Income Inequality and Health Status in the United States

Evidence from the Current Population Survey

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ABSTRACT

Several recent studies have identified an association between income inequality and aggregate health outcomes; this has been taken to be evidence that inequality is detrimental to individual health. We use data from the 1995–99 March Current Population Survey to examine the effect of income inequality on individual health status for both the general population and those individuals in poverty. We find no consistent association between income inequality and individual health status. Our results contradict recent claims that the psychosocial effects of income inequality have dramatic consequences for individual health outcomes.

''It is now clear that the scale of income differences in a society is one of the most powerful determinants of health . . .''
—Richard G. Wilkinson, *Unhealthy Societies: The Afflictions of Inequality*

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I. Introduction

Researchers in multiple disciplines have documented a relationship between income inequality and aggregate measures of health outcomes.[1] These repeated empirical findings have led several researchers to conjecture that income inequality *causes* poor health outcomes.[2] This ''income inequality hypothesis'' (IIH) has received a great deal of attention from the media,[3] medical journals,[4] policy makers,[5] and grant-making institutions.[6]

It is therefore surprising that until recently the evidence of a link from income inequality to health has been shown only in aggregate data, and often without controlling for other covariates. First, there is some reason to doubt the robustness of this ecological association either across countries or U.S. states. For example, Judge (1995), Judge, Mulligan, and Benzavel (1998a), and Mellor and Milyo (2001) find that the association between income inequality and age-adjusted mortality is sensitive to the time periods examined, the specific causes of mortality examined, and the inclusion of controls for other population characteristics. Second, correlations among statistical aggregates do not necessarily reflect causal relationships at the individual level. Both Rodgers (1979) and Gravelle (1998) show that if individual health is a nonlinear function of income, then income inequality may be spuriously correlated with aggregate measures of health. For example, if individual health is a concave function of individual income, then aggregate measures of health should depend on not just mean income, but also the distribution of income. This is because information on income inequality serves as a proxy for the number of persons at lower levels of income. Consequently, ecological studies do not offer much in the way of convincing evidence on this matter.

In order to ascertain whether the association between income inequality and health is spurious, it is necessary to measure the effect of income inequality on health after controlling for the effects of individual income. Several recent studies have taken this approach (Fiscella and Franks 1997 and 2000; Daly et al. 1998; Kennedy et al. 1998; Soobadeer and LeClere 1999; Meara 1999; Deaton and Paxson 2001), and have produced mixed results. With the exception of Meara (1999), however, none of these studies has controlled for regional determinants of individual health.

1. For example, Rodgers 1979; Flegg 1982; Le Grand 1987; Waldmann 1992; Wilkinson 1992, 1996; Wennemo 1993; Ben-Shlomo, White, and Marmot 1996; Kaplan et al. 1996a; Kennedy, Kawachi, and Prothrow-Stith 1996a; Kawachi and Kennedy 1997; Kawachi, Kennedy, and Lochner 1997; Kawachi et al. 1997; Lynch et al. 1998; Ross et al. 2000.

2. For example, the quote above from Wilkinson (1996); several other such examples are cited in Mellor and Milyo (2001).

3. For example, studies supporting the IIH have been reported in *The New York Times* (Pear 1996), *Business Week* (Koretz 1994), and *The Washington Post* (Trafford 1999).

4. Commentaries and letters in medical journals include: Charlton 1994; Watt 1996; Wilkinson 1995, 1997a,b,c and 1998; Kaplan et al. 1996b; Kennedy, Kawachi, and Prothrow-Stith 1996c; Judge 1996; Smith 1996; Judge, Mulligan, and Benzeval 1998b; Milyo 1999; Kennedy et al. 1999.

5. British Prime Minister Tony Blair has stated: ''There is no doubt that the published statistics show a link between income inequality and health'' (quoted in Lloyd 1998); several other examples are cited in Judge (1995).

6. For example, the Robert Wood Johnson Foundation has made three separate Investigator Awards in Health Policy Research for the study of income inequality and health (www.rwjf.org).

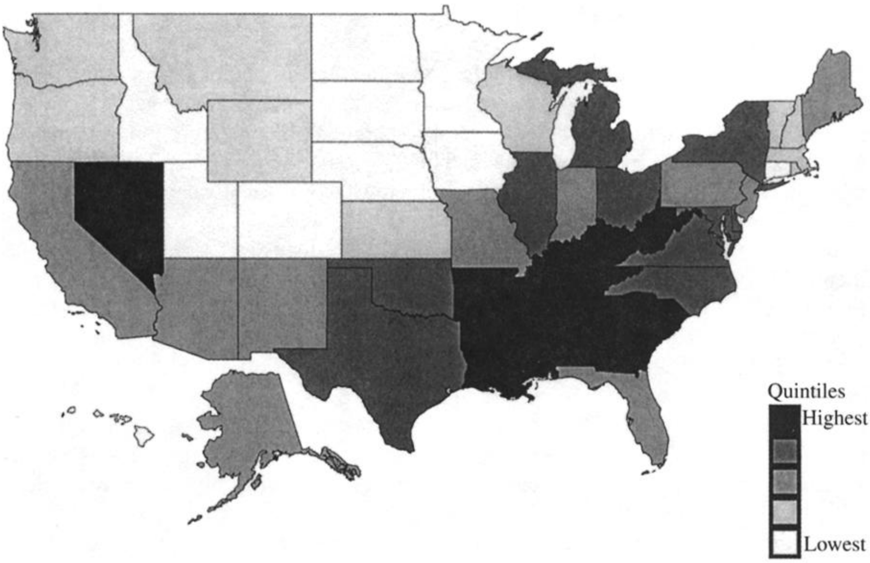

Figure 1
Age-Adjusted Mortality, 1989–1991

It is well known that there are strong regional patterns in health outcomes; textbook accounts attribute these differences to regional variations in diet, lifestyle, and environment, as well as access to quality medical care (for example, Phelps 1997). For example, Figure 1 describes age-adjusted mortality by state; the differences from the southeast United States to the northwest are striking.[7] There are also important regional determinants of income inequality; recent explanations for this include regional variations in manufacturing employment, international in-migration, and the prevalence of households headed by single females (Husted 1991; Levernier, Rickman and Partridge 1995; Partridge, Partridge, and Rickman 1998; Bernard and Jensen 2000). Figure 2 illustrates the regional pattern in state-level gini coefficients for household income; again, there is a clear contrast as one moves from the southeast to the northwest. Consequently, failure to control for regional variations may result in a spurious association between inequality and health, even in studies that adequately control for the effects of individual income on health.

We employ data on self-reported health status for a large sample of individuals to examine whether the frequently observed correlation between income inequality and aggregate health is the product of an ecological fallacy or omitted variable bias. In general, we find a robust negative association between income inequality and health status—until we control for other factors. The inclusion of household income reduces the size and statistical significance of the effect of income inequality in

7. The data presented in Figures 1 and 2 are from the National Center for Health Statistics (www.cdc.gov/nchs). For additional evidence of this sort, see Pickle et al. (1996).

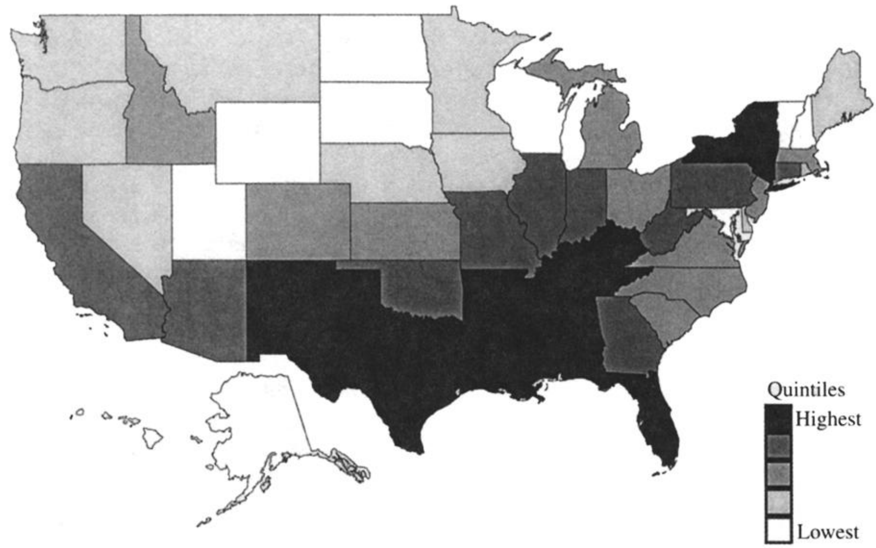

Figure 2
Gini for Household Income, 1989

models of health status. As conjectured by Rodgers (1979) and Gravelle (1998), the apparent deleterious effect of inequality on health status is mitigated once individual-level income is included as a control variable. The addition of controls for geographic region further reduces the association between income inequality and health. In contrast to most of the previous literature, we explicitly test whether inequality has a particularly strong effect on poorer individuals. We also conduct our analysis using several different conceptual measures of inequality, as well as measuring inequality using several different geographic units. For these reasons, we are able to more confidently dismiss the claim that there is consistent and robust evidence that income inequality has important psychosocial consequences for individual health.

II. Income Inequality and Health

The income inequality hypothesis is more than a statement that poverty is associated with poor health.[8] The contention is that income inequality—in and of itself—affects the well-being of individuals in a society. However, there are really two distinct versions of the IIH: inequality may be a public bad for all members

8. It is well understood that individual health outcomes can be predicted by individual income; although it is not clear to what extent this represents a true causal relationship, or whether socioeconomic status in general proxies for unhealthy behavior (for example, see Ettner 1996, Lantz et al. 1998, and Meara 1998). Also, van Doorslaer et al. (1997) show that inequality in self-reported health status is related to income inequality in surveys from nine countries.

of society (strong IIH), or it may afflict only the least well off in society (weak IIH).[9] Most of the ecological level studies are silent on this distinction, while most of the individual-level studies test only the former.[10] In contrast, Waldmann (1992) and Wilkinson (1995, 1997a,b,c) clearly refer only to the weak IIH. In addition, the potential causal mechanisms discussed in Wilkinson (1996) and elsewhere imply the weak version of the hypothesis.[11]

Even proponents of the IIH admit that theoretical explanations for how income inequality influences health are lacking, although they posit the existence of many distinct psychosocial causal pathways (Wilkinson 1992, 1995, 1996; Kaplan et al. 1996a; Kawachi et al. 1997). For example, relative deprivation itself may lead to feelings of inadequacy and envy on the part of certain individuals, which may in turn cause them to engage in (self-) destructive behaviors. Alternatively, the existence of income inequality may undermine social cohesion and hinder the formation of social capital, which in turn has been posited to influence health through the pathways of crime, public assistance, individual behavioral risks, and socioeconomic factors (Kennedy, Kawachi, and Prothrow-Stith 1996a; Wilkinson 1996; Kawachi, Kennedy, and Lochner 1997; Kawachi et al. 1997). For example, recent ecological studies have related income distribution across U.S. states to state-level measures of smoking (Kaplan et al. 1996a), alcohol use (Marmot 1997), abdominal weight gain (Kahn et al. 1998), and homicide by firearm (Kawachi et al. 1998).[12]

Whatever the exact causal mechanism, an association between income inequality and aggregate health measures has been observed repeatedly across countries (Rodgers 1979; Flegg 1982; Le Grand 1987; Waldmann 1992; Wilkinson 1992, 1996; Wennemo 1993), across wards in Britain (Ben-Shlomo, White, and Marmot 1996), and across states and metropolitan areas in the United States (Kaplan et al. 1996a; Kawachi, Kennedy, and Lochner 1997; Kawachi et al. 1997; Kawachi and Kennedy 1997; Lynch et al. 1998).[13] Further, at least for the evidence from the United States, it has been asserted that the association is robust to either the particular measure of health or income inequality (Kawachi et al. 1997; Kennedy, Kawachi, and Prothrow-Stith 1996a,b; Kawachi and Kennedy 1997; Lynch et al. 1998).[14]

9. The distinction is made clear by the following hypothetical examples. Suppose that Diana is rich and Theresa is poor. A redistribution of income from Diana to Theresa may plausibly make Theresa more healthy and Diana less healthy; this is a straightforward implication of the notion that individual income influences health. In contrast, the weak IIH implies that Theresa can be made more healthy by reducing Diana's income, since this reduces income inequality. Further, the strong IIH implies that *both* Theresa and Diana can be made more healthy by reducing Diana's income (although the net effect on Diana is ambiguous).

10. Both Kaplan et al. (1996a) and Smith (1996) correctly point out that the observed correlation between aggregate health outcomes and income distribution is consistent with either version of the IIH.

11. Wilkinson (1996) also suggests that effects of income inequality may "spill over" to the general population through the pathway of violent crime.

12. Also see Lynch, Kaplan, and Salonen (1997).

13. However, Regidor et al. (1997) find no evidence for the IIH across regions of Spain while Ross et al. (1999) find no evidence across Canadian provinces or metropolitan areas. Further, Powers et al. (1997) find no association between long-run changes in national income inequality and mortality in Britain.

14. As noted above, not all studies support these claims. In addition, 1999 changes in inequality are not consistently associated with changes in health outcomes across states (Kaplan et al. 1996a; Daly et al. 1998; Mellor and Milyo 2001, 1999). Further, for the United States as a whole, McDonough et al. (1997)

Most of these studies have examined the association between inequality and aggregate health measures at the state-level. Without some explicit articulation of the pathways by which inequality affects health, it is not clear why state-level inequality is an appropriate independent variable, as opposed to inequality at the national or local level, or inequality within birth cohort (as in Deaton and Paxson 2001), gender, race, or profession. Nevertheless, Wilkinson (1997a), Kennedy et al. (1998), and Soobadeer and LeClere (1999) all argue that U.S. communities are too homogeneous to observe a significant association between inequality and health below the state-level. Consequently, state-level inequality has become the focus of attention in this literature.

In contrast to studies using U.S. data, the quality of the empirical evidence from international comparisons has been the object of much criticism. Bidani and Ravallion (1997) argue that the specification estimated by Waldmann (1992) violates an adding up constraint, while Judge (1995) shows that earlier findings are difficult to replicate with revised data.[15] Further, Judge, Mulligan, and Benzeval (1998a) show that among those developed countries for which reliable data on income distribution are available, neither life expectancy nor infant mortality is significantly related to income distribution.[16] Finally, Mellor and Milyo (2001) show that the association between inequality and measures of aggregate health is extremely sensitive to the time period examined and the inclusion of relevant control variables. However, Deaton (2001) suggests that currently available international data on income inequality are so incomparable that the IIH cannot be tested across countries.

III. Evidence from Individual Data

A plethora of studies has related individual socioeconomic status to individual health (for example, Ettner 1996 and Meara 1998), but these studies do not test the importance of relative versus absolute socioeconomic status.[17] For example, Marmot (1986) finds large differences in age-adjusted mortality across British civil service grades, while Marmot et al. (1998) find a similar pattern across individuals with different educational attainment in the United States. However, it is not known to what extent the social gradient in health outcomes is attributable to the detrimental effects of social hierarchy on those in the lower tiers, the salutary effects of hierarchy on those in the upper tiers, or the unobserved characteristics that lead to selection and placement within the social hierarchy. In contrast, a clean test of the effect of social hierarchy on health can be offered by scientific experiments on animal subjects. For example, experiments on baboons and monkeys can be constructed to test the impact of changes in social status while holding diet and other environmental factors constant; Wilkinson (1996, 1997a) reports that such studies have found that

show that mortality increased at the same time that there was an increase in income inequality, but Smith (1999) finds the opposite in a longer time series.

15. Also, see the response by Wilkinson (1995).

16. Also, see the subsequent response (Wilkinson 1998) and reply (Judge, Mulligan, and Benzeval 1998b).

17. For recent reviews of this literature, see Evans (1994), Robert and House (1998), and Smith (1999).

relative social status has health consequences for lower primates.[18] Our concern is with the more narrow contention that income inequality is detrimental to human health; on this point, there are only a few recent studies that use individual health outcomes, all of which examine U.S. data.

After controlling for individual income, Fiscella and Franks (1997 and 2000) find no association between mortality and the share of income earned by the poorest 50 percent of the population in 105 ''primary sampling units'' (county or combined county units).[19] On the other hand, Kennedy et al. (1998), Fiscella and Franks (2000), and Soobadeer and LeClere (1999) all find a statistically significant association between inequality and self-reported health status.[20] However, the latter two studies do not use continuous data on inequality; none of these studies uses continuous data on income, nor do they test the (more prominent and plausible) weak version of the IIH.

In contrast, Daly et al. (1998) employ several different measures of state-level income inequality (for example, the ratio of the 90th income percentile to the 10th income percentile) and they test both the weak and strong versions of the IIH. Daly et al. examine mortality in the Panel Study of Income Dynamics (PSID) for two distinct five-year periods (centered on 1980 and 1990); they find no support for the weak IIH in either period, but they do find some support for the strong version in the latter time period. As with all of the studies mentioned above, Daly et al. do not control for any regional variation in access to health services or social norms toward diet and exercise, for example. If these factors are also correlated with income inequality (as suggested by Figures 1 and 2), then estimates of the health consequences of income inequality will be biased in favor of finding such a relationship.

The most consistent rejection of the IIH is found in Meara (1999); she examines the relationship between various measures of household income inequality on infant mortality and low birthweight. This study is notable for its large sample size (over four million observations) and because it explicitly tests the weak version of the IIH. Meara also estimates the effects of inequality both with and without controls for unobserved state-specific effects. Under either specification, Meara finds no significant effect of inequality on adverse birth outcomes, after controlling for household income and other maternal characteristics.

Deaton and Paxson (2001) estimate structural models that relate income inequality within a reference group to individual health. Using income inequality among birth cohorts, Deaton and Paxson find no support for a causal relationship between inequality and individual mortality risk. However, no previous articulation of the IIH has related inequality among birth cohorts to individual health, so this cannot be considered evidence against the IIH, at least as the hypothesis has been articulated by its major proponents.

18. Anecdotal evidence suggests that relative deprivation can also increase stress among children, dogs, and assistant professors.

19. The estimated effect of inequality in Fiscella and Franks (1997 and 2000) may be subject to attenuation bias, however, because they construct their inequality measure from (on average) only 131 observations per primary sampling unit.

20. Kennedy et al. measure inequality with a state-level gini coefficient, while Soobadeer and LeClere use a county- or tract-level gini. Also, the latter study examines only white males.

IV. Data

In order to examine whether the frequently observed correlation between income inequality and health is the product of an ecological fallacy or omitted variable bias, we use data from the Current Population Survey (CPS). The March CPS has included a question on health status since 1995.[21] The CPS has several clear advantages: it is a large and nationally representative sample, the quality of income data exceeds that of most other surveys, and it provides geographic identifiers at the level of the census division, state, and (in many cases) county, and metropolitan statistical area (MSA).[22] This allows us to construct measures of income inequality at multiple geographic levels and for noncensus years.[23]

Following Fiscella and Franks (1997, 2000), we limit the sample to white and black civilian individuals, not living in group quarters, between the ages of 25 and 74, and with nonmissing data on key covariates.[24] The resulting sample contains 309,135 individual observations across five years of the survey (1995–99). We use a second sample of individuals residing in metropolitan statistical areas (MSAs) to examine the relationship between health and a more narrowly defined type of income inequality. The MSA sample has a total of 216,572 observations.[25] Our econometric analysis is based on the unweighted data, although we employ the household weights to measure income inequality. Descriptive statistics for all variables (unweighted and weighted by the March supplemental weights for individuals) are listed in Tables 1 and 2.

A. Measure of Health Status

Individuals in the March CPS are queried about health status as part of a series of questions regarding health insurance.[26] Self-reported health status is a common mea-

21. The March CPS files were accessed using CPS Utilities, produced and distributed by Unicon Research Corporation (Santa Monica, Calif.).
22. We treat Washington, D.C. as a state.
23. In contrast, Fiscella and Franks (1997, 2000) are limited to measuring income inequality only at the level of the primary sampling unit in the National Health and Nutrition Examination Survey (NHANES); Daly et al. (1998), Soobadeer and LeClere (1999), and Meara (1999) all use only state-level inequality in census years.
24. Three individual covariates have some missing values: Hispanic ethnicity is sometimes reported as unknown, while county, metropolitan status, and central city status are sometimes not identified. The loss of observations due to these restrictions is as follows. We begin with 667,994 observations and are left with 389,345 due to the age restriction. The sample is reduced when we delete observations with missing data on race and ethnicity (n = 367,591) and again when we drop observations with missing data for MSA and central city status within an MSA (n = 309,135). In the sample of observations with missing data for MSA and central city status, mean income is lower (at $50,500) than the full sample, and there are fewer blacks (6.8 percent) and Hispanics (10 percent) than in the full sample. The mean of poor/fair health status is 13.4 percent among the observations with missing data on MSA and central city, and 14 percent in the full sample.
25. Since mean income and inequality measures are calculated from the survey responses, we drop observations for individuals who reside in MSAs with fewer than 50 household observations. Consequently, our MSA sample has 92,563 fewer observations than our state sample.
26. In an unknown number of cases, a primary respondent reports health status for all members of the household, so the CPS does not measure (strictly speaking) "self-reported health status." Consequently, we refer to our own health status variable as "reported health status."

Table 1
Descriptive Statistics for Individual-Level Variables

	Mean and Standard Deviation			
	State Sample		MSA Sample	
Continuous Variables	Unweighted Means	Weighted Means	Unweighted Means	Weighted Means
Household Income (in 000s)	52.08	53.20	56.47	57.44
	(48.06)	(48.88)	(52.12)	(52.55)
Age (in years)	45.49	45.24	44.96	44.78
	(13.35)	(13.32)	(13.26)	(13.21)

	Mean			
	State Sample		MSA Sample	
Indicator Variables	Unweighted Means	Weighted Means	Unweighted Means	Weighted Means
Poor or fair health status	0.140	0.140	0.130	0.128
Black race	0.102	0.126	0.123	0.143
Hispanic ethnicity	0.140	0.100	0.173	0.120
Female	0.524	0.514	0.526	0.514
Married	0.667	0.649	0.646	0.630
Divorced or separated	0.140	0.146	0.143	0.148
Widowed	0.046	0.045	0.045	0.044
Health insurance coverage	0.845	0.847	0.844	0.846
Central city status	0.276	0.274	0.379	0.355
Metropolitan area status	0.728	0.766	1.000	1.000
Less than high school	0.170	0.158	0.162	0.146
Some college	0.253	0.255	0.252	0.259
College degree	0.162	0.166	0.179	0.186
Advanced degree	0.080	0.081	0.091	0.092
Sample size	309,135	309,135	216,572	216,572

Note: Weighted means are calculated using the March supplemental weights for individual observations in the March CPS.

Table 2
Descriptive Statistics for Aggregate Income Variables

		Mean and Standard Deviation of						
	Sample Size	Mean Income in dollars (*Y*)	Coefficient of Variation (*CV*)	Ratio of 90th to 10th income percentile (*90:10*)	Share of Income held by top 50 percent of distribution (*Share*)	Pearson Correlation Coefficient (*Y, CV*)	Pearson Correlation Coefficient (*Y, 90:10*)	Pearson Correlation Coefficient (*Y, Share*)
State-level	255	43,322	96.11	9.94	0.799	0.095	0.085	0.056
		(6,326)	(12.29)	(1.77)	(0.017)	(0.13)	(0.17)	(0.37)
MSA-level	792	46,032	92.22	10.02	0.797	0.125	0.011	−0.002
		(9,295)	(19.07)	(2.91)	(0.026)	(0.0004)	(0.76)	(0.95)

Note: Observations are pooled over a five year period (1995–99); Washington, D.C. is treated as a state. MSAs with fewer than 50 observations are dropped from the analysis.

sure of individual health (for example, Appels et al. 1996; van Doorslaer et al. 1997; Vistnes 1997) and several studies have found it to be significantly correlated with mortality, even when controlling for other, more objective indicators of individual health (for example, Hornbrook and Goodman 1996; for a recent review of this literature, see Idler and Benyamini 1997). Nevertheless, self-reported health status is subjective and likely to be influenced by nonhealth-related factors.[27] To the extent that subjective evaluations of health status are spuriously influenced by income inequality, we expect that relative deprivation will cause people to report lower health status. Consequently, our estimates of the effect of income inequality on the health of individuals in poverty may be exaggerated by our use of reported health status as a measure of individual health.

In the CPS, health status is measured on a scale from one (excellent) to five (poor). Following van Doorslaer et al. (1997) and Marmot et al. (1998), we construct a dummy health indicator from the bottom two responses (equal to one if fair or poor, and zero otherwise). This choice of dependent variable makes our study directly comparable to Kennedy et al. (1998), Fiscella and Franks (1997, 2000), and Soobadeer and LeClere (1999). In addition, it is well established that low values (fair/poor) of self-reported health status are strongly and consistently associated with mortality, even when controlling for various medical diagnoses (Idler and Benyamini 1997).

B. Measures of Individual-Level Explanatory Variables

In the individual-level analysis, we control for the nonlinear effect of household income on health; all specifications that include household income also include household size. We use the consumer price index to adjust household income for inflation across the five years of the March CPS. Other individual-level covariates include age and age-squared, and indicator variables for race, Hispanic ethnicity, sex, marital status, health insurance coverage (either public or private), metropolitan area status, central city status, and education level. Descriptive statistics for all individual covariates are found in Table 1. Individuals in the state sample had an average household income of $53,200. Mean income among MSA residents is higher at $57,440. Fourteen percent of the state sample and 13 percent of the MSA sample reported having either poor or fair health status.

C. Measures of Income Inequality

We employ three measures of income inequality. To construct each measure, we use one observation per household and weight these by the household weights provided in the CPS. The number of observations per state-year ranges from a low of 252 (Delaware) to a high of 4,509 (California). We calculate mean state income in a similar manner. Our first measure of income inequality is the coefficient of variation (the standard deviation divided by the mean, expressed as a percentage) for real household income in each state. The coefficient of variation (CV) averages 96.11

27. Self-reported health measures seem to be endogenous to (expectations of) individual labor market outcomes (Butler et al. 1987; Bound 1990; Waidmann, Schoenbaum, and Bound 1995).

across states over the time period, and ranges from 69.1 to 142.9. We also measure inequality using the ratio of the 90th and 10th percentiles of household income (as in Daly et al. 1998, Meara 1999). This measure has a mean of 9.94, and ranges from 5.89 to 17.50. Our third measure is the share of income going to the top 50 percent of households (as in Kaplan et al. 1996a; Fiscella and Franks 1997, 2000; Meara 1999).[28] This share has a mean of 0.799, a minimum of 0.759, and a maximum of 0.857.

In addition to these state-level variables, we construct the mean income and inequality variables for MSAs, although we drop any MSAs with less than 50 observations. Descriptive statistics for state and MSA mean income and inequality variables are reported in Table 2. State-level mean income averages $43,322 while the average of MSA-level mean income is $46,032. At the MSA-level, the mean coefficient of variation is 92.22 percent. The ratio of income at the 90th percentile to the 10th percentile is about ten to one, and the share of income held by the top 50 percent of the distribution is 0.797. The final three columns of this table show that at both the state and MSA-level, mean income is not highly correlated with inequality.

V. Estimation

A. The Effects of Income and Income Inequality in Aggregate Data

It is necessary to first demonstrate that our data yield results similar to those found in previous ecological-level analyses. We accomplish this by examining the effects of mean income and income inequality on aggregate health status with ordinary least squares (OLS) models. We measure aggregate health status by the proportion of individuals reporting fair or poor health status. The results in Table 3 show that both mean income and income inequality (however measured) are associated with aggregate health status; these associations are significant across both the state and MSA levels. Of course, these results do not suggest a causal relationship, given the pitfalls of aggregate analysis. Having established that our dependent variable produces results that are qualitatively similar to those in previous ecological studies, we now turn to the individual-level analysis.

B. Testing the Strong IIH

In Tables 4 through 6, we report estimated effects of mean income and area-level income inequality from probit models of individual health status. In this exercise, we examine the impact of inequality on all individuals, or the strong version of the IIH. Each table summarizes the results from models using one of the three measures of income inequality. The first three columns of each table report results using state

28. We also measured inequality as the ratio of income at the 50th percentile to the 10th percentile (following Daly et al. 1998), and as the variance of the logarithm of income (following Deaton 2001 and Deaton and Paxson 2001). In general, these measures yield results similar to the 90:10 ratio, although the variance of log income measure is extremely sensitive to the treatment of negative incomes. For example, if negative incomes are treated as missing data, then inequality is often significantly and *negatively* associated with poor health status.

Table 3
OLS Models Using Aggregate Measures

	Proportion with Fair or Poor Health Status	
	Across States	Across MSAs
Explanatory Variable	(1)	(2)
Model 1		
Mean income	−0.0033	−0.0024
	(9.67)	(12.12)
Coefficient of variation of income (CV)	0.0010	0.0006
	(6.95)	(6.54)
Model 2		
Mean income	−0.0033	−0.0023
	(10.59)	(12.73)
Ratio of 90th to 10th income percentile	0.0094	0.0040
	(9.07)	(7.44)
Model 3		
Mean income	−0.0033	−0.0023
	(10.78)	(12.95)
Share of income held by top 50 percent of distribution	1.10	0.562
	(11.19)	(9.39)
Dependent mean	0.138	0.132
Sample size	255	792

Note: Absolute values of t-statistics are reported in parentheses. T-statistics are based on White standard errors. Aggregate income statistics are calculated at the state-level for Column 1, and the MSA-level for Column 2. MSAs with fewer than 50 respondents are not included in the MSA sample.

mean income and state-level income inequality; the next three columns report results using measures of MSA mean income and MSA-level income inequality. Marginal effects are reported; the standard errors are based on robust variance estimates that control for the clustering of observations within states and MSAs. Below we describe the results when the coefficient of variation is used to measure income inequality; these are found in Table 4. The results obtained using the other inequality measures are remarkably similar in terms of the patterns we describe below (as seen in Tables 5 and 6).

First, note that absent other controls, the estimated marginal effects of mean income and area-level inequality (reported in Columns 1 and 4 of Table 4) are similar in size and significance to those reported in the aggregate analysis (Columns 1 and 2 of Table 3). Next, we add controls for individual attributes and year dummies. To

Table 4

Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean income	−0.0034	−0.0011	−0.0005	−0.0020	−0.0003	−0.0002
	(10.74)	(4.61)	(1.93)	(10.40)	(2.16)	(1.27)
Coefficient of variation	0.0009	0.0002	−0.0001	0.0006	−0.00001	−0.00001
	(7.14)	(1.67)	(1.04)	(6.45)	(0.12)	(0.07)
Household income						
Lowest fifth		0.0050	−0.0050		−0.0046	−0.0046
		(28.09)	(28.16)		(23.80)	(23.76)
Second fifth		−0.0033	−0.0033		−0.0025	−0.0025
		(17.97)	(18.03)		(13.32)	(13.37)
Middle fifth		−0.0014	−0.0014		−0.0014	−0.0013
		(8.13)	(8.26)		(7.26)	(7.22)
Fourth fifth		−0.0013	−0.0013		−0.0011	−0.0011
		(10.45)	(10.52)		(8.21)	(8.20)
Highest fifth		−0.00002	−0.00003		−0.000004	−0.00001
		(0.86)	(0.94)		(0.15)	(0.21)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	154.06	20,451.78	21,678.55	136.03	18,085.20	19,593.30
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of t-statistics are reported in parenthesis; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and (for state sample only) residence in an MSA.

Table 5
Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean income	−0.0034	−0.0012	−0.0005	−0.0019	−0.0003	−0.0002
	(11.25)	(5.30)	(1.87)	(12.30)	(2.18)	(1.25)
Ratio of 90th to 10th	0.0073	0.0022	−0.00002	0.0048	0.0003	0.0004
	(6.34)	(2.53)	(0.02)	(8.94)	(0.91)	(0.99)
Household income						
Lowest fifth		−0.0050	−0.0050		−0.0046	−0.0046
		(27.85)	(28.05)		(23.71)	(23.66)
Second fifth		−0.0033	−0.0033		−0.0025	−0.0025
		(17.97)	(18.03)		(13.31)	(13.35)
Middle fifth		−0.0014	−0.0014		−0.0014	−0.0014
		(8.16)	(8.26)		(7.28)	(7.24)
Fourth fifth		−0.0013	−0.0013		−0.0011	−0.0011
		(10.53)	(10.53)		(8.23)	(8.22)
Highest fifth		−0.00002	−0.00003		−0.00001	−0.00001
		(0.86)	(0.97)		(0.18)	(0.24)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	137.86	20,454.64	21,593.08	251.82	18,159.52	19,579.49
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of *t*-statistics are reported in parenthesis; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence, and (for state sample only) residence in an MSA.

Table 6
Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean income	−0.0035	−0.0011	−0.0005	−0.0019	−0.0003	−0.0002
	(11.98)	(5.03)	(1.89)	(12.18)	(2.17)	(1.28)
Share of top 50 percent	0.925	0.285	0.016	0.551	−0.012	−0.008
	(9.55)	(3.06)	(0.20)	(10.51)	(0.31)	(0.17)
Household income						
Lowest fifth		−0.0050	−0.0050		−0.0046	−0.0046
		(27.95)	(28.12)		(23.78)	(23.75)
Second fifth		−0.0033	−0.0033		−0.0025	−0.0025
		(17.93)	(18.02)		(13.34)	(13.39)
Middle fifth		−0.0014	−0.0014		−0.0014	−0.0013
		(8.16)	(8.26)		(7.26)	(7.22)
Fourth fifth		−0.0013	0.0013		−0.0011	−0.0011
		(10.53)	(10.52)		(8.22)	(8.21)
Highest fifth		−0.00003	−0.00003		−0.000004	−0.00001
		(0.90)	(0.98)		(0.14)	(0.21)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	189.22	20,532.85	21,646.94	302.41	18,239.47	19,766.77
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of *t*-statistics are reported in parenthesis; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence, and (for state sample only) residence in an MSA.

allow for nonlinearity in the relationship between health status and individual income, we estimate a spline function in household income where the knots are defined at the quintiles of the income distribution. Other individual characteristics are also included as explanatory variables, such as age, race, sex, marital status, education, and health insurance status. As a result the marginal effect of income inequality is reduced substantially (see Columns 2 and 5 in Table 4). Moreover, MSA-level income inequality no longer has a statistically significant effect on health status. At each quintile in the distribution, the marginal effect of household income is negative; the effect is largest among the bottom fifth of households and successively smaller at each quintile. At the top fifth of the distribution, household income has no significant effect on health status. Judging from these results, a large part of the ecological-level association between income inequality and health status is attributable to the nonlinear association between individual income and health. However, there remains a significant association between individual health status and state-level income inequality.

The effects of several other individual-level variables included in the models are also worth noting. For example, respondents with a college degree are 30 percent less likely to report being in poor or fair health (the effect of having an advanced degree is even greater, at 36 percent). Blacks are 28 percent more likely to report poor or fair health status, all else equal. Having health insurance has the unexpected effect of increasing the probability of being in poor or fair health by 1.8 percentage points.

In addition to individual characteristics such as these, there are other important determinants of health status that can not be measured explicitly in the Current Population Survey. These include access to medical care, prices of medical care, practice patterns of health care suppliers, environmental and behavioral risk factors, and diet and exercise. As we discussed in the introduction, many of these factors have a large regional component. We control for these important regional factors by including dummy variables representing census divisions in the United States. These are added to our probit models of health status; results are reported in Columns 3 and 6.[29] When the set of census division dummies is added to the model, the marginal effect of income inequality is statistically insignificant in both the MSA sample and the state sample. In both samples, the sign of the marginal effect is negative.

The same pattern of results is found in Table 5 (using the ratio of the 90th to 10th percentiles of income) and in Table 6 (using the share of income held by the top 50 percent of the distribution). In summary, we find initial support for the strong version of the IIH, but the addition of income and other individual controls strongly attenuates this association and yields an insignificant coefficient on inequality in the MSA sample. In the state sample, the further addition of controls for region of resi-

29. Census division dummies are preferred over other types of regional aggregations, such as state and region. Region dummies for north, south, west, and central often mask differences within those areas. For example in our analysis, a western region dummy had a marginal effect of 0.005 ($t = 0.98$), whereas two division dummies for mountain and pacific had marginal effects of -0.0001 and 0.015 respectively, and the latter was significant at the 0.001 level. State dummy variables on the other hand may remove more variation than is desired in a five year panel. In all models shown here, results from likelihood ratio tests reject the null hypothesis that the division dummies are jointly equal to zero.

dence removes any remaining contribution of income inequality to reported health status.

One concern is that the inclusion of division effects alone is driving this latter result; in particular, if there is insufficient variation in inequality within census divisions, then we might not observe a statistically significant association between health status and income inequality even when inequality is an important determinant of health. When we reestimate our models with division effects but absent individual level controls, however, then we again find a significant association between state income inequality and health (with *t*-statistics between 4 and 7). In fact, we also find a similar result in the MSA sample. Consequently, the aforementioned concern is unfounded.

C. Testing the Weak IIH

The evidence from existing research on the weak version of the IIH is less favorable than that for the strong version. We reexamine this issue in the same manner that we have tested the strong version of the IIH, except that now we allow the effect of income inequality to vary by the income level of the household. This is accomplished by creating five dummy variables based on quintiles in the distribution of household income. For example, if an individual lives in a household that has income at the 56th percentile in the distribution, a dummy variable (middle fifth) is set equal to one, and four dummies for the other quintiles are set equal to zero. These dummies are interacted with the measure of income inequality. Differences in the magnitude and sign of these five interaction terms will suggest how income inequality affects low-income individuals relative to middle and higher income individuals. The results are reported in Tables 7 through 9; as before, the coefficient of variation, the ratio of 90th to 10th percentile of incomes, and the share of the top 50 percent of household incomes are used in separate analyses to measure inequality.

Below we describe results using the coefficient of variation; as in the previous set of tables there is little change in the key results when the other inequality measures are used. In Columns 1 and 4 of Table 7, note that, absent other controls, income inequality increases the likelihood of being in poor or fair health among low-income respondents, has no effect on middle-income respondents, and reduces the likelihood of poor or fair health among those with higher incomes. But when controls for the independent effect of household income and other individual-level characteristics are added, the state-level results suggest that income inequality has adverse health consequences across all income levels, although marginal effects for two of the five interaction terms are not significant at conventional levels and the remaining three are significant only at the 0.10 level. In the MSA sample, none of the five interaction terms has a statistically significant effect after individual covariates are added.

Once we include the dummies for census division, the coefficient on income inequality (at any level of household income) is further attenuated. In both the state and MSA samples, the marginal effects are all statistically insignificant, although likelihood ratio tests are unable to reject the null hypothesis that the interaction terms are jointly significant at the 0.01 level. More troubling for the weak IIH is that the estimated coefficient on inequality has the wrong sign for every income quintile in

Table 7
Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean income	−0.0014	−0.0011	−0.0005	−0.0004	−0.0003	−0.0002
	(4.83)	(4.60)	(1.93)	(2.84)	(2.14)	(1.25)
Coefficient of variation						
Lowest fifth	0.0015	0.0003	−0.0001	0.0011	−0.0001	−0.0001
	(13.28)	(1.76)	(0.79)	(13.07)	(1.26)	(1.10)
Second fifth	0.0006	0.0002	−0.0002	0.0002	−0.0001	−0.0001
	(4.94)	(1.39)	(1.30)	(2.71)	(0.85)	(0.78)
Middle fifth	0.00001	0.0003	−0.0001	−0.0003	0.00005	0.00004
	(0.13)	(1.78)	(0.85)	(3.33)	(0.65)	(0.63)
Fourth fifth	−0.0004	0.0003	−0.0001	−0.0007	0.0001	0.0001
	(3.24)	(1.89)	(0.65)	(7.55)	(1.24)	(1.19)
Highest fifth	−0.0007	0.0002	−0.0001	−0.0010	0.0001	0.0001
	(5.63)	(1.43)	(1.06)	(9.83)	(1.19)	(1.12)

Household income						
Lowest fifth		−0.0048	−0.0048		−0.0046	−0.0046
		(22.74)	(22.87)		(21.18)	(21.23)
Second fifth		−0.0032	−0.0032		−0.0030	−0.0030
		(11.06)	(11.06)		(10.27)	(10.20)
Middle fifth		−0.0019	−0.0019		−0.0019	−0.0019
		(6.55)	(6.69)		(6.31)	(6.25)
Fourth fifth		−0.0011	−0.0011		−0.0012	−0.0012
		(4.62)	(4.72)		(4.66)	(4.64)
Highest fifth		−0.00001	−0.00002		−0.00001	−0.00001
		(0.42)	(0.50)		(0.29)	(0.34)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	3,075.45	20,542.64	21,765.00	2,746.92	18,245.26	19,844.50
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of t-statistics are reported in parentheses; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and (for state sample only) residence in an MSA.

Table 8
Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean Income	−0.0015	−0.0012	−0.0005	−0.0004	−0.0003	−0.0002
	(5.27)	(5.30)	(1.86)	(2.99)	(2.17)	(1.24)
Ratio of 90th to 10th						
Lowest fifth	0.0148	0.0022	0.00001	0.0109	−0.00003	0.00007
	(12.79)	(2.40)	(0.01)	(22.06)	(0.08)	(0.16)
Second fifth	0.0058	0.0017	−0.0006	0.0031	−0.000001	0.00008
	(5.32)	(1.82)	(0.67)	(6.68)	(0.003)	(0.18)
Middle fifth	0.0007	0.0023	0.0001	−0.0013	0.0007	0.0008
	(0.67)	(2.62)	(0.15)	(2.74)	(1.65)	(1.65)
Fourth fifth	−0.0031	0.0027	0.0006	−0.0049	0.0009	0.0010
	(2.97)	(3.11)	(0.70)	(8.67)	(1.70)	(1.66)
Highest fifth	−0.0057	0.0022	0.0002	−0.0070	0.0007	0.0008
	(5.39)	(2.34)	(0.20)	(12.33)	(1.09)	(1.10)

Household income						
Lowest fifth		−20.0047	−20.0047		−20.0046	−20.0046
		(22.91)	(23.14)		(21.13)	(21.12)
Second fifth		−20.0032	−20.0032		−20.0028	−20.0028
		(11.80)	(11.67)		(10.19)	(10.13)
Middle fifth		−20.0020	−20.0020		−20.0017	−20.0017
		(7.45)	(7.69)		(6.05)	(5.98)
Fourth fifth		−20.0012	−20.0012		−20.0010	−20.0010
		(5.05)	(5.25)		(4.17)	(4.18)
Highest fifth		−20.00001	−20.00002		0.000003	0.000004
		(0.47)	(0.62)		(0.09)	(0.15)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	2,143.1	20,896.90	21,932.05	2,352.80	18,686.02	19,953.40
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of t-statistics are reported in parentheses; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and (for state sample only) residence in an MSA.

Table 9

Effect of Income Inequality on Individual Health Status: Marginal Effects from Probit Models Reported

	Dependent Variable = 1 if Health Status is Poor or Fair					
	State Level Inequality (n = 309,135)			MSA Level Inequality (n = 216,572)		
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
Mean income	−0.0015	−0.0011	−0.0005	−0.0004	−0.0003	−0.0002
	(5.17)	(5.03)	(1.88)	(2.63)	(2.16)	(1.27)
Share of top 50 percent						
Lowest fifth	0.700	0.294	0.036	0.327	−0.021	−0.016
	(7.57)	(3.20)	(0.48)	(6.36)	(0.53)	(0.35)
Second fifth	0.579	0.286	0.029	0.215	−0.017	−0.013
	(6.26)	(3.11)	(0.37)	(4.23)	(0.45)	(0.29)
Middle fifth	0.511	0.291	0.034	0.153	−0.005	−0.001
	(5.55)	(3.17)	(0.44)	(3.01)	(0.14)	(0.03)
Fourth fifth	0.461	0.293	0.036	0.104	−0.001	0.003
	(4.99)	(3.21)	(0.47)	(2.03)	(0.02)	(0.07)
Highest fifth	0.424	0.286	0.029	0.075	−0.002	0.002
	(4.58)	(3.12)	(0.37)	(1.46)	(0.05)	(0.05)

Household income						
Lowest fifth		−0.0047	−0.0048		−0.0046	−0.0046
		(23.28)	(23.28)		(21.00)	(21.03)
Second fifth		−0.0031	−0.0031		−0.0030	−0.0030
		(10.46)	(10.48)		(9.48)	(9.45)
Middle fifth		−0.0018	−0.0019		−0.0018	−0.0018
		(6.42)	(6.50)		(5.66)	(5.61)
Fourth fifth		−0.0011	0.0011		−0.0011	−0.0011
		(4.58)	(4.58)		(4.08)	(4.07)
Highest fifth		−0.00001	−0.00002		−0.000002	−0.000004
		(0.48)	(0.56)		(0.07)	(0.12)
Plus individual characteristics and year dummies	no	yes	yes	no	yes	yes
Plus census division dummies	no	no	yes	no	no	yes
Model chi-squared	4,535.17	20,863.16	21,935.68	5,400.20	18,501.73	19,978.41
(P value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Note: Absolute values of *t*-statistics are reported in parentheses; the test statistic is based on the null hypothesis that the underlying coefficient is equal to zero. Marginal effects are calculated by multiplying the probit coefficient by the value of the standard normal probability density function evaluated at the mean of all explanatory variables. The mean of the dependent variable in the state-level sample is 0.14, and 0.13 in the MSA-level sample. Other individual characteristics include age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and (for state sample only) residence in an MSA.

the state sample, and for the poorest three quintiles in the MSA sample. This is quite contrary to what the weak IIH would predict.

We do not observe as many changes in the direction of the marginal effect of inequality when we use the other measures of inequality, although the same general pattern arises. First, absent any individual-level covariates, the estimated effects of inequality are consistent with the weak IIH. However, once we control for individual characteristics, these effects tend to be attenuated; the further addition of controls for census divisions quashes any remaining significant effect of income inequality.

One near exception to this should be noted. In Column 6 of Table 8, we do find marginally significant effects of inequality on the third and fourth income quintiles ($0.05 < p < 0.10$). However, this "upper-middle class effect" is inconsistent with either version of the IIH, and is not borne out in the state sample, or with the other two inequality measures. Finally, we should note that in every specification that includes individual covariates, we are unable to reject the null hypothesis of a common coefficient on income inequality across all five income quintiles; this is also inconsistent with the weak IIH.

D. Robustness Tests

The results described above are robust to several changes in the sample and the model specification. In any given year, 50 percent of the respondents in the March CPS are repeated from the previous year; this is because groups of respondents are surveyed for four months, omitted for eight months, then surveyed again for another four months. For this reason, pooling cross-sections of the CPS will result in multiple observations of some individuals whose health status in one year may likely depend on health status in the previous year. To test whether the interdependence of some observations is driving our results, we reestimate all of the models reported in Tables 4 to 9 on a sample of observations for 1995, 1997, and 1999.[30] We find no substantive differences in the pattern of the results.

We next restrict our sample to household heads only, since the adverse consequences of income inequality may be expected to have a greater effect on persons who are decision makers in their households. Because heads supplied information on health status for all household members, it is also interesting to examine their own self-reported response to this question separately. There are 127,698 household heads in the state sample and 88,179 in the MSA sample. Again, we find no support for the income inequality hypothesis in the state or the MSA sample;[31] this is also the case if we restrict the sample to be only men or only women.

In addition, we have also repeated our analysis using the original five-category measure of reported health status as our dependent variable. The ordered probit model results are broadly consistent with those of the probit models reported here.

30. Using only odd-numbered years reduces the size of the state sample to 188,002 observations, and the MSA sample to 130,685 observations.

31. Contrary to the IIH, marginal effects for income inequality interacted with the second fifth of the income distribution are negative and significant in the state sample for two measures of inequality in the "household-heads only" specification.

For the most part, the coefficients of the income inequality measures are statistically insignificant, consistent with the results reported here.

VI. Discussion

The oft-repeated finding of an association between income inequality and aggregate health outcomes has generated a great deal of attention among policy-makers and public health researchers. A handful of skeptics have pointed to the absence of a clear and convincing articulation of the causal pathway by which income inequality may affect individual health, as well as the possibility that the empirical evidence is attributable to an ecological fallacy. On this latter point, only a few recent studies have attempted to test the income inequality hypothesis with individual-level data. Even ignoring the shortcomings of these studies, results are at best mixed. However, this has not deterred proponents of the IIH from concluding that the health consequences of income inequality are well established and should be considered by policy makers (see especially Wilkinson 1996, Kennedy et al. 1998).

We demonstrate that previous findings of such an association are partly the product of an ecological fallacy and partly attributable to the failure to control for individual covariates, year effects, and geographic characteristics. Our empirical exercise differs from much of the previous literature in two important respects: we control for regional characteristics that may be spuriously correlated with income inequality and we explore whether the relationship between income inequality and health is robust across geographic units. The failure to find a robust association between income inequality and health after controlling for census division effects is consistent with previous studies that have found no relationship between changes in state-level income inequality and changes in aggregate health outcomes (Kaplan et al. 1996a; Daly et al. 1998; Mellor and Milyo 2001).

One finding stands out in earlier work, as well as in our own: the statistical association between income inequality and individual health outcomes is greatly attenuated once controls are added for individual income. But this might occur precisely because the IIH is true; for example, if the psychosocial consequences of inequality adversely effect an individual's health, which in turn limits his or her ability to earn income. Although there is a well-established link from individual health status to the ability to earn income (for example, Levy 1999), the same cannot be said for a relationship between inequality and individual income. We have explored this latter claim by regressing individual income on state income inequality and various sets of individual-level covariates (education, race, etc.); in general, the coefficient on inequality is marginally significant, but *positive*. Consequently, there is no reason to believe that evidence of the IIH has been masked by controlling for the effects of individual income.

In summary, we find no consistent evidence of an association between state-level and metropolitan-area-level income inequality and the health status of all individuals (strong IIH), and no consistent evidence that inequality has its strongest impact on the health of the poor (weak IIH). We use reported health status for a dependent variable but similar results have been found in studies that examine mortality (Daly et al. 1998) or infant health (Meara 1999). Consequently, we doubt that, even among the poor, income inequality is one of the most powerful determinants of health.

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