Economic Opportunity, Health Behaviors, and Mortality in the United States

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Objectives. We assessed whether economic opportunity was independently associated with health behaviors and outcomes in the United States.

Methods. Using newly available, cross-sectional, county-level data from the Equality of Opportunity Project Database and vital statistics, we estimated associations between all-cause mortality rates (averaged over 2000-2012) and economic opportunity, adjusting for socioeconomic, demographic, and health system covariates. Our measure of economic opportunity was the county-average rank in the national income distribution attained by individuals born to families in the bottom income quartile. Secondary outcomes included rates of age- and race-specific mortality, smoking, obesity, hypertension, and diabetes.

Results. An increase in economic opportunity from the lowest to the highest quintile was associated with a 16.7% decrease in mortality. The magnitudes of association were largest for working-age adults and African Americans. Greater economic opportunity was also associated with health behaviors and risk factors.

Conclusions. Economic opportunity is a robust, independent predictor of health. Future work should investigate underlying causal links and mechanisms. (*Am J Public Health*. 2016; 106:478–484. doi:10.2105/AJPH.2015.302941)

The "American Dream" is predicated on the concept of equality of economic opportunity—the idea that one's prospects for upward social mobility depend little on one's family background.[1,2] Driven by growing concerns about disparities in accessing the American Dream, policymakers from both ends of the political spectrum have begun to focus on bolstering economic opportunity.[3,4] President Barack Obama emphasized this priority in his January 2015 State of the Union address, in which he vowed to "do more to restore the link between hard work and growing opportunity for every American."[5]

In addition to its importance for economic policy, economic opportunity may also have important implications for health. Economic theory suggests that credible prospects for upward socioeconomic mobility may incentivize people to invest more in their health, given the importance of good health in determining earnings.[6] That is, the prospect of being able to obtain a higher-paying job raises expectations and hopes about one's future socioeconomic success and, consequently, the expected returns to health investments. In addition, greater optimism about the quality of one's future may raise the desire to achieve good health even independent of the possibility of obtaining greater income by doing so. For example, being healthy could better allow individuals to derive fulfillment from the bright futures they anticipate having. By contrast, the lack of economic opportunity could create a disincentive to engage in healthy behaviors, since the future monetary and intrinsic benefits of doing so are less likely to materialize.

Although the theoretical link between economic opportunity and health is compelling, this association has not been systematically examined. This may be attributable to the lack of high-resolution data on economic opportunity. The most closely related literature has focused on the relationship between income inequality and health.[7–10] Although income inequality and economic opportunity are often mentioned interchangeably in policy debates, the two are in fact distinct concepts. Measures of income inequality reflect existing differences in the distribution of income, but do not necessarily provide any specific insight into the potential upward mobility of individuals at different points of that income distribution.[1] For example, one can imagine a society that is unequal in its distribution of income in the present, but in which individuals at each point of that income distribution have an equal chance of future upward mobility. Consequently, studies focusing on contextual effects of income equality do not necessarily provide insights into the independent relationship between economic opportunity and health.

We assessed whether economic opportunity was independently associated with health behaviors and outcomes in the United States. We examined 3 main questions. First, what is the relationship between economic opportunity and health? Second, is the association more pronounced among certain populations, such as working-age adults and historically disadvantaged racial minorities, for whom economic opportunity may be more salient? Third, can the association between economic opportunity and health outcomes be explained by differences in risk

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factors and healthy behaviors? Through all of these analyses, our main aim was not to argue for causality per se but to assess the potential public health relevance of economic opportunity and motivate future work.

METHODS

In this section, we discuss the measurement of economic opportunity, outcome and covariate measures, and the analytic strategy.

Data

Explanatory variable. The dominant method of measuring economic opportunity in the literature is through computing statistics on intergenerational income mobility,[1,2,11] typically for large geographic areas. The underlying assumption is that in areas with greater opportunity, an individual's ultimate socioeconomic fate is less likely to be governed by one's socioeconomic status at birth.

In recent groundbreaking work, Chetty et al. developed intergenerational mobility measures up to the county level, all of which are available through the Equality of Opportunity Project Database.[2,12,13] The database makes use of novel data linking federal income tax records for nearly 10 million individuals from the 1980 to 1982 birth cohorts to their parents' income tax records. Measures of income for the child sample reflect averages over 2010 to 2012 tax returns (mean age = 30 years); for parents, incomes reflect averages for 1996 to 2000 tax returns (mean age = 43 years). Chetty et al. then used these income measures to compute a number of different indicators of intergenerational income mobility at the county level, using a child's county of residence at age 15 for geographic assignment.

For the purposes of this study, we used the preferred measure of opportunity from Chetty et al., which is the county-averaged national rank (range = 1–100) in income for individuals born to families in the lowest quartile of the national income distribution (as measured in the years 1996 to 2000). Thus, for each county, we obtained a measure of how far in the income distribution, on average, individuals born into relative poverty were able to rise. Higher values equate to greater mobility and therefore greater economic opportunity in that county. Given the higher mortality risk among the poor, this measure represents an appropriate margin of analysis for the purposes of this study. Sensitivity checks using alternate measures are discussed in the "Analysis" subsection.

Outcomes. Our primary outcome was the county-level, age-standardized, all-cause mortality rate. We obtained these data from the US Centers for Disease Control and Prevention (CDC), and they reflect average mortality rates from 2000 to 2012.[14] We also obtained average race- and age-specific (age groups = 25–34, 35–44, 45–54, 55–64, and ≥ 65 years) mortality rates over the same period as secondary outcomes. For the secondary outcomes of healthy behaviors and prevalence of risk factors, we obtained from the CDC the percentage of adults in each county who reported current smoking, obesity, and diagnoses of hypertension or diabetes.[15]

Covariates. We included covariates that were examined or adjusted for in prior analyses of the social determinants of health.[8,16–22] To account for traditional markers of socioeconomic status and inequality, we adjusted for county-level per capita income, the Gini coefficient, and unemployment rates, using the averages of the 2000 and 2010 data for each of these variables. (Because the economic opportunity measure is a function of 1996–2000 and 2010–2012 income data, using the averages of related socioeconomic measures helps account for potential income effects arising from either period.) We took the income measures (which were adjusted for inflation) as well as the unemployment measures from the US Department of Commerce Bureau of Economic Analysis.[23] We derived the 2000 and 2010 Gini measures from the Equality of Opportunity Project Database and the US Census Bureau,[24] respectively.

We obtained data on high school completion rates (year = 2000) and level of urbanization (counties in metropolitan areas, nonmetropolitan areas with urban populations [> 20 000 residents vs 2500–20 000 residents], or rural areas; year = 2000) from the Inter-University Consortium for Political and Social Research.[25] Using data from the same source, we also adjusted for demographic variables such as the percentage of the population that was African American (year = 2005), the percentage of the population aged older than 65 years and aged birth to 15 years (year = 2005), and population density (year = 2000).

To account for differences in social structure and marginalization, we included county-level measures of the violent crime rate per 100 000 (year = 2000; Inter-University Consortium for Political and Social Research)[26] and Rupasingha and Goetz's social capital index (normalized to zero) that accounts for voter turnout and participation in community organizations over the period 1990 through 2005.[27] We also included variables for residential income segregation and racial segregation measured at the commuter zone level (year = 2000). We obtained these variables from the Equality of Opportunity Project Database.

Finally, to address differences in the availability of health services, we adjusted for number of primary care physicians per capita (year = 2007) and presence or absence of a community health center (year = 2009), obtained from the Community Health Status Indicators data set,[15] as well as the percentage of adults younger than 65 years who lacked health insurance (year = 2006) and a binary indicator denoting the county's status as medically underserved (year = 2007), obtained from the Inter-University Consortium for Political and Social Research.[25] Detailed descriptions of the data and their sources can be found in Table A (available as a supplement to the online version of this article at http://www.ajph.org).

Analysis

We computed descriptive statistics for the entire county sample, and then separately for those counties below and above the national median of economic opportunity. We then compared descriptive statistics for the latter 2 groups by using the t test for differences in means and the χ^2 test for differences in proportions. We explored the spatial distribution of the economic opportunity measure and the primary outcome, the standardized, all-cause mortality rate, by examining quartiles of each variable in US county maps. We further assessed the bivariate relationship between these variables by fitting a nonparametric scatterplot.

We next fitted multivariable linear regression models using the natural logarithm of the primary outcome as the dependent variable and the economic opportunity measure as the key independent variable. In this setup, parameter estimates can be interpreted as the percent change in mortality for each 1-unit change in the economic opportunity measure. We adjusted for each of the characteristics described in the "Covariates" subsection and additionally included state fixed effects to account for potential state-level institutional and social confounders. It is important to note that the main purpose of adjustment was to isolate the independent association between economic opportunity and health. As such, this strategy may preclude deep interpretation of coefficients on some of the covariates. For example, the inclusion of state fixed effects may complicate the interpretation of variables, such as income inequality, whose contextual effects may operate at levels of aggregation higher than the county.[28]

Next, we pursued our second objective by estimating associations between economic opportunity and race- and age-specific mortality rates, respectively. For race-specific mortality rates, our hypothesis was that economic opportunity would have a larger association with mortality among African Americans than Whites, given that communities facing a long history of socioeconomic marginalization may be more sensitive to differences in economic opportunity.[29] For age-specific mortality rates, we hypothesized that economic opportunity would have a larger association with mortality rates among working-age adults because (1) this population would benefit more from future economic opportunities over the life course, (2) mortality risk may be more modifiable by investments in health that are made at younger ages, and (3) the economic opportunity measure itself was computed using tax data for younger individuals. To pursue the second point more directly, which is the purpose of our third objective, we fit similar multivariable regression models specifying each of the health behaviors and risk factors as dependent variables.

We performed 4 sensitivity analyses. First, we assessed the robustness of our findings to alternate measures of economic opportunity. For these analyses, we used the average income ranks for individuals born to families in the bottom 40% and 50% of the income distribution, respectively; a measure of the fraction of adult income gains owing to residence in a particular county (developed recently by Chetty and Hendren[30]); and the correlation between parent and child income. For the latter measure, higher values (i.e., a tighter correlation between the incomes of parents and their children) indicate less economic opportunity, whereas for the other measures, higher values indicate greater economic opportunity. Second, we used a newly developed method by Oster[31] to address the sensitivity of the findings to any residual, unobserved confounding. This method, which has precedence in the economics literature,[32–34] uses differences in coefficient sizes and R^2 values between unadjusted and adjusted models to simulate the extent to which additional confounders may change the coefficient estimates.[31]

Third, we adjusted for in- and out-migration by including a variable for the fraction of migrants in the total population at the commuter-zone level, also derived from the Equality of Opportunity Project Database tax record sample for the mid-2000s. This was done in order to address potential bias from non-random selection of individuals by health into high or low opportunity counties. We anticipated that such bias would be small given the lack of correlation between migration and economic opportunity in other work.[2] Finally, given growing evidence regarding the importance of early childhood conditions in driving both adult economic mobility and health,[30,35–38] we additionally adjusted for county average birth weight at different time points.[39,40]

We weighted all regressions by county population. We computed heteroscedasticity-robust standard errors[41,42] corrected for clustering at the commuter zone level, given that commuter patterns may induce geographic clustering of economic opportunities across contiguous counties.[2] We conducted all analyses with Stata version 13 (StataCorp LP, College Station, TX).

RESULTS

Our sample included 2697 counties out of a total of 3144 counties and county equivalents in the United States for which full data were available for all variables (Table 1). The sample counties made up nearly 96% of the 2010 US population. The mean of economic opportunity was 43.5 (range = 23.7–63.8), meaning that individuals in the 1980 to 1982 birth cohorts born to parents in the lowest quintile of the income distribution would expect to attain, by age 30 years, annual incomes just below the median of the national income distribution.

Counties with more economic opportunity (i.e., above the median for the opportunity measure) had statistically significantly higher per capita incomes, lower levels of Gini inequality, lower unemployment rates, and higher rates of high school completion. They had also fewer African American residents, lower rates of racial segregation, higher social capital indices, and lower uninsurance rates. These differences, too, were statistically significant.

In the descriptive spatial analysis, low opportunity and high mortality rates shared a similar geographic distribution, with a particularly high concentration of counties with both attributes in the US South and parts of the Upper Midwest and Southwest (online Figure A, available as a supplement to the online version of this article at http://www.ajph.org, panels 1 and 2). A nonparametric fitting of a scatterplot of the 2 measures was negative and close to linear (Figure A, panel 3).

Association Between Economic Opportunity and Mortality

In both bivariate and multivariate regressions, we found a strong negative relationship between economic opportunity and mortality rates. A 1 standard deviation (SD) increase in economic opportunity was associated with a 10.3% decrease in the county-level mortality rate in unadjusted models (b = –0.019; 95% confidence interval [CI] = –0.021, –0.016; $P < .001$; Table 2) and a 6.5% decrease after multivariable adjustment (b = –0.012; 95% CI = –0.014, –0.009; $P < .001$; Table 2). To place the magnitudes in context, we note that this 1 SD change was equivalent to an increase in the average attained income rank of 5.45 points—roughly the difference between a county in the 10th versus 50th percentile of the opportunity distribution, or between an average county in the South versus the Northeast. (Full

TABLE 1—Descriptive Statistics: United States Counties, 2000–2012

Variable	Full Sample (n = 2697), Mean (SD)	Below-Median Economic Opportunity (n = 1336), Mean (SD)	Above-Median Economic Opportunity (n = 1361), Mean (SD)	P[a]
Economic opportunity	43.50 (5.46)	39.20 (2.65)	47.72 (4.01)	< .001
Economy				
Avg real per capita income (2000 and 2010), $	25 470.68 (5698.40)	24 377.71 (5262.30)	26 543.57 (5904.44)	< .001
Avg Gini coefficient (2000 and 2010)	0.41 (0.06)	0.43 (0.05)	0.39 (0.05)	< .001
Avg unemployment rate (2000 and 2010), %	7.06 (2.11)	7.84 (0.05)	6.29 (0.06)	< .001
High school graduate (2000), %	77.31 (8.65)	74.54 (8.29)	80.02 (8.14)	< .001
Housing stress[b] (2004)	0.17 (0.38)	0.22 (0.42)	0.12 (0.33)	< .001
Urbanization (2003)				
Metro urban[b]	0.38 (0.49)	0.38 (0.49)	0.38 (0.49)	.98
Nonmetro urban[b] (> 20 000 people)	0.12 (0.32)	0.13 (0.33)	0.11 (0.31)	.09
Nonmetro urban[b] (2500–20 000 people)	0.37 (0.48)	0.37 (0.48)	0.37 (0.48)	.99
Rural[b]	0.13 (0.33)	0.12 (0.32)	0.14 (0.34)	.11
Age (2005), y				
> 65, %	14.50 (3.62)	13.73 (3.37)	15.23 (3.70)	< .001
< 15, %	19.25 (2.66)	19.67 (2.46)	18.83 (2.78)	< .001
African American (2005), %	9.60 (14.83)	16.85 (17.97)	2.48 (4.06)	< .001
Population density (persons/sq mi) (2000)	254.03 (1775.36)	345.43 (2337.79)	164.31 (25.24)	.01
Social infrastructure and segregation				
Social capital index (1990)	−0.19 (1.36)	−0.77 (0.94)	0.38 (1.46)	< .001
Violent crime rate (per 100 000) (2000)	141.14 (125.16)	175.36 (140.79)	107.56 (96.52)	< .001
Income segregation index (2000)	0.05 (0.03)	0.06 (0.03)	0.05 (0.03)	< .001
Racial segregation index (2000)	0.16 (0.10)	0.18 (0.10)	0.15 (0.10)	< .001
Health infrastructure				
Primary care physicians per 100 000 (2007)	59.21 (38.90)	61.01 (39.10)	57.43 (38.64)	.02
Presence of community health center[b] (2009)	0.47 (0.50)	0.58 (0.49)	0.37 (0.48)	< .001
Uninsured (2006), %	14.10 (4.65)	15.05 (4.16)	13.14 (4.89)	< .001
Designated underserved population[b] (2007)	0.30 (0.50)	0.32 (0.47)	0.27 (0.45)	.01

Note. Economic Opportunity refers to the county-averaged national income rank attained by individuals from the 1980–1982 birth cohort born to parents in the bottom quartile of the income distribution between 1996 and 2000. See main text ("Data" subsection) and online Table A for additional details on variable definitions and data sources. Variable year is provided in parentheses.

[a]The *P* values are from bivariate tests of differences in means or proportions for each covariate across the "below" and "above" median groups. Those groups are defined on the basis of the median of the economic opportunity variable.

[b]Binary variable with 0 = no and 1 = yes.

estimates for covariates are provided in Table B, available as a supplement to the online version of this article at http://www.ajph.org).

Differential Mortality Estimates by Race and Age

The differences in adjusted mortality rates were greater for African Americans than for Whites (Table 3). A 1 SD increase in economic opportunity was associated with a 10.9% decrease in mortality rates among African Americans (b = −0.020; 95% CI = −0.028, −0.012; *P* < .001) compared with a 4.6% decrease for Whites (b = −0.0084; 95% CI = −0.011, −0.0056; *P* < .001).

With respect to age, the largest estimated associations between economic opportunity and mortality were among working-age adults in the age groups 25 to 34, 35 to 44, and 45 to 54 years, with smaller associations for older age groups (Table 3). For example, a 1 SD increase in opportunity was associated with a 13.1% decrease in mortality in the age group 25 to 34 years (b = −0.024; 95% CI = −0.029, −0.018; *P* < .001). The association for this age group was nearly 10 times the magnitude of that for the group older than 65 years.

Health Behaviors and Risk Factors

We found statistically significant associations between economic opportunity and each of the health risk factor and behavior variables (Table 4). Specifically, relative to the mean of each outcome, a 1 SD increase in economic opportunity was associated with a decrease of 11.2% in rates of smoking, 5.6% in obesity, 2.8% in hypertension, and 7.7% in diabetes (*P* < .001 for each).

TABLE 2—Unadjusted and Adjusted Association Between Economic Opportunity and Standardized, All-Cause Mortality: United States, 2000–2012

Variable	Economic Opportunity,[a] b (95% CI)	Change From 1 SD Increase,[b] %	No.	R^2
All Ages (Unadjusted)	−0.019 (−0.022, −0.016)	−10.3	2697	0.295
All Ages (Adjusted)	−0.012 (−0.014, −0.009)	−6.5	2697	0.776

Note. CI = confidence interval. The CIs were computed using heteroscedasticity-robust standard errors corrected for clustering at the commuter zone level. All models are weighted by county population. All models adjust for a rich set of covariates: county income per capita (both for 2000 and 2010), Gini coefficient (also both at 2000 and 2010), high school completion rates, age and racial demographic characteristics, social capital, violent crime rates, indices of racial and income segregation, physicians per capita, uninsurance rates, and state fixed effects (see “Data” subsection for details). Bivariate associations between the covariates and all-age mortality and estimates on covariates from adjusted models for all-age mortality are provided in Table B, available as a supplement to the online version of this article at http://www.ajph.org.

[a]Economic opportunity refers to the county-averaged national income rank attained by individuals born to parents in the bottom quartile of the income distribution. See “Data” subsection for details.

[b]The percent change in mortality for a 1 SD increase in the economic opportunity measure is calculated by multiplying the coefficient estimate by 5.45 (which is the SD of the opportunity measure in the estimation sample) and then by 100 to recover a percentage. A 1 SD increase in the opportunity variable is roughly equivalent to moving from the 10th to the 50th percentile of the opportunity distribution.

Robustness Checks

Our findings remained robust when we used each of the alternate measures of economic opportunity (Table C, available as a supplement to the online version of this article at http://www.ajph.org). Using Oster’s proportional selection test to address potential bias from unobserved confounders,[31] we found that the simulated lower bound effect sizes rejected the null hypothesis of no association for the primary outcome and all secondary outcomes (Table D, with the table notes providing details on how to compute lower bounds, available as a supplement to the online version of this article at http://www.ajph.org). Finally, our findings were robust to the inclusion of migration and birth weight measures (Tables E and F, respectively, available as a supplement to the online version of this article at http://www.ajph.org).

TABLE 3—Adjusted Association Between Economic Opportunity and Mortality, by Race and Age Group: United States, 2000–2012

	Economic Opportunity,[a] b (95% CI)	Change From 1 SD Increase,[b] %	No.	R^2
White, all ages	−0.008 (−0.011, −0.006)	−4.6	2697	0.709
African American, all ages	−0.020 (−0.028, −0.012)	−10.9	1801	0.698
Age group, y				
25–34	−0.024 (−0.029, −0.018)	−13.1	2408	0.811
35–44	−0.029 (−0.034, −0.024)	−15.8	2639	0.836
45–54	−0.027 (−0.031, −0.023)	−14.7	2697	0.842
55–64	−0.017 (−0.021, −0.014)	−9.3	2697	0.808
≥ 65	−0.003 (−0.006, −0.0006)	−1.58	2697	0.638

Note. The CIs were computed using heteroscedasticity-robust standard errors corrected for clustering at the commuter zone level. All models are weighted by county population. Logged-standardized, all-cause mortality for race and age group listed are the dependent variables. All models adjust for a rich set of covariates: county income per capita (both for 2000 and 2010), Gini coefficient (also both at 2000 and 2010), high school completion rates, age and racial demographic characteristics, social capital, violent crime rates, indices of racial and income segregation, physicians per capita, uninsurance rates, and state fixed effects (see “Data” subsection for details).

[a]Economic opportunity refers to the county-averaged national income rank attained by individuals born to parents in the bottom quartile of the income distribution. See “Data” subsection for details.

[b]The percent change in mortality for a 1 SD increase in the economic opportunity measure is calculated by multiplying the coefficient estimate by 5.45 (which is the SD of the opportunity measure in the estimation sample) and then by 100 to recover a percentage. A 1 SD increase in the opportunity variable is roughly equivalent to moving from the 10th to the 50th percentile of the opportunity distribution.

DISCUSSION

In this national, cross-sectional study of US counties, we found a strong relationship between economic opportunity and health outcomes at the county level. The magnitude of the adjusted association was substantively large: compared with the quintile of lowest economic opportunity (much of the Southeast), mortality was 6.5% lower in the middle quintile (much of the Northeast) and 16.7% lower in the highest quintile. There were larger associations between economic opportunity and mortality rates among African Americans, who continue to face critical barriers to economic mobility, and among working-age adults, for whom economic opportunity is likely more salient and mortality risk more modifiable. Finally, we found that increasing economic opportunity was associated with lower rates of smoking, inactivity, obesity, hypertension, and diabetes.

The main limitations of our study center around the cross-sectional, observational study design, which is prone to bias from unmeasured covariates and reverse causality. Although we were able to adjust for rich set of covariates, it is still possible that unobserved confounders (whether at the county level or at smaller levels of aggregation) such as neighborhood characteristics, quality of health services, racial–socioeconomic discrimination, or early childhood health and educational services may bias our findings. To (partially) address these limitations, we employed new methods from the applied microeconomics literature that seek to address residual confounding. Our findings were robust to these and other sensitivity checks. The use of aggregate data is another important limitation, given potential biases from ecological fallacy as well as the inability to separate contextual effects of economic opportunity from compositional changes. Finally, we did not measure all of our covariates for the same time point and, because we used aggregate data for many age groups, we were unable to match covariates to the specific ages of exposure at which they might be most important for health.

Ultimately, although we were unable to establish causality, we believe that our findings have a number of important implications and should motivate further research. First, our findings extend the literature on the social

TABLE 4—Adjusted Associations Between Economic Opportunity and Risk Factor and Behaviors: United States, 2000–2012

		Change From 1 SD Increase[b]			
Dependent Variable	Economic Opportunity,[a] b (95% CI)	Percentage Point	% Relative to Mean of Outcome	No.	R^2
Smoking	−0.49 (−0.59, −0.39)	−2.6	−11.2	2131	0.633
Obesity	−0.25 (−0.33, −0.16)	−1.4	−5.6	2108	0.667
Hypertension	−0.23 (−0.31, −0.15)	−1.3	−2.8	1477	0.639
Diabetes	−0.11 (−0.14, −0.07)	−0.6	−7.7	2526	0.526

Note. CI = confidence interval. The CIs were computed using heteroscedasticity-robust standard errors corrected for clustering at the commuter zone level. All models are weighted by county population. All models adjust for a rich set of covariates: county income per capita (both for 2000 and 2010), Gini coefficient (also both at 2000 and 2010), high school completion rates, age and racial demographic characteristics, social capital, violent crime rates, indices of racial and income segregation, physicians per capita, uninsurance rates, and state fixed effects (see "Data" subsection for details).

[a]Economic opportunity refers to the county-averaged national income rank attained by individuals born to parents in the bottom quartile of the income distribution. See "Data" subsection for details.

[b]The percent change in mortality for a 1 SD increase in the economic opportunity measure is calculated by multiplying the coefficient estimate by 5.45 (which is the SD of the opportunity measure in the estimation sample) and then by 100 to recover a percentage. A 1 SD increase in the opportunity variable is roughly equivalent to moving from the 10th to the 50th percentile of the opportunity distribution. To get the percent change relative to the mean of the outcome, we divided the estimated percentage-point changes by the mean of each outcome and then multiplied by 100.

determinants of health. In particular, we have demonstrated that economic opportunity is potentially an important predictor of health behaviors and outcomes. Along these lines, the results of our study may be of particular relevance in understanding the sources of health disparities in the United States. For example, in their landmark "Eight Americas" study, Murray et al. argued that nationwide disparities in mortality could not be explained solely by differences in race, income, or access to health care.[43] Future work could attempt to understand whether differences in economic opportunity may help solve this puzzle. In addition, the stronger association between economic opportunity and mortality among African Americans may have specific relevance to understanding and ameliorating persistent racial disparities in health outcomes.[43–46]

Second, our findings suggest that prospects of upward mobility are a source of aspirations and hopes, leading to greater investment in health and better health outcomes. This putative mechanism differs from those typically invoked regarding the social determinants of health, such as access to health-promoting material goods and services, health care–related knowledge, or social participation.[47] The postulated power of aspirations and hopes for health outcomes echoes prior insights from the health psychology literature.[48,49] Future work linking individual-level data on health behaviors and outcomes to measures of hopes, aspirations, and perceptions of economic opportunity will be valuable in further elucidating and validating these mechanisms.

Finally, and most broadly, our findings add to the literature linking macroeconomic conditions to health outcomes.[50–52] Specifically, they suggest that policies that improve economic opportunities may stimulate people to invest in their health. If true, this supports a growing notion that policies that improve opportunities for socioeconomic advancement may be important for improving population health.[50,51,53] Consistent with this logic, a growing number of individual-level natural and randomized experiments are demonstrating how rising economic opportunities lead to significant increases in education, a form of human capital strongly tied to health.[54–58] These studies are of particular interest as they offer examples of tractable research designs that can investigate causal mechanisms linking economic opportunity to health outcomes.

In conclusion, in this study we have established the relevance of economic opportunity as a potential social determinant of health in the United States. Our results motivate further research on the causal nature of these associations and therefore on the role of economic policy in affecting population health. AJPH

CONTRIBUTORS

A. S. Venkataramani conducted the analysis and drafted the article. All of the authors designed and conceptualized the study, interpreted the results, and revised the article.

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HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because this research was an analysis of publicly available aggregate data.

REFERENCES

1. Putnam R. *Our Kids: The American Dream in Crisis*. New York, NY: Simon and Schuster; 2015.

2. Chetty R, Hendren N, Kline P, Saez E. Where is the land of opportunity? The geography of intergenerational mobility in the United States. *Q J Econ*. 2014;129(4):1553–1623.

3. Yellen JL. Perspectives on inequality and opportunity from a survey of consumer finances. Speech at: Conference on Economic Opportunity and Inequality, Federal Reserve Bank of Boston; October 17, 2014; Boston, MA.

4. Kristof N. The American Dream is leaving America. *The New York Times*. October 25, 2014. Available at: http://www.nytimes.com/2014/10/26/opinion/sunday/nicholas-kristof-the-american-dream-is-leaving-america.html?_r=0. Accessed March 13, 2015.

5. Obama BH. State of the Union Address. January 20, 2015. Available at: https://www.whitehouse.gov/the-press-office/2015/01/20/remarks-president-state-union-address-january-20-2015. Accessed February 27, 2015.

6. Grossman M. On the concept of health capital and the demand for health. *J Polit Econ*. 1972;80(2):223–255.

7. Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. Social capital, income inequality, and mortality. *Am J Public Health*. 1997;87(9):1491–1498.

8. Kawachi I, Subramanian S. Income inequality. In: Berkman L, Kawachi I, Glymour M, eds. *Social Epidemiology*. 2nd ed. New York, NY: Oxford University Press; 2014:126–152.

9. Williams JAR, Rosenstock L. Squeezing blood from a stone: how income inequality affects the health of the American workforce. *Am J Public Health*. 2015;105(4):616–621.

10. Wilkinson RG, Pickett K. Income inequality and socioeconomic gradients in mortality. *Am J Public Health*. 2008;98(4):699–704.

11. Corak M. Income inequality, equality of opportunity, and intergenerational mobility. *J Econ Perspect*. 2013;27(3): 79–102.

12. Chetty R, Hendren N, Kline P, Saez E, Turner N. The Equality of Opportunity Project. Available at: http://www.equality-of-opportunity.org. Accessed July 5, 2015.

13. Chetty R, Hendren N, Kline P, Saez E, Turner N. Is the United States still a land of opportunity? Recent trends in intergenerational mobility. *Am Econ Rev*. 2014;104(5): 141–147.

14. Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed mortality file on CDC Wonder online database. Available at: http://wonder.cdc.gov. Accessed July 8, 2015.

15. US Dept of Health and Human Services, Centers for Disease Control and Prevention. Community health status indicators, community health data initiative. May 1, 2010. Available at: http://wwwn.cdc.gov/community-health. Accessed August 1, 2014.

16. Kitagawa EM, Hauser PM. *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*. Cambridge, MA: Harvard University Press; 1973.

17. Pritchett L, Summers LH. Wealthier is healthier. *J Hum Resour*. 1996;31(4):841–868.

18. Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep*. 2001;116(5):404–416.

19. Lobmayer P, Wilkinson RG. Inequality, residential segregation by income, and mortality in US cities. *J Epidemiol Community Health*. 2002;56(3):183–187.

20. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q*. 2005;83(3): 457–502.

21. Franks P, Clancy C, Gold M. Health insurance and mortality: evidence from a national cohort. *JAMA*. 1993; 270(6):737–741.

22. Wilkinson RG, Pickett K. *The Spirit Level: Why More Equal Societies Almost Always Do Better*. London, UK: Allen Lane; 2009.

23. Dept of Commerce, Bureau of Economic Analysis. Local area personal income and employment. Available at: http://www.bea.gov/iTable/index_nipa.cfm. Accessed September 3, 2015.

24. US Census Bureau. Gini index of income inequality (American Community Survey 2009–13 5-year estimates, table b19083). Available at: http://www.census.gov/programs-surveys/acs/data/summary-file.html. Accessed July 7, 2015.

25. Inter-University Consortium for Political and Social Research. County characteristics, 2000–2007 (United States). Available at: http://www.icpsr.umich.edu/icpsrweb/DSDR/studies/20660. Accessed July 29, 2014.

26. Inter-University Consortium for Political and Social Research. Uniform crime reporting program data (United States): county-level detailed arrest and offense data, 2000. Available at: http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/57/studies/3451. Accessed August 17. 2015.

27. Rupasingha A, Goetz SJ. *US County-Level Social Capital Data, 1990–2005*. University Park, PA: Northeast Regional Center for Rural Development, Penn State University; 2008.

28. Subramanian SV, Kawachi I. Income inequality and health: what have we learned so far? *Epidemiol Rev*. 2004; 26:78–91.

29. Wilson WJ. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago, IL: University of Chicago Press; 1990.

30. Chetty R, Hendren N. The impacts of neighborhoods on intergenerational mobility: childhood exposure effects and county-level estimates. Harvard University, 2015. Available at: http://scholar.harvard.edu/files/hendren/files/nbhds_paper.pdf. Accessed November 30, 2015.

31. Oster E. Unobservable selection and coefficient stability: theory and validation. Brown University, 2015. Available at: http://www.brown.edu/research/projects/oster/sites/brown.edu.research.projects.oster/files/uploads/Unobservable_Selection_and_Coefficient_Stability.pdf. Accessed November 30, 2015.

32. Altonji J, Elder T, Taber C. Using selection on observed variables to assess bias from unobservables when evaluating Swan–Ganz catheterization. *Am Econ Rev*. 2008;98(2):345–350.

33. Altonji J, Elder T, Taber C. Selection on observed and unobserved variables: assessing the effectiveness of Catholic schools. *J Polit Econ*. 2005;113(1):151–184.

34. Manski C. Nonparametric bounds on treatment effects. *Am Econ Rev*. 1990;80(2):319–323.

35. Bhalotra S, Venkataramani A. Shadows of the captain of the men of death: early life health, human capital, and institutions. University of Essex, 2015. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1940725. Accessed November 30, 2015.

36. Noble KG, Houston SM, Brito NH, et al. Family income, parental education, and brain structure in children and adolescents. *Nat Neurosci*. 2015;18(5):773–778.

37. Bezruchka S. Early life or early death: support for child health lasts a lifetime. *Int J Child Youth Fam Stud*. 2015;6 (2):204–229.

38. Cunha F, Heckman JJ. The economics and psychology of inequality and human development. *J Eur Econ Assoc*. 2009;7(2):320–364.

39. Currie J. Inequality at birth: some causes and consequences. *Am Econ Rev*. 2011;101(3):1–22.

40. Figlio D, Guryan J, Karbownik K, Roth J. The effects of poor neonatal health on children's cognitive development. *Am Econ Rev*. 2014;104(12):3921–3955.

41. Wooldridge JM. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press; 2010.

42. Rogers WH. Regression standard errors in clustered samples. *Stata Tech Bull*. 1993;13:19–23.

43. Murray CJ, Kulkarni SC, Michaud C, et al. Eight Americas: investigating mortality disparities across races, counties, and race-counties in the United States [erratum in *PLoS Med*. 2006;3(12):e545]. *PLoS Med*. 2006;3(9): e260.

44. Smedley BD, Stith AY, Nelson AR, eds. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academies Press; 2003.

45. Harper S, MacLehose RF, Kaufman JS. Trends in the black–white life expectancy gap among US states, 1990–2009. *Health Aff (Millwood)*. 2014;33(8): 1375–1382.

46. Satcher D, Fryer GJ, McCann J, Troutman A, Woolf S, Rust G. What if we were equal? A comparison of the black–white mortality gap in 1960 and 2000. *Health Aff (Millwood)*. 2005;24(2):459–464.

47. Marmot MG. The influence of income on health: views of an epidemiologist. *Health Aff (Millwood)*. 2002; 21(2):31–46.

48. Snyder CR, Irving LM, Anderson JR. Hope and health. In: Snyder CR, Forsyth DR, eds. *Handbook of Social and Clinical Psychology: The Health Perspective*. Elmsford, NY: Pergamon Press; 1991:285–305.

49. Richman LS, Kubzansky L, Maselko J, Kawachi I, Choo P, Bauer M. Positive emotion and health: going beyond the negative. *Health Psychol*. 2005;24(4):422–429.

50. Kaplan GA, Lynch JW. Is economic policy health policy? *Am J Public Health*. 2001;91(3):351–353.

51. Stuckler D, Basu S. *The Body Economic: Why Austerity Kills*. New York, NY: Basic Books; 2013.

52. Riumallo-Herl C, Basu S, Stuckler D, Courtin E, Avendano M. Job loss, wealth, and depression during the great recession in the USA and Europe. *Int J Epidemiol*. 2014;43(5):1508–1517.

53. Navarro V, Muntaner C, Borrell C, et al. Politics and health outcomes. *Lancet*. 2006;368(9540):1033–1037.

54. Beaman L, Duflo E, Pande R, Topalova P. Female leadership raises aspirations and educational attainment for girls: a policy experiment in India. *Science*. 2012;335 (6068):582–586.

55. Jensen R. The (perceived) returns to education and demand for schooling. *Q J Econ*. 2010;125(2):515–548.

56. Jensen R. Do labor market opportunities affect young women's work and family decisions? Experimental evidence from India. *Q J Econ*. 2012;127(2):753–792.

57. Macours K, Vakis R. Changing households investment behaviour through social interactions with local leaders: evidence from a randomised transfer programme. *Econ J*. 2014;124(576):607–633.

58. Oster E, Steinberg B. Do IT service centers promote school enrollment? Evidence from India. *J Dev Econ*. 2013;104:123–135.