Associations Between Income Inequality and Mortality Among US States: The Importance of Time Period and Source of Income Data

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Objectives. We used census data to examine associations between income inequality and mortality among US states for each decade from 1949 to 1999 and tax return income data to estimate associations for 1989.

Methods. Cross-sectional correlation analyses were used to assess income inequality–mortality relationships.

Results. Census income analyses revealed little association between income inequality and mortality for 1949, 1959, or 1969. An association emerged for 1979 and strengthened for 1989 but weakened for 1999. When income inequality was based on tax return data, associations were weaker for both 1989 and 1999.

Conclusions. The strong association between income inequality and mortality observed among US states for 1989 was not observed for other periods from 1949 through 1999. In addition, when tax return rather than census data were used, the association was weaker for 1989 and 1999. The potential for distal social determinants of population health (e.g., income inequality) to affect mortality is contingent on how such determinants influence levels of proximal risk factors and the time lags between exposure to those risk factors and effects on specific health outcomes. (*Am J Public Health.* 2005;95:1424–1430. doi:10.2105/AJPH.2004.048439)

In 1996, 2 studies[1,2] that used US state data apparently confirmed an association between income inequality and health in rich countries.[3] However, a recent comprehensive, systematic review yielded little supportive evidence for such an association.[4] That review and others suggest that the most consistent evidence in favor of an association between income inequality and health is based on various cross-sectional aggregate and multilevel analyses of data collected during the late 1980s.[4–6] However, in the few analyses of other periods and in analyses involving time trends, evidence for such associations is less convincing.[7,8]

We examined cross-sectional associations between income inequality and mortality among US states for each decade from 1949 to 1999 with income inequality estimates based on household income as reported in the decennial US census. We examined the sensitivity of these associations to sources of income inequality estimates by calculating associations between income inequality and mortality for 1988, 1995, and 1999 with information on family and individual incomes as reported in Internal Revenue Service (IRS) tax returns.[9] The increase in income inequality since the 1970s has been driven mainly by disproportionate gains in income among the highest earners.[10] Thus, use of census-derived data, which include only precoded income categories, may underestimate levels of income inequality because the highest incomes reported in the open-ended top category (above $150 000) are treated equivalently.

METHODS

We obtained estimates of Gini coefficients for household incomes from published decennial census data for 1949–1979[11] and calculated coefficients directly from decennial census files for 1989 and 1999. In the US census, income is reported for the preceding year in intervals, but the highest income category is open ended, which could lead to "top-coding" problems because very high incomes might be underestimated. We used income data derived from a statistical match of the 1988 IRS Individual Use Tax File with US Census Public Use Micro Data Samples[9] and projections from these estimates for 1995 and 1999. The IRS matched file was created by the Institute for Taxation and Economic Policy and reports actual income rather than income category because it was derived from tax returns.

Information from reports published by the National Center for Health Statistics,[12] along with this agency's Compressed Mortality Files (1949–1999),[13] was used to calculate age-adjusted mortality rates for each state. Information on self-rated health was included because it is commonly used in US studies of income inequality and health.[4] Information on prevalence of fair and poor self-rated health was derived from 1993 (the first year in which such data were available for all states) and 1999 Behavioral Risk Factor Surveillance System data.

RESULTS

Table 1 shows cross-sectional correlations between US census income inequality data and mortality rates for each decade from 1949 through 1999. Also shown are associations between income inequality measured in 1989 and 1999 and self-rated health measured in 1993 and 1999. We found little association between income inequality and mortality for 1949, 1959, or 1969. An association between income inequality and mortality emerged for 1979 ($r=0.39$, $P=.005$) and became stronger for 1989 ($r=0.58$, $P<.001$) but weakened for 1999 ($r=0.44$, $P=.002$). Income inequality in 1989 was strongly associated with self-rated health in 1993 ($r=0.63$, $P<.001$), and there was an equally strong cross-sectional association between income inequality and self-rated

TABLE 1—Associations of Income Inequality With Mortality and With Self-Rated Health Derived From Different Sources of Income Information: US States, 1949–1999

		All-Cause Mortality Rate[a]		Reports of Fair or Poor Health[b]	
	Gini Coefficient, Mean (Range)	*r*	*P*	*R*	*P*
US census data					
1949	0.44 (0.40-0.51)	0.11	.478	...	...
1959	0.39 (0.35-0.49)	-0.06	.689	...	...
1969	0.36 (0.32-0.43)	0.24	.089	...	...
1979	0.40 (0.37-0.44)	0.39	.005	...	...
1989[b]	0.43 (0.39-0.48)	0.58	<.0001	0.63	<.0001
1999	0.45 (0.40-0.50)	0.44	.002	0.64	<.0001
Internal Revenue Service (IRS) tax return data					
1988[b]	0.48 (0.45-0.54)	0.34	.013	0.14	.354
1995	0.49 (0.45-0.54)	0.30	.034	0.18	.216
1999	0.51 (0.45-0.58)	0.11	.409	0.15	.279

[a]Age adjusted to US year 2000 standard population.
[b]Self-rated health in 1993 or 1999.

health for 1999 (r=0.64, P<.001). Figure 1 depicts the patterns of the changing associations of income inequality with mortality among the US states across time periods. Figures 1a through 1f are identically scaled on the x- and y-axes to aid comparisons across decades.

Table 1 shows that when income inequality was based on IRS tax return data for 1988, associations of income inequality with mortality and with self-rated health were weaker (r=0.34, P=.013) than when calculations were based on census data for 1989 (r=0.58). For 1999, use of census income data yielded a correlation of 0.44 (P=.002), whereas use of IRS estimates yielded a correlation of 0.11 (P=.409). Unlike with census data, when IRS data were used to measure income inequality no association of income inequality with self-rated health was observed for 1988, 1995, or 1999. Figure 2 shows cross-sectional associations for 1989 between income inequality and mortality derived from US census data (Figure 2A) and IRS estimates (Figure 2B). When estimates of income inequality were based on IRS tax return estimates rather than census data, absolute levels of income inequality were much higher, and a different rank ordering of US states was evident.

DISCUSSION

We observed an inconsistent association for the past 50 years between income inequality and mortality. Little association was observed for the 1950s and 1960s, but an association did appear for the late 1970s; this association peaked in 1989 and declined for 1999. These dynamics in the association between income inequality and mortality primarily reflect different temporal patterns of mortality declines across US states. If we could "animate" the series of cross-sectional plots across decades, we would see all states "shift to the left" between 1949 and 1969. Income inequality declined in all states during that period, although these decreases were less pronounced in southern states such as Mississippi, Arkansas, and Louisiana.

By 1969, mortality had begun to decline among the more economically equal states, largely as a result of reductions in rates of coronary heart disease (CHD). The decline in CHD drove the overall mortality reduction beginning in the mid-20th century in the United States. CHD rates peaked in the 1950s among women and in the late 1960s among men, and since have declined by more than 50%. New England states exhibited the lowest levels of income inequality in the 1970s and showed strong declines in CHD rates over time despite simultaneously showing some of the largest increases in income inequality.[14]

In contrast, states in the west south central (Arkansas, Louisiana, Oklahoma, Texas) and east south central (Alabama, Kentucky, Mississippi, Tennessee) regions exhibited slower mortality declines, and by the mid-1980s these states' downward trends in CHD rates had actually reversed.[8] The smaller reductions in CHD and slower overall decreases in mortality among southern states are thus the key to understanding how the strong correlation between income inequality and overall mortality emerged for 1989. The southern states with higher rates of income inequality showed more gradual mortality declines between 1949 and 1989 than did other states.

However, by 1999 the correlation was again weak, because New York, Connecticut, Massachusetts, and California had higher rates of income inequality and relatively low mortality rates. The correlation between high rates of income inequality and reduced rates of mortality was 0.62 (P<.001), suggesting that the states with the largest increases in income inequality from 1949 to 1999 exhibited the largest decreases in mortality.

It is possible that a lower income-inequality environment during the 1950s and 1960s created a more favorable context for greater declines in CHD rates in some states. In an analysis that assumed a 50-year time lag, the correlation between income inequality in 1950 and all-cause mortality in 2000 was 0.71 (P<.001); that is, states with higher income inequality rates in 1950 had higher mortality rates in 2000. Although this explanation is plausible, it has problems. First, it would be a theoretical prediction and would not be consistent with state trends in causes of death such as suicide and homicide, which do not show similar temporal patterns and may be even more directly linked to income inequality.[8] Second, if lower income inequality promotes declines in CHD, how did high levels of CHD come to exist in these lower-inequality states in the first place? Third, the states that exhibited the largest mortality declines were also those that exhibited the largest income inequality increases between the 1970s and the 1990s.

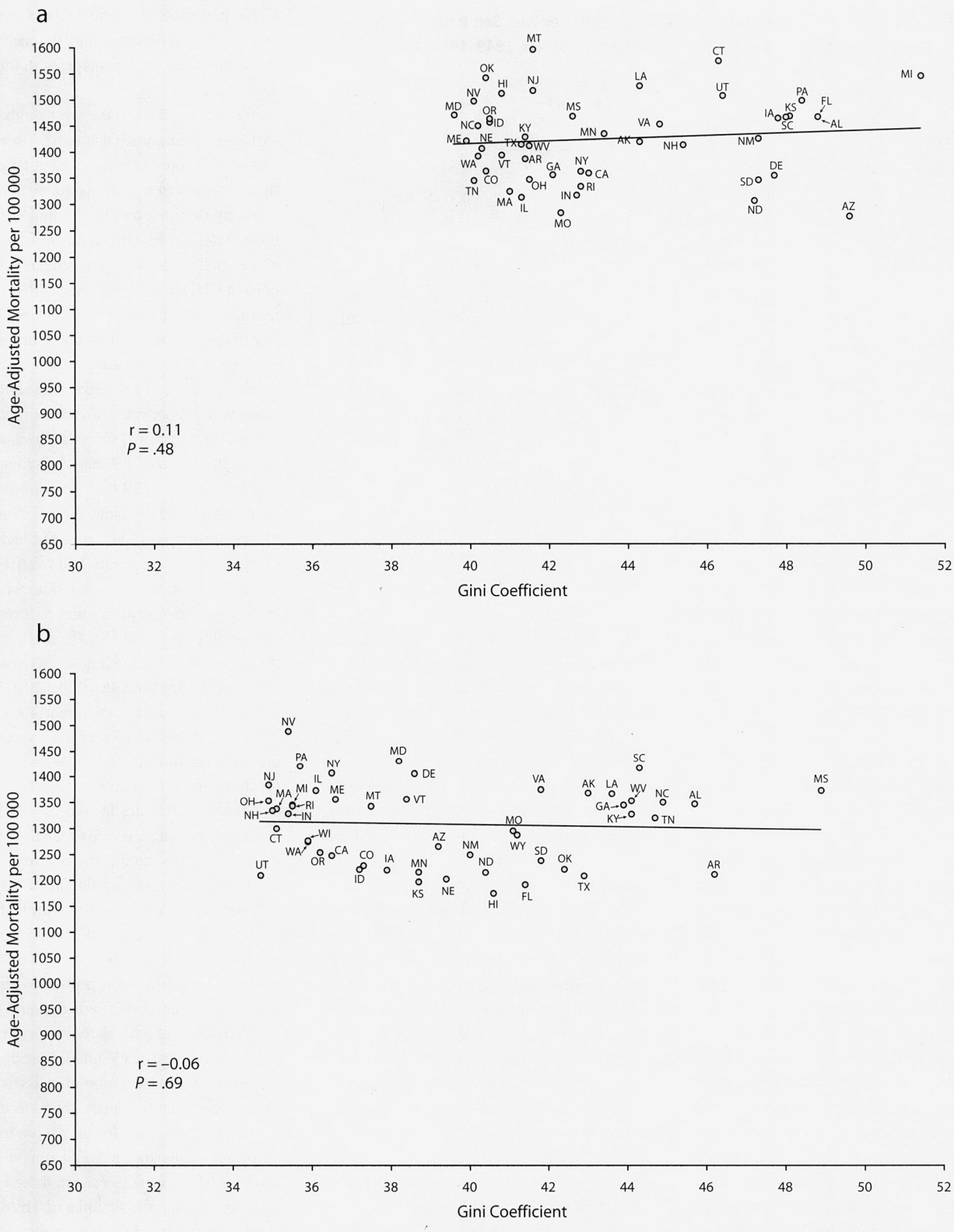

FIGURE 1—Cross-sectional associations between income inequality (derived from census income data) and mortality for US states at 10-year intervals, (a) 1949 through (f) 1999.

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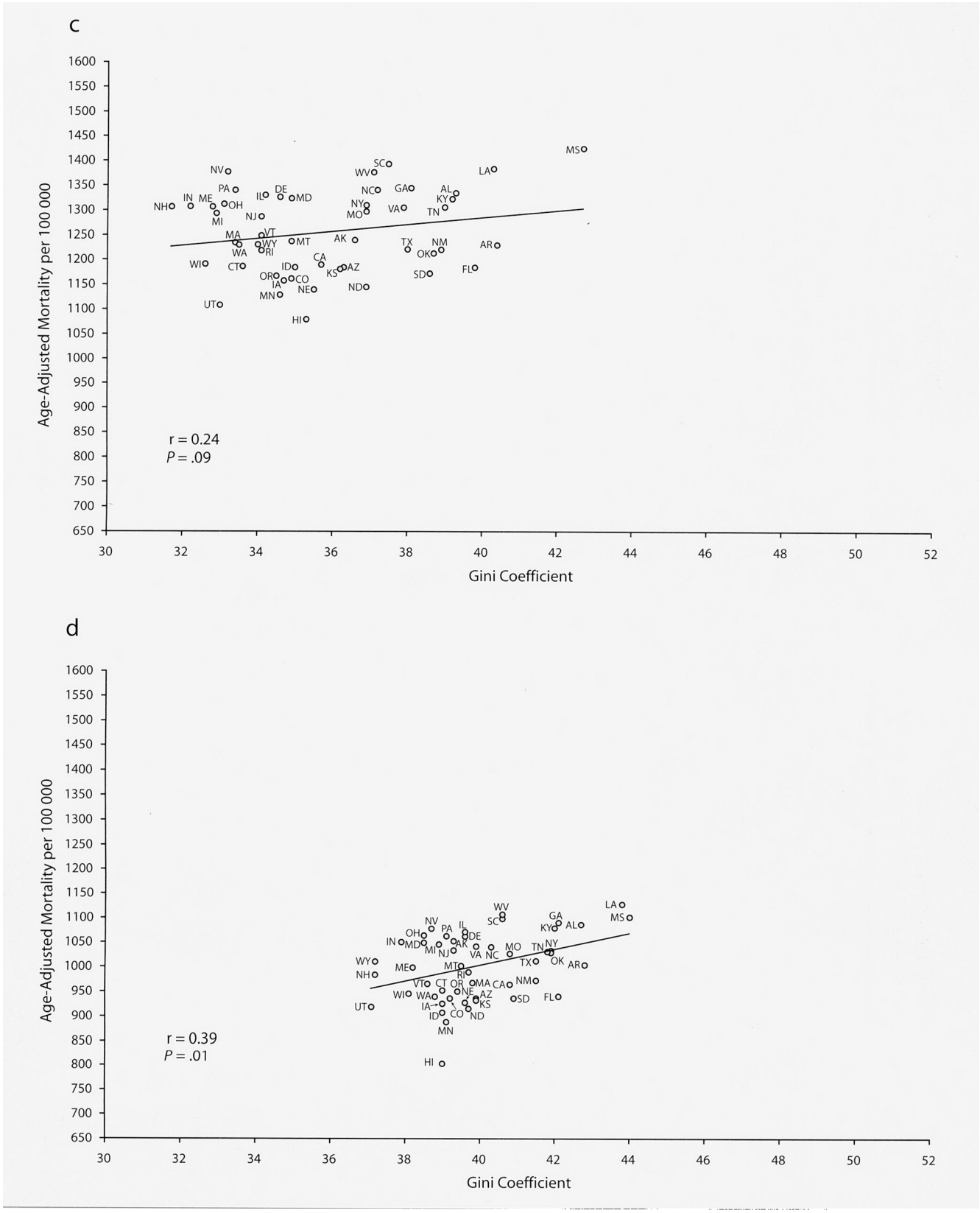

FIGURE 1—*Continued*.

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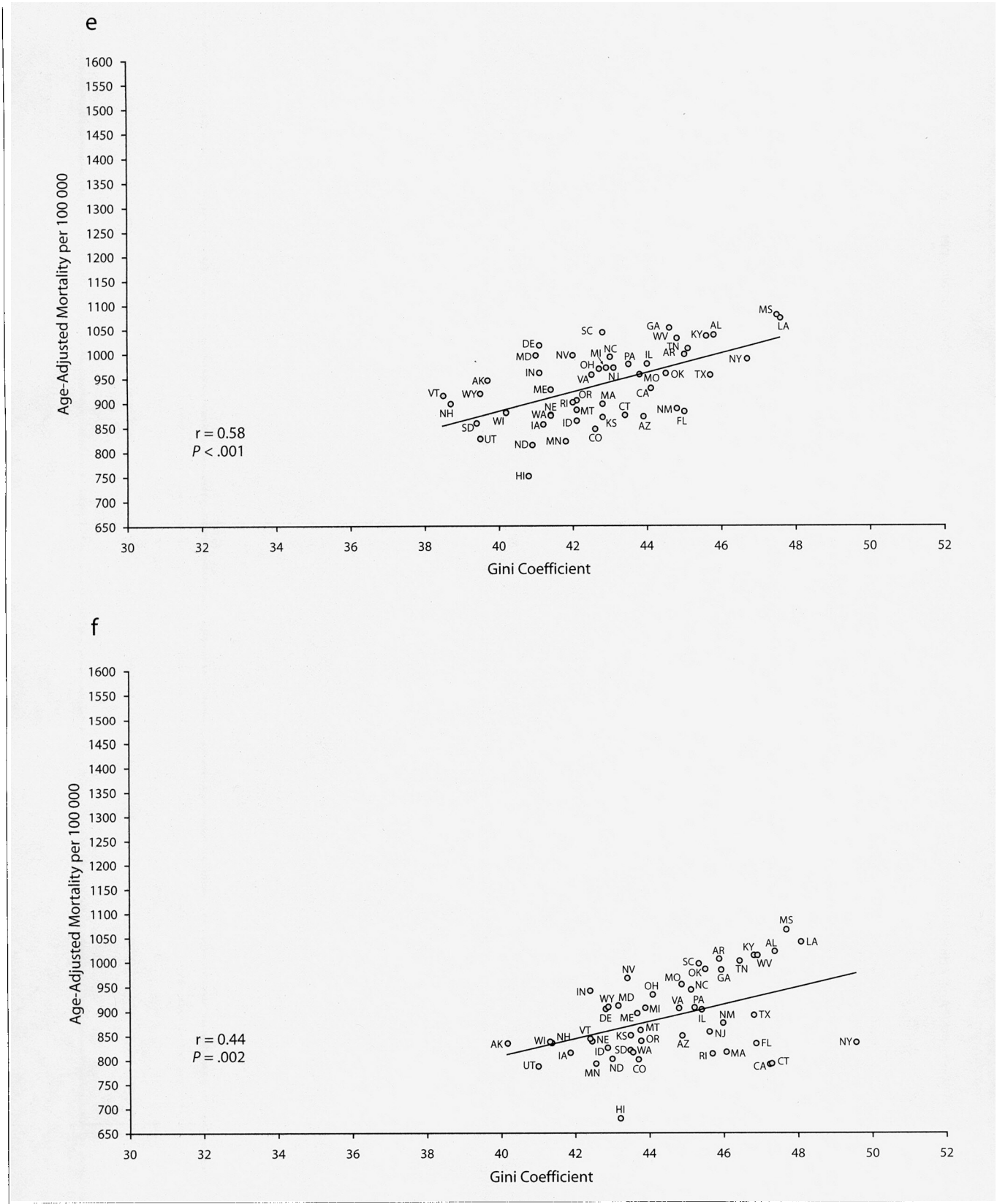

FIGURE 1—*Continued*.

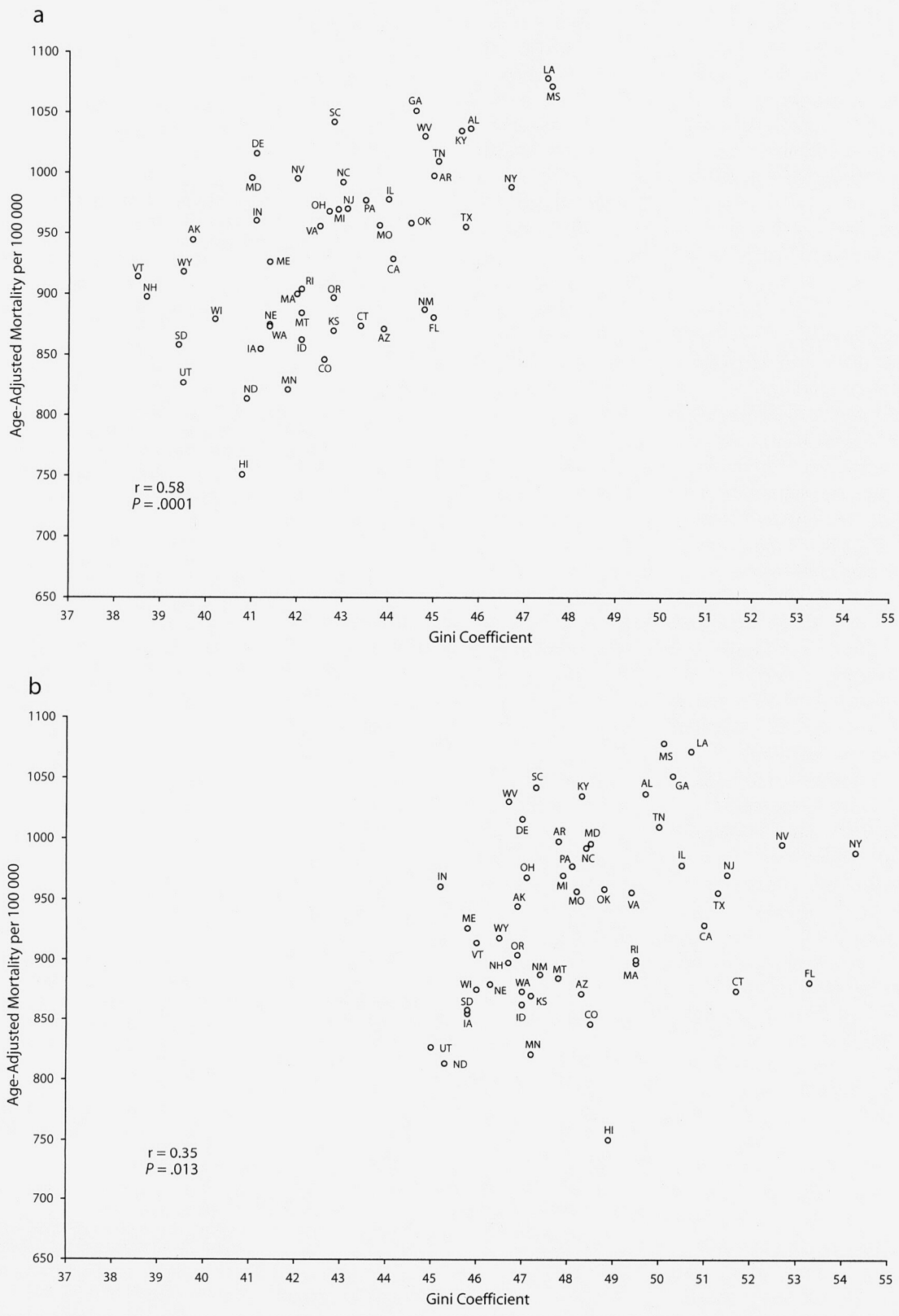

FIGURE 2—Cross-sectional associations between income inequality and mortality based on (a) US census data and (b) Internal Revenue Service (IRS) tax return data: US states, 1989.

Rather than income inequality directly determining mortality trends, it seems more likely that income inequality's effects on mortality are contingent on the way in which levels of income inequality are linked to population levels of the major proximal CHD risk factors, such as blood lipid levels, hypertension, and smoking.[15] As we have shown elsewhere, income inequality trends do not follow trends in major CHD risk factors.[8] At the national level, income inequality evidenced its most dramatic decline from the end of the Depression through the end of World War II, precisely the same time that smoking rates underwent their steepest increase.[8]

Our second analysis showed that the strong cross-sectional association between income inequality and mortality for 1989 was reduced when income inequality estimates were based on IRS tax return data rather than on census data. International studies of income inequality and health have been criticized for problems involving data quality and measurement,[16,17] but US studies may be less susceptible to these problems because income figures can be derived from reliable US census data. Our analyses show that the strength of the association between income inequality and health—even for the late 1980s, the period for which this association is strongest—is dependent on the source of income data.

It can be seen from Figure 2 that when very high incomes were included in income inequality estimates, a different ranking of US states emerged. When extent of income inequality was based on actual income from IRS tax returns, New York, Florida, Nevada, Connecticut, and New Jersey were among the states with the highest levels of inequality. When estimates were based on US census gross income categories, income inequality spuriously appeared higher among southern states. Not surprisingly, the percentage of households with incomes in the top category was highest (3.2%) in the middle Atlantic region (New York, New Jersey, Pennsylvania) and lowest (1.4%) in the east south central region (Alabama, Kentucky, Mississippi, Tennessee). Thus, the key difference between sources of income data probably is located in the top coding of very high incomes, so that tax return estimates better reflect the true extent of income inequality by more accurately capturing the top of the income distribution.[9]

In summary, the strength of the association between income inequality and mortality observed among US states for 1989 was not observed in preceding or subsequent periods. The association was very weak for 1949–1979 and declines by 1999. In addition, when income inequality was measured via tax return data—a method that better characterizes incomes among the wealthy and provides a more accurate indication of the true extent of income inequality—associations with mortality and self-rated health were uniformly weaker. The strength of the association between income inequality and mortality observed for the latter half of the 20th century depends on temporal contexts and how income inequality is measured. The potential for distal social determinants of population health—such as income inequality—to affect mortality is contingent on how such determinants influence levels of more proximal risk factors. In addition, associations between distal social determinants and population health depends on the time lags between exposure to these risk factors and their effects on different types of health outcomes. ■

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Contributors

J. Lynch, S. Harper, and G. Davey Smith contributed to the study's conception, design, analysis, and interpretation and to the writing of the article. G.A. Kaplan contributed to the writing.

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Human Participant Protection

No protocol approval was needed for this study.

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