income inequality and health.

Hypothesis 3: The relationship between metropolitan-level income inequality and negative health outcomes is stronger in areas with greater population aging.

Finally, any interactive effect of income inequality and population aging on health may also be stratified by race/ethnicity. If population aging increases competition for health resources, then racial/ethnic minorities likely face greater exclusion than whites due to persistent discrimination in health care services (Williams et al. 2003). Increases in income inequality in areas with greater population aging may also have racially stratified effects to the extent that minorities face reduced resource availability combined with greater competition.

Hypothesis 4: The interactive relationship between income inequality and population aging is associated with larger racial/ethnic health disparities.

Data and Methods

This chapter analyzes data from two sources. The 5% micro-data samples from the 1990 and 2000 decennial Censuses, and the 2010 American Community Survey (ACS) are used to estimate metropolitan-level characteristics, and analyze disability among individuals. The 1990 decennial Census is the first year to collect disability information. The March CPS first includes self-rated health in 1996, so the chapter also uses data from the 1999–2001 and 2009–2011 waves to examine self-rated health among individuals.[1] All data are accessed through the Integrated Public Use Micro-Data Series at the University of Minnesota (King et al. 2010; Ruggles et al. 2010).

The analytic samples include adults over 45 years-old.[2] The sample drawn from the decennial Census and ACS includes 3,150,422 respondents living in a balanced panel of 238 MSAs.[3] The sample from the CPS contains 116,052 respondents in a balanced two-wave panel of 197 MSAs.

Disability and Poor Health

The first dependent variable is a dichotomous indicator for currently being *Disabled*. The variable is coded as one if the individual reports having difficulty with any activities of daily living (ADLs), which include self-care activities such as "bathing, dressing, or getting around inside the home." The Census and ACS also ask about difficulty with any instrumental activities of daily living (IADLs), which include ba-

[1]The three waves around each Census year are pooled to yield larger sample sizes within MSAs for estimating self-rated health in 2000 and 2010. However, the CPS uses a rotating panel design with eight rotation groups. In each year, the first four rotation groups of each month are re-interviewed in the same month of the following year, but panel identifiers for individuals are not available. This chapter examines only the fourth through eighth rotation groups of consecutive years to avoid unobserved repeated observations at the individual level.

[2]The sample is restricted to those over 45 years old because there is less meaningful heterogeneity in health among younger adults. Alternative analyses among adults over 65 years-old yield comparable substantive findings.

[3]Similar to Chapter 2, the analyses use a 25% random subsample of whites from the 1990 and 2000 waves of decennial Census data to facilitate model estimation. The survey sample weights are adjusted accordingly.

sic activities like “going outside the home alone, for example, to a shop or visit a doctor’s office.” However, there is some discrepancy in the the reporting of IADL disability between the decennial Census and the ACS.[4] I restrict the primary analyses to ADL disability, but additional analyses of ADL and IADL disability separately and together all yield similar substantive conclusions. The 2000 decennial Census and the ACS also collect data on functional limitations, which include difficulty “walking, climbing stairs, reaching, lifting, or carrying.” Supplemental analyses on the 2000 Census and 2010 ACS examine functional limitations as the dependent variable, and disability defined as the presence of any functional limitations, or difficulties with ADLs or IADLs. Again, all substantive conclusions are comparable to those presented here.

The left-hand panel of Figure 1 presents trends in minority-white percentage-point differences in the proportion *Disabled* in the analytic sample. The differences between whites and all groups decline substantially between 1990 and 2000. The black-white difference in disability continues to decline from 2000 to 2010, but less rapidly. The Latino-white and Asian-white differences remain fairly constant in the last decade. The black-white difference in disability is the largest in each decade, exceeding seven percentage points in 1990, and declining to two percentage points in 2010. The Latino-white disparity declines to approximately one percentage point by 2000, and the Asian-white difference is a one percentage-point advantage for Asians by 2010. The right-hand panel of Figure 1 depicts the trends in the percent *Disabled* for each racial/ethnic group. Disability declines for all groups over time, with the largest decreases between 1990 and 2000. However, the decreases in the percent *Disabled* are more pronounced for minorities than whites, reflected by the shrinking disparities.

[4] After 2002, the ACS changed the wording of its disability questions The estimate of IADL disability among adults over 16 years-old declined by 30% with the new version of the question. Comparisons between mail-in survey responses and computer-assisted interviews suggest misreporting in previous waves of the ACS and decennial Census over estimate IADL disability (Stern and Brault 2005).

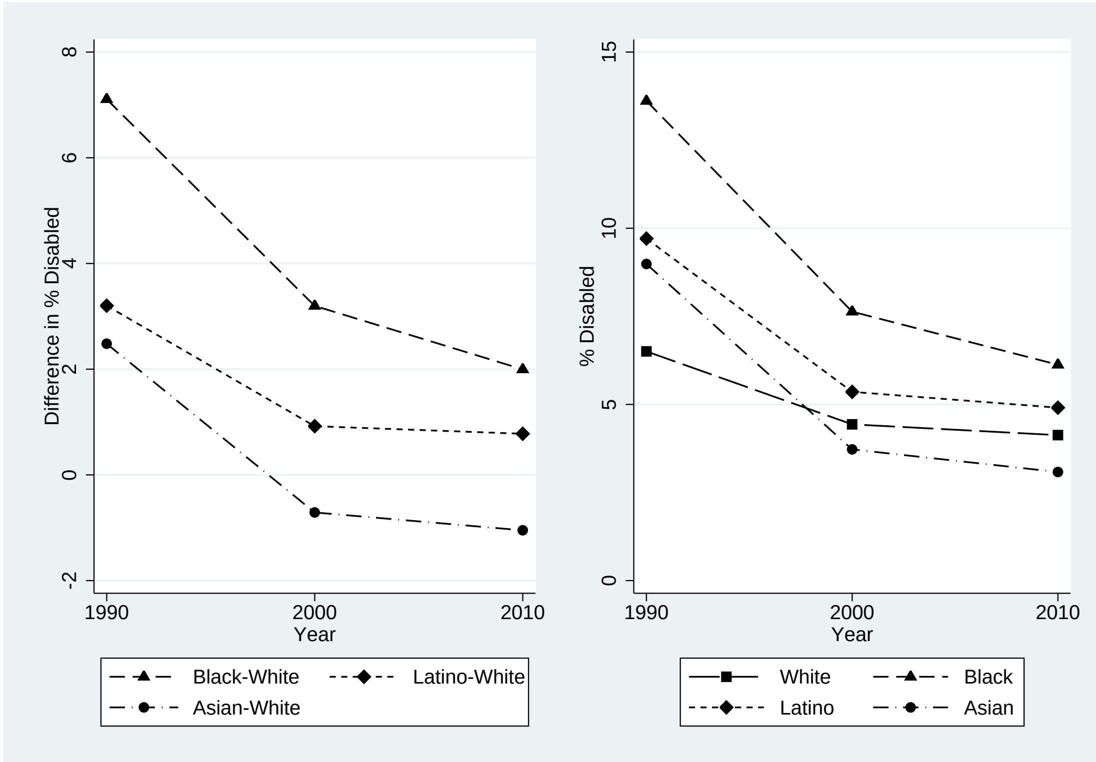

Figure 1: Trends in Differences and Levels of Percent Disabled, by Race/Ethnicity.

The particularly large decrease in disability among Asians is the primary cause of the reversal of the Asian-white disparity by 2000.

Overall decline in ADL disability is also widespread, occurring in all but 11 of the 238 metropolitan areas between 1990 and 2010. The proportion of adults over 45 who are *Disabled* declines by at least 35% of the 1990 level in more than half of the MSAs. Decreases in racial/ethnic disparities in disability are similarly widespread. The minority-white percentage-point differences in the proportion of disabled adults shrink in 84% to 90% of metropolitan areas between 2010 and 1990. The metropolitan-level distributions of racial/ethnic differences in the percent *Disabled* are described in Table A.1 in the Appendix.

The second dependent variable is a binary variable for *Poor Health*, and is a collapsed version of the standard five-point measure of self-rated health. *Poor Health* equals one for individuals reporting poor or fair health, and zero for individuals reporting good, very good, or excellent health. This operationalization of self-rated health has precedent in studies of the Income Inequality Hypothesis (Mellor and Milyo 2001, 2002).[5] Self-rated health is often best analyzed in dichotomous form because it frequently fails the proportional odds assumption behind ordered logistic regression models, and dichotomization generally loses relatively little information (Manor et al. 2000). Regardless, analyses of the five-point form of self-rated health yield similar results as those presented below.[6]

The prevalences of *Poor Health* among the analytic sample by race/ethnicity are presented in Figure 2. Similar to the trends in the percent *Disabled*, there is a slight decline in racial/ethnic disparities in the percent reporting *Poor Health* over time. The black-white disparity exhibits the largest change, decreasing by almost four percentage points between 2000 and 2010. The proportion of each group in poor health also declines over time, and reductions in racial/ethnic disparities result from the larger declines for minorities relative to whites. The metropolitan-level distributions of racial/ethnic differences in the percent in *Poor Health* are described in Table A.1 in the Appendix.

Metropolitan-Level Variables

The analyses measure income inequality with the Gini index for household income within each MSA-year, *Gini*, which is the standard measure for testing the Income Inequality Hypothesis (Eberstadt and Satel 2004; Subramanian and Kawachi 2004; Wilkinson and Pickett 2006). Household income is the sum of all current household members' total income from the previous calendar year. As a result, the measure of the Gini is lagged one year prior to the health measure. In addition to the *Gini*, I replicate all analyses with alternative measures of inequality at the metropolitan

[5]Mellor and Milyo (2001; 2002) dichotomize self-rated health with poor/fair health equal to one, also using the CPS.

[6]Analyses of the five-point variable using ordered logistic regression and OLS regression yield substantively comparable results.

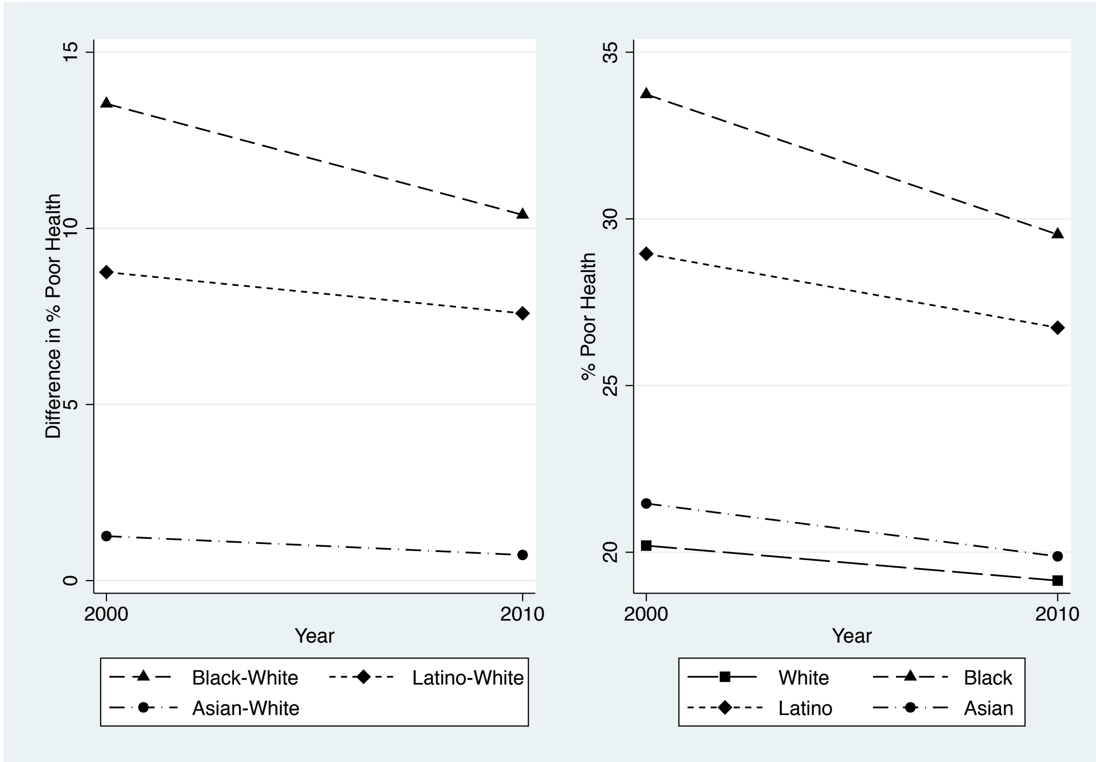

Figure 2: Trends in Differences and Levels of Percent in Poor Health, by Race/Ethnicity.

level: the coefficient of variation in household income, the ratio of the 90th to the 10th percentiles of household income, and the Gini coefficient for inequality in home values as a proxy for wealth inequality. The coefficient of variation and 90/10 ratio correlate approximately 0.86 and 0.78 with the *Gini* respectively, and the Gini coefficient for home values correlates 0.52. There is some variation in the size and statistical significance of the odds ratios for the different inequality measures in comparable models, but the overall patterns of results have the same substantive implications for the chapter's hypotheses.

Population aging is measured with the percent of the local population above age 65, *%Over 65*. Growth in the *Gini* and *% Over 65* for the average member of the analytic sample in the Census and ACS data, relative to the level in 1990, is presented in Figure 3. Income inequality increases rapidly between 1990 and 2000, rising by 7.5%. Inequality continues to increase in the subsequent decade, but much less rapidly. The *Gini* for the average sample member in 2010 is approximately 9% higher than the average in 1990. Of course, the 2000-2010 trend in income inequality is likely affected by the recession of the late 2000s, possibly obscuring a rise and subsequent decline of inequality within that decade.

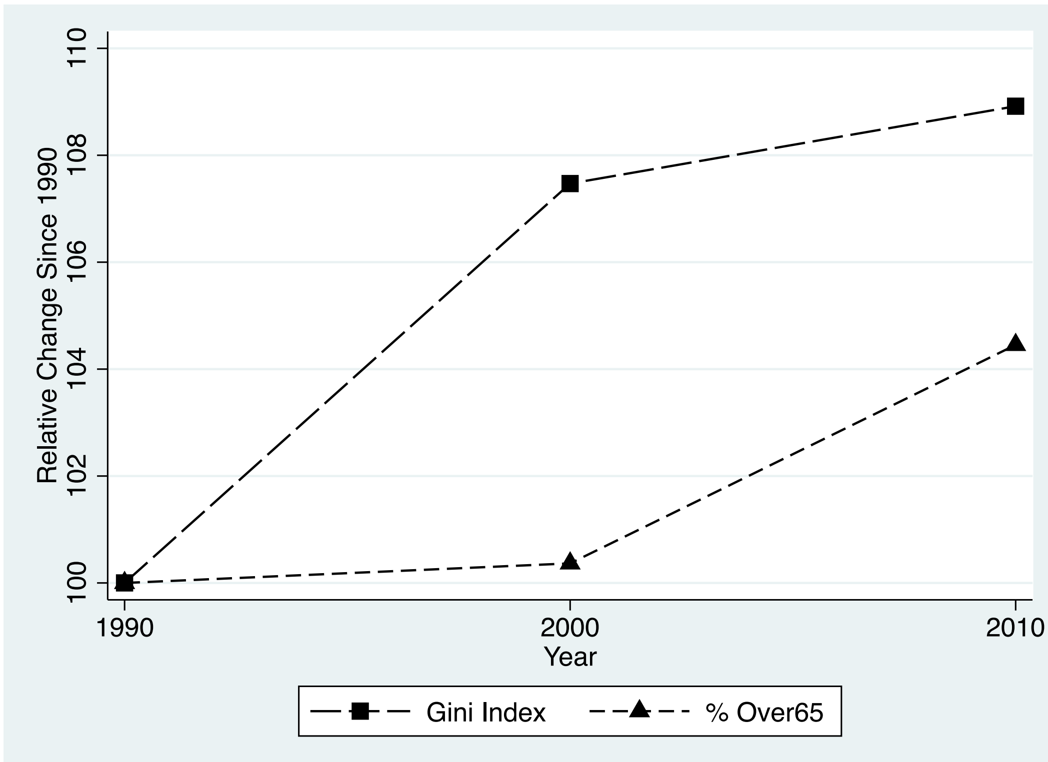

Figure 3: Average Growth in Income Inequality and Population Aging, Relative to 1990.

Population aging exhibits the reverse pattern between decades. The share of the local population over 65 for the average sample member changes very little between 1990 and 2000, increasing by approximately a third of one percent. The increase between 2000 and 2010 is far more notable, rising over 4.5% of the 1990 level. The average *% Over 65* will only increase more rapidly, as only the first Baby Boomer cohorts reach 65 years-old by 2010.

Naturally, there is substantial geographic variation in these two trends. Only 15 of the 238 metropolitan areas experience a decrease in the *Gini* between 1990 and 2010, and the *Gini* decreases by more than two percent only in Macon, GA, and St.

Cloud, MN. Meanwhile, income inequality increases by more than 10% relative to its 1990 level in over one-third of metropolitan areas.

Trends in population aging are even more heterogeneous. The *% Over 65* increases by more than 10% between 1990 and 2010 in almost half, 117, of the MSAs. However, the *% Over 65* decreases in 43 MSAs. Interestingly, many of the metropolitan areas with the highest proportions of older adults exhibit the largest declines, including Fort Lauderdale, Sarasota, Tampa-St. Petersburg, and West Palm Beach-Boca Raton, FL. Descriptive statistics for the *Gini* and *% Over 65* at the metropolitan level are presented in Table A.2 in the Appendix.

Controls

Metropolitan-level control variables include the local demographic and economic contexts, following past studies (Eberstadt and Satel 2004; Subramanian and Kawachi 2004). The size of the total population is logged to account for the skewed distribution, *ln(Population)*. The racial/ethnic composition of the MSA is measured with the *% Black*, *% Latino*, and *% Asian* of the local population.[7] Local levels of immigration are measured with the *% Foreign Born*. Economic conditions are roughly measured with the percent of working-aged adults that are currently employed, *Employment Rate*. Descriptive statistics for the metropolitan-level controls are presented in Table A.2 in the Appendix.

The usual set of individual-level socioeconomic and demographic predictors of disability and poor health are included as controls. There is some debate over potential confounding and mediating effects of individual-level variables for income inequality (Subramanian and Kawachi 2004; Wilkinson and Pickett 2006), so the results of analyses with varied sets of control variables are discussed in the chapter's conclusion. The variable *Black* is equal to one for individuals that self-identify as non-Latino black

[7]The variables *% Latino* and *% Asian* measure the percent of the local population that is native-born Latino or Asian to avoid collinearity with *% Foreign Born*.

for their sole racial category, and *Asian* equals one for self-identifying as non-Latino Asian for the sole racial category. The variable *Latino* is equal to one for individuals who report being of "Hispanic origin" of any race. All three variables are relative to those who identify as non-Latino white for their sole racial/ethnic category. The variable *Female* is a dummy variable equal to one for women. The analyses include age in years and its square, *Age* and *Age*^{2}. Marital status is measured with binary indicators, *Never Married*, *Separated*, *Divorced*, and *Widowed* relative to being currently married. I include the number of children and adults in the respondents' household, *Children HH* and *Adults HH*. The final demographic factor is time since immigration, measured with the binary variables *Imm<5 Yrs*, *Imm 5–10 Yrs*, *Imm 10–15 Yrs*, *Imm 15–20 Yrs*, and *Imm 20+ Yrs*, all relative to being native born. Education is coded with three binary variables for *Less than HS*, *Some College*, which includes technical and associates' degrees, and *Bachelors +*, as the respondents' highest educational attainment. High school completion or a G.E.D. is the reference category. I control for the logged value of respondents' total household income in the previous year, *ln(HH Income)*, to ensure that the effect of local economic inequality is purely contextual, not compositional. Finally, the models also control for homeownership, with *Own* equal to one for homeowners, as a proxy for household wealth.

Analytic Strategy

The analyses estimate the relationships between income inequality, population aging, and health with a series of logistic regression models. For each dependent variable, I test all hypotheses using cross-sectional regression models with data from 2010. These models examine the spatial patterns of the dependent and key independent variables. I also test the hypotheses using variation within MSAs over time with regression models including metropolitan and year fixed effects for all available time points. Both models adjust the standard errors of the coefficients for the nesting of individuals within MSAs or MSA-years.

The first set of models estimates the conditional relationship between income inequality and health to test Hypothesis 1, the Income Inequality Hypothesis. These models regress the dependent variables on the *Gini*, and all metropolitan- and individual-level controls.

I test the second hypothesis, income inequality increases racial/ethnic health disparities, with interaction terms between the *Gini* and race/ethnicity indicator variables added to the model for the first hypothesis. Unlike the previous chapters, the interpretation of the interaction effects is relatively traditional. Significant odds ratios greater than one for the interaction terms indicate the odds of disability or poor health increase more for minorities than whites with higher levels of the *Gini*. Then, odds ratios greater than one indicate larger gaps and odds ratios smaller than one indicate smaller gaps. The 'main effect' for whites is traditionally interpreted, with values above one indicating higher odds of the dependent variable with higher levels of the *Gini*.

I also test the third hypothesis, income inequality is more strongly linked to disability and poor health in areas with greater population aging, with interaction terms. These regression models include all the terms from those evaluating the first hypothesis, and add *% Over 65* and the interaction, $Gini \times \%Over65$. Significant odds ratios greater than one for the interaction term indicate higher levels of the *Gini* are more strongly associated with greater odds disability or poor health in areas with greater *% Over 65*.

The test of the final hypothesis requires a complex set of interaction terms. Hypothesis 4 predicts that higher levels of the *Gini* are associated with larger racial/ethnic health disparities in areas with greater population aging. I test the hypothesis with interaction terms between the race/ethnicity indicators and: *Gini*, *% Over 65*, and

$Gini \times \%Over65$. The regression models can be expressed as,

$$
\begin{aligned}
ln\left(\frac{Pr(Y_{ij})}{1-Pr(Y_{ij})}\right) &= \beta_{White} + \beta_{Race}Race_{ij} \\
&\begin{cases}
+\beta_{Gini,White}Gini_j \\
+\beta_{Over65,White}\%Over65_j \\
+\beta_{Interact,White}Gini_j \times \%Over65_j
\end{cases} \\
&\begin{cases}
+\beta_{Gini,Race}Race_{ij} \times Gini_j \\
+\beta_{Over65,Race}Race_{ij} \times \%Over65_j \\
+\beta_{Interact,Race}Race_{ij} \times Gini_j \times \%Over65_j
\end{cases} \\
&+ \beta_X X_{ij} + \beta_W W_j,
\end{aligned}
\tag{1}
$$

where Y_{ij} is either disability or poor health health status, and X_{ij} represents the vector of individual-level control variables for person i in MSA j. The set of metropolitan-level controls are represented by W_j. The first set of bracketed terms are the variables described to test Hypothesis 3, and represent the 'main effects' of these variables for whites. The second set of bracketed terms represent the effects of the key independent variables for minorities relative to whites. Ultimately, significant odds ratios greater than one for the three-way interaction terms, $Race \times Gini \times \%Over65$, indicate the *Gini* is more strongly related to disability or poor health for minorities than whites in areas with higher levels of *% Over 65*, and larger racial/ethnic health disparities.

As discussed in the previous chapter, there is some concern about the direction and statistical significance of interaction terms in standard logistic regression (Ai and Norton 2003; Allison 1999). However, all results presented here are similar to those for linear probability models, which approximate the marginal effects of the independent variables without the same concerns for interaction terms (Angrist and Pischke 2008).

Results

Descriptively, the bivariate patterns between income inequality, and disability and poor health at the metropolitan level resemble those found by Wilkinson and Pickett (2006) for U.S. states. In the left panel of Figure 4, there is a strong positive relationship between levels of disability and income inequality in 1990. The relationship is weaker, but still positive in 2000 and 2010. The right panel of Figure 4 shows a similar positive relationship between higher levels of income inequality and levels of *Poor Health*.

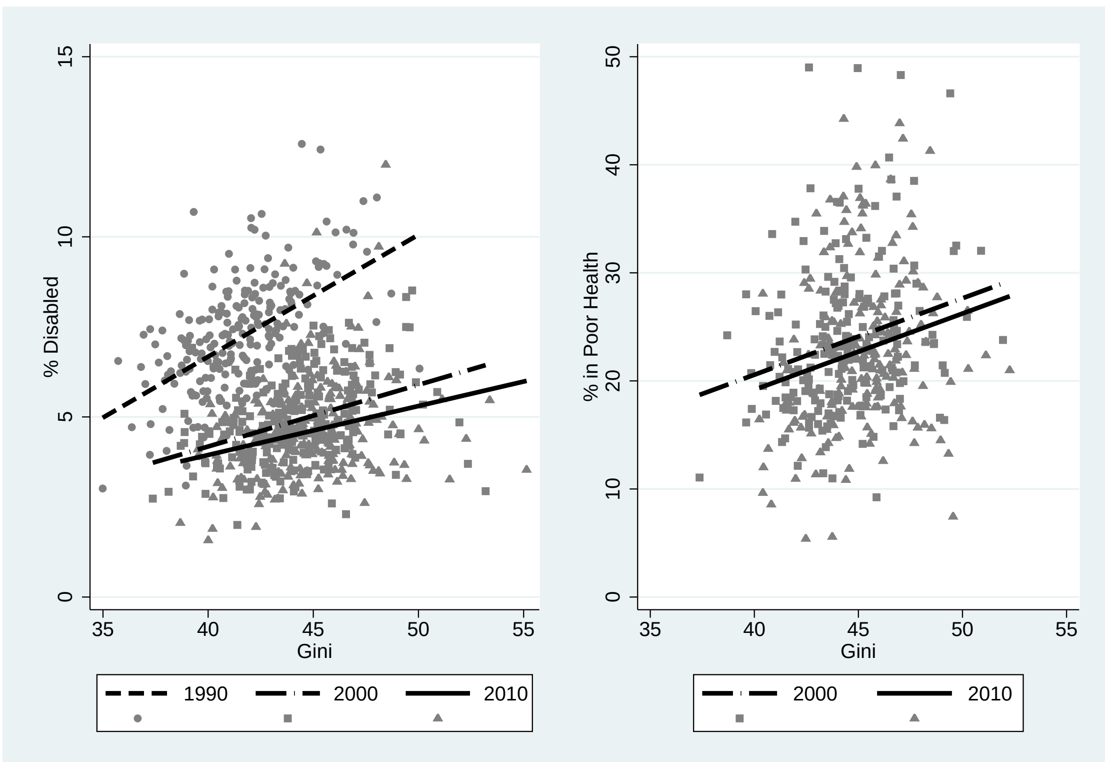

Figure 4: Bivariate Relationships between Metropolitan-Level Income Inequality, % Disabled, and % Poor Health, by Decade.

This basic comparison is consistent with the *Income Inequality Hypothesis*. However, plots of the ten-year changes in disability or poor health against the ten-year change in income inequality within metropolitan areas show no clear bivariate relationship. The absence of support for the *Income Inequality Hypothesis* with basic within-MSA differencing suggests the bivariate relationship between income inequality and health may be confounded by other metropolitan characteristics.

Regression results testing the chapter's first three hypotheses yield no significant support, so are presented in tables in the Appendix. The most direct test of the *Income Inequality Hypothesis* is presented in Table A.3 in the Appendix. The cross-sectional regression models find slightly positive but statistically insignificant relationships between the *Gini* and the odds of being *Disabled* or in *Poor Health*. The results of the fixed-effects models are even less consistent with the hypothesis. The odds of being *Disabled* or in *Poor Health* are significantly *lower* with increases in the *Gini* within metropolitan areas over time. The odds of disability decline by a factor of 1.10 in areas experiencing the average increase in the *Gini* between 1990 and 2010, and the odds of poor health decline by a factor of 1.04 for the observed average increase in the *Gini* between 2000 and 2010. Combined, the results in Table A.3 favor rejection of the *Income Inequality Hypothesis*.

There is also little evidence supporting Hypothesis 2, that income inequality is significantly related to larger racial/ethnic health disparities. The odds ratios for the *Gini* and race/ethnicity interactions are presented in Table A.4 in the Appendix. In 2010, whites have significantly higher odds of being *Disabled* in metropolitan areas with greater income inequality. However, the relationship is significantly weaker for blacks than whites, indicating smaller disparities in areas with higher income inequality. The *Gini* also has smaller odds ratios for Latinos and Asians than whites, but the differences are not significant.

Similar to the results in Table A.3, the main effects of increases in the *Gini* for whites are lower odds of being *Disabled* or in *Poor Health*, but the odds ratio for *Disabled* is only significant for $p < 0.10$. However, all three race/ethnicity interaction terms indicate a more negative relationship between increases in the *Gini* and *Disabled* for minorities than whites. The odds of disability decline more for minorities than whites as income inequality increases, reducing racial/ethnic disparities and contradicting Hypothesis 2.

The results for regression analyses testing Hypothesis 3, the interactive effect of income inequality and population aging, are presented in Table A.5. The main effects of the *Gini* are comparable to those from the first set of regression analyses in Table A.3, but the odds ratio in the fixed-effects model for *Disabled* is only statistically significant at $p < 0.10$. The main effects of *% Over 65* are not statistically significant in any model. The magnitudes of the odds ratios also vary considerably. The relationship between *% Over 65* and *Disabled* is negative in the cross-sectional model and positive in the fixed-effects model. The pattern is reversed for *Poor Health*. The *% Over 65* is positive in the cross-sectional model, but large and negative in the fixed-effects model. Finally, there is no support for Hypothesis 3 in Table A.5. The odds ratios for the interaction terms are all statistically insignificant and close to one.

Results for regression analyses testing Hypothesis 4, the interactive effect of income inequality and population aging on health disparities, are presented in Table 1. The main effects of these models also provide tests of the first three hypotheses. First, the odds ratios for the *Gini* for whites test the Income Inequality Hypothesis. The only statistically significant effect is *lower* odds of *Poor Health* with increases in income inequality in the fixed-effects model in the final column. Again, these results do not support, and even contradict, the Income Inequality Hypothesis.

The direction and significance of the odds ratios for the *Gini* for black-white, Latino-white, and Asian-white differences test Hypothesis 2, that income inequality worsen racial/ethnic health disparities. Only two of the *Gini* × *Race* interactions are significant. The odds of *Poor Health* for Asians relative to whites increase with greater inequality in the fixed-effects model. However, The odds of being *Disabled* decline for Latinos relative to whites with greater inequality in the fixed-effects model. Overall, there is no robust support for Hypothesis 2.

Table 1: Regression Results for Disability and Poor Health on Income Inequality and Population Aging, by Race/Ethnicity.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Black-White				
Gini	1.085	1.000	1.016	1.142
	(1.300)	(0.000)	(0.155)	(1.371)
% Over 65	1.668*	1.215*	1.138	1.892
	(2.187)	(2.164)	(0.333)	(1.671)
$Gini \times \%Over65$	0.989*	0.996*	0.997	0.986
	(-2.182)	(-2.126)	(-0.329)	(-1.696)
Latino-White				
Gini	0.950	0.929*	0.926	1.052
	(-0.432)	(-2.017)	(-0.981)	(0.799)
% Over 65	0.831	0.901	0.770	1.313
	(-0.442)	(-0.833)	(-0.884)	(1.101)
$Gini \times \%Over65$	1.004	1.003	1.006	0.995
	(0.442)	(1.016)	(1.004)	(-0.950)
Asian-White				
Gini	0.810	0.887*	1.115	1.360*
	(-1.332)	(-2.314)	(0.718)	(2.067)
% Over 65	0.476	0.865	1.837	3.966*
	(-1.170)	(-0.711)	(0.946)	(2.169)
$Gini \times \%Over65$	1.017	1.003	0.986	0.970*
	(1.219)	(0.716)	(-1.035)	(-2.208)
White				
Gini	1.021	0.993	1.086	0.846**
	(0.723)	(-0.520)	(1.541)	(-2.644)
% Over 65	0.954	1.047	1.219	0.576*
	(-0.424)	(1.227)	(0.944)	(-2.227)
$Gini \times \%Over65$	1.000	0.999	0.995	1.011
	(0.189)	(-1.014)	(-1.045)	(1.887)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.

*** p<0.001, ** p<0.01, * p<0.05

The 'main' interaction $Gini \times \%Over65$ for whites tests Hypothesis 3, that income inequality has a stronger effect on health with greater population aging. The interaction terms are statistically insignificant and relatively close to one in all four models. These results provide no support for the hypothesis.

Finally, there is no evidence to support Hypothesis 4, that any positive effect of income inequality on the size of racial/ethnic disparities is larger in areas with greater population aging. Only three of the 12 three-way interaction terms are statistically significant, and all three significant odds ratios are in the opposite direction of the hypothesis. The regression results suggest the *% Over 65* increases the black-white disparity in disability, but this relationship is weaker in areas with higher income inequality. The *Gini* has no 'main effect' on the odds of disability for blacks relative to whites. The significant odds ratios above one for Asians predict larger Asian-white gaps in *Poor Health* with increases in income inequality and population aging. However, the interaction between the *Gini* and *% Over 65* is significantly negative for Asians, indicating the Asian-white gaps grow less in areas with *both* increases in income inequality *and* population aging.

It is important to note that the magnitudes and statistical significance levels for these interaction effects are not robust for different measures of income inequality. For example, both main effects and the interaction of the coefficient of variation in income with *% Over 65* are statistically significant for black-white differences in self-rated health, but none are significant for whites or Latino-white or Asian-white differences. Ultimately, the inconsistency of the results for different health and income inequality measures, as well as the negative interactive effects between inequality and aging, favor rejection of Hypothesis 4.

The odds ratios for the metropolitan-level controls corresponding to the models in Table 1 are presented in Table A.6 in the Appendix. The odds of disability are lower in larger metropolitan areas, but local population size or growth is not significant in the other models. Growth in the *% Black* is significantly related to higher odds of disability, and lower odds of poor health in the fixed-effects models. The *% Latino* is significantly related to higher odds of disability and poor health in the cross-sectional models, but is only significant and positive for disability in the fixed-effects models. Finally, the odds of disability and poor health are negatively related to the *% Foreign Born* and *Employment Rate* in all models.

The odds ratios for the metropolitan-level controls corresponding to the models in Table 1 are presented in Table A.7 in the Appendix. Consistent with previous findings, the odds of being *Disabled* or in *Poor Health* are higher for older adults, the unmarried, those without children in the household, the native born, those with less education and income, and renters relative to homeowners. The odds of disability are also higher for women, and those with more adults in the households.

Conclusion

This chapter provides an empirical test of the Income Inequality Hypothesis, and three extensions of it, using data from U.S. metropolitan areas over two decades. Ultimately, the results provide no evidence to support the hypothesis beyond the most basic bivariate pattern between MSAs. To the contrary, results from the fixed-effects regression models indicate individuals' odds of disability and poor self-rated health decrease with increasing income inequality at the metropolitan level. There is also no evidence that population aging exacerbates any effect of income inequality (Hypothesis 3), or that either income inequality or population aging significantly worsen racial/ethnic disparities in disability or poor health (Hypotheses 2 and 4).

Despite contradicting many published studies evaluating the Income Inequality Hypothesis, the null findings are consistent with many studies using similar analytic approaches (Beckfield 2004; Mellor and Milyo 2002). Metropolitan-area fixed effects account for stable, unobserved MSA characteristics that may induce a spurious correlation between inequality and health. As a result, this test of the Income Inequality Hypothesis accounts for one of the more prominent criticisms of most cross-sectional studies in this literature (Eberstadt and Satel 2004).

Aside from the potential for unobserved confounding factors, past studies suggest other concerns for the validity of the Income Inequality Hypothesis. The most common critique is that absolute income levels, rather than inequality, influence population health because they reflect material deprivation (Wilkinson and Pickett 2006, 2009b). Replications of all analyses presented here replace the Gini index with the metropolitan median income to test the 'absolute income hypothesis.' However, the results reveal no robust relationship between absolute income levels and disability or self-rated health. Similarly, replacing the Gini index with the local poverty rate yields no meaningful pattern of results.[8]

In their review, Judge and colleagues (1998) propose that a nonlinear relationship between income and health may induce a significant effect for income inequality, despite controlling for income inequality linearly at the individual level. Conversely, Wilkinson and Pickett (2006) argue theoretically that individual income is partly determined by the class stratification system, and societal stratification is better measured by income inequality at the macro-level. As a result, they claim the inclusion of individual-level income is a misspecification of the of the regression model. I test this version of the hypothesis by replicating all analyses without controlling for household income, and find no robust pattern of significant positive effects of income inequality on disability or poor self-rated health. Some argue that other measures of socioeconomic status, like education, may also confound the income inequality relationship (Subramanian and Kawachi 2004). Again, I replicate all analyses without

[8] I define the local poverty rate as the proportion of households with equivalized household income below half of the national median income in that year. Equivalized income is the household's total annual income from all sources, adjusted for size by dividing by the square root of the number of household members (Brady 2009).

controls for education, income, or homeownership at the individual level, and find no support for the Income Inequality Hypothesis or the chapter's other hypotheses. Analyses omitting all metropolitan-level controls also do not provide any significant support for the hypotheses.

This chapter's analyses use a wide variety of measures and model specifications to test the robustness of each of the four hypotheses, and find no support. It is still possible, however unlikely, that some underlying relationship between income inequality and health remains undetected. Many of the past studies supporting the Income Inequality Hypothesis at the metropolitan level use mortality as the outcome measure (Lynch et al. 1998; Shi and Starfield 2001). If the relationship to mortality is sufficiently robust, selective mortality of those with disability or poor health in unequal metropolitan areas could bias the results toward null findings. This selection effect may be particularly problematic for the evaluation of health disparities, given large racial/ethnic differences in mortality rates (Martin and Soldo 1997).

Future research may expand on the approach used here, and adjust the health outcomes for potential mortality selection. With access to metropolitan-level age- and race-specific mortality rates, one may apply life table methods to the individual-level data to estimate active and healthy life expectancy (Land et al. 2005). Total, active, and healthy life expectancy by race/ethnicity would then be the dependent variables in an MSA-year level analysis. More theoretically, this chapter's analytic approach can be fruitfully applied to evaluating other structural factors influencing health disparities. Income inequality at the metropolitan level may have no direct effect on health, but it may have interactive effects with other individual characteristics that alter the social gradient in health (Zheng and George 2012). Similarly, the trend in population aging will only accelerate with time. Continued study of its potential impact on health, or moderating effect on other structural factors, should remain a priority.

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A Appendix

Table A.1: Summary of Metropolitan-Level Distribution of Disability and Poor Health Prevalences and Disparities, by Racial and Ethnicity.

	1990	2000	2010	2000	2010
Difference	*% Disabled*			*% Poor Health*	
Black-White	5.98	2.77	2.15	13.44	11.56
	(6.62)	(3.46)	(5.43)	(24.70)	(23.77)
Latino-White	2.06	0.12	-0.21	5.54	2.91
	(8.43)	(3.64)	(4.42)	(26.27)	(22.57)
Asian-White	0.82	-1.49	-2.09	0.42	-0.44
	(6.73)	(3.59)	(3.81)	(31.37)	(28.68)
Percentage	*% Disabled*			*% Poor Health*	
Total	7.21	4.91	4.61	23.67	22.81
	(1.60)	(1.20)	(1.35)	(6.91)	(7.39)
White	6.48	4.60	4.36	21.69	20.63
	(1.41)	(1.12)	(1.27)	(7.37)	(7.41)
Black	12.47	7.38	6.53	35.34	32.41
	(6.71)	(3.51)	(5.36)	(23.89)	(22.93)
Latino	8.54	4.71	4.17	27.26	23.54
	(8.35)	(3.49)	(4.21)	(25.97)	(21.31)
Asian	7.30	3.11	2.26	21.59	19.42
	(6.65)	(3.40)	(3.64)	(31.40)	(27.37)
MSAs	238	238	238	197	197

Note: The metropolitan areas are not weighted by population. Standard deviations in parentheses.

Table A.2: Summary of Metropolitan-Level Inequality, Population Aging, and Controls.

	1990	2000	2010
Gini	41.59	44.26	44.91
	(2.45)	(2.64)	(2.47)
% Over 65	11.12	11.45	12.12
	(3.12)	(2.99)	(2.83)
Population (1,000s)	703.82	847.25	942.17
	(1,466.67)	(1,657.07)	(1,768.15)
% Black	10.34	10.40	11.06
	(9.82)	(9.88)	(10.14)
% Latino	5.70	7.15	9.71
	(9.62)	(10.21)	(11.43)
% Asian	0.75	0.87	1.19
	(3.10)	(2.50)	(2.53)
% Foreign Born	6.51	8.73	10.53
	(6.33)	(7.55)	(7.90)
Employment Rate	73.21	73.05	69.58
	(4.70)	(4.84)	(4.75)
MSAs	238	238	238

Note: The metropolitan areas are not weighted by population. Standard deviations in parentheses.

Table A.3: Regression Results for Disability and Poor Health on Income Inequality.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Gini	1.009	0.971***	1.015	0.942**
	(1.277)	(-4.022)	(1.321)	(-2.937)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.
*** p<0.001, ** p<0.01, * p<0.05

Table A.4: Regression Results for Disability and Poor Health on Income Inequality, by Race/Ethnicity.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Black-White				
Gini	0.957*	0.955***	0.987	0.975
	(-2.134)	(-7.192)	(-0.702)	(-1.943)
Latino-White				
Gini	0.996	0.963**	1.005	1.002
	(-0.212)	(-3.273)	(0.381)	(0.132)
Asian-White				
Gini	0.982	0.918***	0.946	0.973
	(-0.890)	(-8.488)	(-1.750)	(-0.923)
White				
Gini	1.017**	0.982	1.019	0.946**
	(2.857)	(-1.935)	(1.578)	(-2.727)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Table A.5: Regression Results for Disability and Poor Health on Income Inequality and Population Aging.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Gini	1.012	0.975	1.063	0.871*
	(0.455)	(-1.927)	(1.277)	(-2.298)
% Over 65	0.956	1.025	1.151	0.661
	(-0.450)	(0.681)	(0.731)	(-1.758)
$Gini \times \%Over65$	1.000	1.000	0.997	1.008
	(0.204)	(-0.465)	(-0.827)	(1.434)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Table A.6: Regression Results for Disability and Poor Health on Metropolitan-Level Controls.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
ln(Population)	0.958***	1.092	0.970	1.593
	(-3.363)	(1.681)	(-1.493)	(1.774)
% Black	1.001	1.010*	0.999	0.967*
	(0.569)	(2.430)	(-0.497)	(-2.110)
% Latino	1.006**	1.006*	1.006*	0.999
	(2.841)	(2.079)	(2.120)	(-0.074)
% Asian	1.004	1.015	1.000	1.000
	(0.504)	(1.625)	(-0.046)	(-0.007)
% Foreign Born	0.994**	0.981***	0.991***	0.956**
	(-2.891)	(-4.338)	(-3.359)	(-3.031)
Employment Rate	0.977***	0.991*	0.979**	0.980**
	(-6.115)	(-2.534)	(-3.118)	(-3.289)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.
*** p<0.001, ** p<0.01, * p<0.05

Table A.7: Regression Results for Disability and Poor Health on Individual-Level Controls.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Age	0.939***	0.935***	1.063***	1.080***
	(-8.321)	(-16.103)	(4.625)	(7.665)
Age^2	1.001***	1.001***	1.000	1.000***
	(16.716)	(29.913)	(-1.642)	(-3.564)
Female	1.115***	1.069***	0.976	0.972
	(8.280)	(7.559)	(-1.141)	(-1.694)
Single	1.715***	1.609***	1.386***	1.410***
	(17.457)	(22.280)	(8.711)	(11.050)
Separated	1.840***	1.679***	1.444***	1.496***
	(14.413)	(23.126)	(5.836)	(8.055)
Divorced	1.590***	1.494***	1.395***	1.418***
	(19.834)	(25.370)	(8.595)	(10.418)
Widowed	1.521***	1.432***	1.228***	1.165***
	(24.019)	(22.557)	(5.324)	(4.838)
Children HH	0.912***	0.954***	0.926***	0.961**
	(-7.267)	(-6.881)	(-4.860)	(-3.157)
Adults HH	1.261***	1.208***	1.106***	1.096***
	(17.600)	(18.314)	(5.024)	(6.105)
Imm<5 Yrs	0.510***	0.729***	0.549***	0.598***
	(-5.087)	(-5.174)	(-4.000)	(-4.825)
Imm 5–10 Yrs	0.549***	0.893	0.798*	0.932
	(-5.756)	(-1.623)	(-2.012)	(-0.627)
Imm 10–15 Yrs	0.722**	0.908	0.985	0.985
	(-2.761)	(-1.503)	(-0.138)	(-0.161)
Imm 15–20 Yrs	0.984	1.053	1.040	1.004
	(-0.174)	(1.002)	(0.369)	(0.056)
Imm>20 Yrs	0.864**	0.957	0.963	1.016
	(-3.156)	(-1.903)	(-0.727)	(0.400)

Continued on next page.

Table A.7 continued.

	Disabled		*Poor Health*	
	2010	1990-2010	2010	2000-2010
Less than HS	1.438***	1.425***	1.699***	1.666***
	(20.377)	(36.040)	(10.824)	(14.947)
Some College	0.902***	0.868***	0.852***	0.818***
	(-5.532)	(-13.289)	(-4.695)	(-7.600)
Bachelor's+	0.619***	0.618***	0.502***	0.513***
	(-19.170)	(-34.187)	(-17.785)	(-23.083)
ln(HH Income)	0.886***	0.899***	0.852***	0.836***
	(-32.655)	(-42.695)	(-12.731)	(-16.792)
Homeowner	0.585***	0.684***	0.621***	0.635***
	(-27.198)	(-23.745)	(-14.973)	(-17.390)
Year 1990		1.458***		
		(10.264)		
Year 2000		1.079***		0.955
		(3.879)		(-0.912)
Fixed Effects	No	Yes	No	Yes
MSAs	238	238	197	197
MSA-Years	238	714	197	394
N	881,921	3,150,546	72,274	121,621

Note: Robust t-statistics in parentheses. Models include, but do not display, all individual- and metropolitan-level control variables.
*** p<0.001, ** p<0.01, * p<0.05