Which State Policies Explain Racial Disparities in U.S. Infant Health?

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Introduction

Disparities in mortality are a bellwether for underlying social inequalities in access to the basic ingredients of a meaningful and decent life (Sen 1993). One of the most troubling statistics in recent decades is the country's lack of progress in reducing the two-fold disparity in survival between African American and white infants. Between 1990 and 1998 the U.S. black/white infant mortality rate ratio (BWIMRR) remained at 2.3 (Keppel, Pearcy, and Wagener 2002). Although the national trends in infant mortality rate ratios are discouraging, several states have achieved consistent reductions in their race-related infant survival disparities and in race-related rates of low birth weight. Connecticut, Massachusetts, Nebraska, New Mexico and Rhode Island have each reduced their BWIMRR by 17% or more between 1985 and 1997 (Centers for Disease Control and Prevention 2002). In Massachusetts the BWIMRR is now 1.85—progress is clearly possible. Figure 1 indicates the range of variation that is possible in narrowing racial disparities.

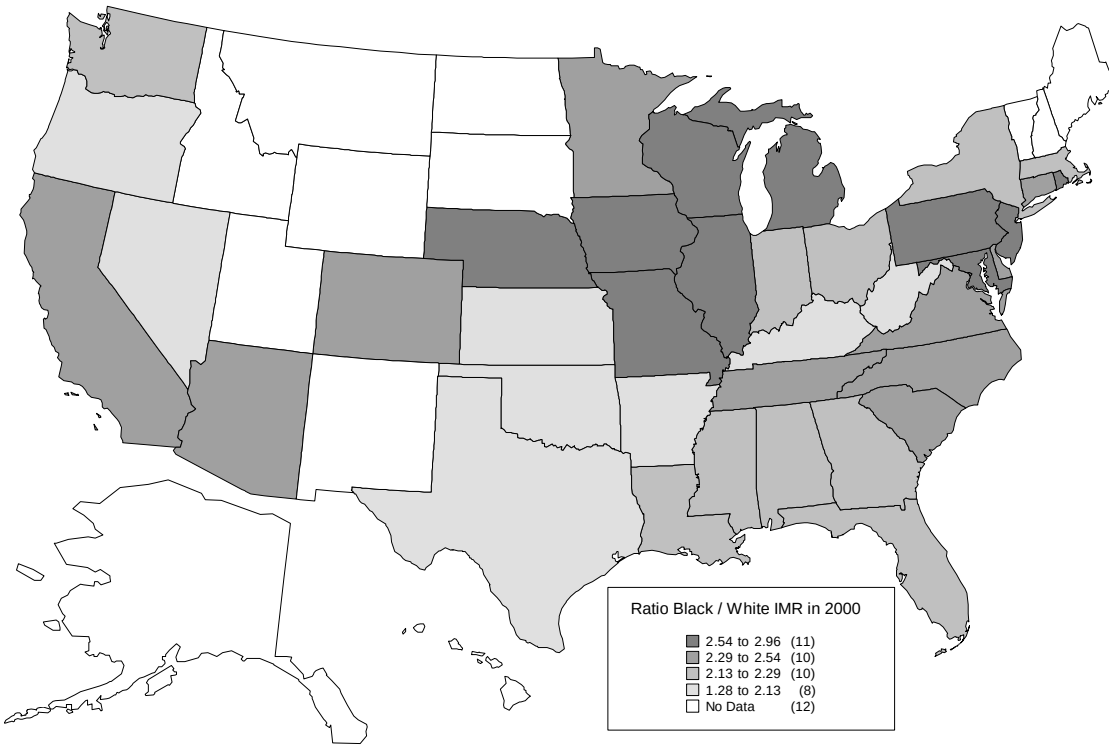

Figure 1. Map of Black to White IMR rate ratios in US in 2000

When a racial disparity is narrowed, it necessarily seems like a positive achievement. It is important to remember, however, that a rate-ratio such as the BWIMRR is made up of several parts. The BWIMRR would decrease if a positive change occurred, which in this case would be improved infant survival in black populations. It would also decrease, however, if the white infant mortality rate increased. This is important to remember, since although in recent years survival rates have improved for low birth weight infants, there has also been an increased occurrence of low birth weight overall (7.6% in 2000), as a result the overall infant mortality rate has not greatly changed. (Hoyert, Freedman, Strobino, & Guyer, 2001).

In this paper, we seek to explain the change in disparities between black and white infant mortality rates in different states in recent years using state policies and economic circumstances. Of paramount importance is the academic debate as to the influence of economic development on African American populations as compared to their white counterparts. In their 1996 study, Stockwell and Goza found a strong inverse relationship between infant mortality rates and income for whites, but found that this relationship did not hold true for non-whites (Stockwell & Goza 1996). Athough this study only used data for a few select U.S. cities, this finding suggests a more interactive relationship between race and wealth, and calls into question the common treatment of income variables to "control" for socioeconomic diversity in models comprised of mixed race groups (Conley & Bennett 2000; Aber & Bennett 1997).

In a study using aggregate data from the 50 U.S. states, McLeod, Nonnemaker, and Call examined the relationship between income inequality between races and population health. They found no relationship between income inequality and poor population health, but found strong relationships between poor health indicators and states with large black populations (McLeod etc 2004). In fact, poor health indicators are increasing being linked to race and racial geography, rather than economics. Polednak found that an increased BWIMRR was closely related to areas with a high segregation index, a measure of black-white residential dissimilarity (Polednak 1991).

METHODS

Data

The dependent variables are state measures of infant mortality rates, neonatal mortality rates, and postneonatal mortality rates. The source for data was the Center for Disease Control's National Center for Health Statistics website. We use data from 1994 to 2002. We exclude any state with fewer than 400 black births in a given year. Data on state policies and attributes have been drawn from the "CQ State fact Finder", which is electronically available for 1996-2004 (Centers for Disease Control and Prevention, 2002). We examine 75 state policy-related variables, reflecting many dimensions of the state including: population, economics, geography, government, federal aid, taxes, education, health, crime and welfare. Table 1 provides a complete list of the variables included in the initial analyses, as well at their means and standard deviations pooled across all years and states.

Model

Initially, we examined the relationship between each of the 75 independent variables and each of the infant mortality measures as it changed over time. To achieve this we used a series of bivariate fixed-effects models which controlled for the correlation of state policy measures within each state over time, and allowed us to filter out the effect of policy changes within each state over time, and the corresponding changes in infant mortality measures. Table 1 contains some results of these initial analyses. We explored black to white infant, neonatal, and postneonatal mortality rate ratios in the initial analyses. If the relationship between an outcome measure and state policy variable achieved a significance level of .05 or better, then this variable was selected for our final multivariate models. We found that a small subset of the variables were consistently associated with the BWIMRR throughout our initial analyses. A separate set of variables displayed strong relationships with the black/white postneonatal mortality rate ratio , and each subset of variables were used in the multivariate models..

Multivariate models controlled for state fixed effects. For each mortality indicator, in each state in each year there were two outcomes: a black mortality and a white mortality. By interacting a dummy variable for race with each independent variable we could assess whether that dependent variable had statistically significantly Multiple fixed-effects models were generated, and each time a different race interaction term was included. That is, initially variable 1 was multiplied by our race "dummy" variable (labeled "X black" in table) and this interaction term was included in the model. Then variable 2 was multiplied by our race term and included in a separate model, etc. Each variable in turn was examined using an interaction term and the results are found in Table 2. Note that some variables were only included in the models using the postneonatal mortality rate as the outcome.

Results

Of the 75 independent variables measuring changes over time for state policies and attributes, only a few were found to consistently to be related to the BWIMRR. The strongest relationships were seen in measures of the per capita administrative costs for welfare, per capita alcohol consumption, percentage of non-elderly population without health insurance, education spending per capita, federal research and development spending per capita, motor fuel taxes, and the per capita gross state product (GSP). A positive coefficient in Table 1 indicates a relationship with a reduction in the BWIMRR over time, whereas a negative coefficient indicates the opposite.

A strong relationship between a change in the black/white postneonatal mortality rate ratio was found for a few variables, including the per capita administrative costs for welfare, law enforcement spending per capita, physicians per 100,000 residents, AIDS cases per 100,000 residents, percent of the population that is overweight, percent of drivers using seatbelts, and state education spending per student.

In the multivariate models of Table 2, we see that when race is used as an interaction term, strong relationships are seen with fewer variables, namely the per capita administrative costs for welfare and the state GSP. As for the postneonatal outcomes, many of the same variables seen in

Table 1 to have significant relationships with the black white post neonatal mortality rate ratio still had significant relationships with the postneonatal outcome when our second approach was used.

Discussion

In this paper, we initially sought to statistically explain state success in reducing racial disparities in the infant, neonatal, and postneonatal mortality rate distribution on the basis of state policies, economic factors and sociopolitical processes. We found that the wealth of a state (measured using GSP) was highly correlated with an increase in the black-white infant mortality rate-ratio. This means that improving economic conditions helped the white communities in the states showing increased GSP over time, but not the black communities.

The increased disparity associated with more money spent per welfare case might be because white communities are using these services more than black communities. This explanation certainly merits further study in the future. As for the postneonatal disparities, there seems to be a plausible relationship between indicators of quality health care and a reduced racial disparity. This makes sense, given the fact that postneonatal mortality is more likely to be preventable (than neonatal mortality) given the availability of quality health care services (Scott, Iyasu, Rowley & Atrash 1998). Reduced postneonatal disparities were also correlated with some measures of the state populations attentiveness to safety, such as seat belt usage. This is also plausible, given that household and automobile accidents are important causes of child mortality (Hoyert et al., 2001).

Overall, this study lends support to the idea that increased economic prosperity improves infant mortality outcomes only among white communities. One possible explanation is that recent technological innovations have improved birth weight specific infant survival, and this has differentially improved white infant survival. This has been attributed to in increased incidence of low birth weight among the white population, in correlation with improved high-risk obstetric care and neonatal care. Survival of low birth weight black infants had not benefited as much from technological advancements of recent years (Alexander, Tompkins, Allen, & Hulsey 1999). Other mechanisms may be reduced access to health care for black communities that are not affected by increased economic prosperity overall. This could reflect a legacy of institutional racism in the U.S. that has yet to be overcome (Weinick, Zuvekas, & Cohen 2000).

In any case, then the goal of reducing racial health disparities must be approached with an understanding of complexity of the problem. It is important to figure out the dynamics affecting the black infant mortality rate in itself before we can truly hope to improve survival of black infants. Our study suggests that state policies can play a role in decreasing the racial disparity in postneonatal mortality. According to our findings, this could be done by special attention vehicle safety, increased physicians per capita, and improving health care in general. Improving racial disparities in neonatal and overall infant mortality is proving to be more complicated, and further work should be done to evaluate the role of preventable causes of low birth weight for black infants, access to health care, geography, segregation, and other factors affecting black infant mortality.

Table 1 Univariate Tabulation and Results from Bivariate FE Regression

Variable	Mean *for all states and years	SD		BWIMR FE		BWPNMRR FE
Legislators per million population	64.6	3.43		-0.062 -0.57		-0.288 (1.97)*
Administrative costs per AFDC/ TANF case	82.4	2.81		0.009 (3.56)***		0.007 (2.95)***
Children in foster care per 10,000 children	70.8	2.39		-0.015 (1.75)*		-0.019 (2.40)**
Food stamp recipients as percent of population	8.0	0.14		-0.014 -0.15		-0.281 (2.19)**
Percentage of Population receiving TANF	1.9	0.08		-0.164 -1.19		-0.422 (2.28)**
Percent of births to unwed mothers	32.3	0.33		0.028 -0.34		-0.199 (1.73)*
Law enforcement spending per capita	281.7	6.95		0 -0.05		0.022 (2.94)***
Incarceration rate (per 100,000 population)	374.6	9.63		-0.003 (2.71)***		-0.004 (3.17)***
Property crime rate (per 100,000 population)	4089.8	54.02		-0.001 (2.03)**		-0.001 -1.36
Violent crime rate (per 100,000 population)	515.5	15.88		-0.007 (2.93)***		-0.003 -0.98
Crime rate per (100,000 population)	4605.3	66.23		-0.001 (2.38)**		-0.001 -1.4
Percent of population with Medicaid	13.2	0.23		-0.045 -1.33		-0.117 (2.58)**
Physicians per 100,000 population	258.4	4.28		0.004 -1.05		-0.015 (2.91)***
AIDS cases per 100,000 residents	17.2	1.24		-0.013 -0.74		-0.075 (3.17)***
Percent of overweight population	28.4	0.29		-0.011 -1.03		-0.027 (2.11)**
Per capita alcohol consumption in gallons	2.3	0.02		-6.897 (5.01)***		-7.407 (4.19)***
Percent of non-elderly population Without health insurance	17.1	0.26		-0.056 (1.73)*		-0.129 (2.92)***
Infant deaths per 1,000 live births	7.4	0.08		-0.322 (2.04)**		-0.506 (2.05)**
Vaccination coverage	79.0	0.25		-0.025 -1.1		-0.058 (1.80)*
Vehicle miles traveled per capita	10008.6	87.80		-0.001 (3.28)***		-0.001 (2.44)**
Percent of drivers using seatbelts	65.9	0.54		0.008 -0.61		0.04 (2.26)**
Federal research and development Spending per capita	310.2	30.52		-0.002 (1.67)*		0.003 (2.19)**
Education employees Per 10,000 employees	222.5	1.58		0.013 -0.59		0.087 (1.91)*

Table 1 CONTINUED Univariate Tabulation and Results from Bivariate FE Regression						
Variable	**Mean**	**SD**		BWIMR		BWPNMRR
	***for all states and years**			**FE**		FE
Percent of school funds from federal	7.6	0.13		0.207 (1.89)*		-0.178 -1.1
Spending per pupil	6391.0	76.37		0 -1.34		0.001 (5.17)***
Education spending per capita	1539.9	15.06		0.004 (2.07)**		0.004 (2.40)**
AFQT rank/score	60.7	0.14		-0.039 -1.2		-0.085 (1.90)*
State reserve balances as a percent of expenditures	8.3	0.65		0.017 (1.77)*		0.016 -1.23
General revenue as % of personal income	21.0	0.28		0 0		0.592 (2.20)**
General revenue per capita	4638.0	82.06		0 -0.28		0.002 (2.61)**
Tobacco taxes as % of personal income	0.1	0.00		-17.338 -1.58		-21.28 (1.74)*
Motor Fuel taxes as % of personal income	0.5	0.01		12.338 (2.00)**		8.654 -1.12
Property tax per capita	764.7	16.43		-0.012 (3.73)***		-0.002 -0.64
Federal share of welfare and Medicaid	60.5	0.39		0.031 -0.88		0.198 (4.25)***
Percent reporting not to be physically active	27.3	0.38		-0.016 -0.76		-0.052 (1.91)*
Housing permits per 10,000 population	57.6	1.51		-0.019 (1.80)*		-0.031 (2.12)**
Per capita personal income ($)	25715.3	236.16		0 -0.33		0 (1.68)*
Per capita Gross State Product ($)	31986.7	606.89		0 -1.52		0 (2.33)**
Percent of under 18 in poverty	17.1	0.29		0.01 -0.49		-0.049 (1.71)*
Percent of population in poverty	12.1	0.18		0.018 -0.41		-0.115 (1.93)*
Percent of total population that are African American	11.2	0.68		-0.568 (1.96)*		-0.294 -0.8
Median age (years)	35.1	0.09		-0.682 (3.08)***		-1.096 (3.52)***

Table 2

Variable	Dependent Variable				
	Log IMR [1]	Log Neonatal Mortality [2]			Log Post Neonatal Mortali
Administrative costs per AFDC/ TANF case	-0.0001 [0.14]	0.0006 [0.93]	0.0007 [0.75]	0.0007 [0.85]	0.0007 [0.81]
Administrative costs per AFDC/ TANF case X Black	0.0018 [2.26]**				
Per capita alcohol consumption in gallons	0.7529 [1.80]*	1.1427 [2.34]**	0.7573 [1.18]	0.8008 [1.29]	0.7059 [1.10]
Alcohol consumption X Black	-0.1779 [1.82]*				
Federal research & development spending per capita	-0.0003 [0.71]	0.0006 [1.43]	-0.0001 [0.19]	-0.0001 [0.18]	0.0004 [0.56]
Federal research and development spending X Black	0.0002 [2.75]***	0.0001 [2.07]**	0.0002 [1.78]*		
Per capita Gross State Product ($)	-2.4596 [2.15]**	-4.7355 [4.01]***	-1.2699 [0.71]	-1.8610 [1.07]	-0.8188 [0.46]
Gross State Product X Black	0.5943 [2.02]**			0.7193 [3.39]***	
Children in foster care per 10,000 children	-0.0025 [1.44]		-0.0063 [2.51]**	-0.0064 [2.63]***	-0.0059 [2.37]**
Children in foster care per 10,000 children X Black	0.0000 [0.03]				
First Difference	0.3648 [2.86]***		0.2495 [1.24]	0.2166 [1.12]	0.3092 [1.55]
Percentage of population receiving TANF X Black	-0.1175 [2.67]***				
Percent of population with Medicaid	-0.0075 [0.48]		-0.0120 [0.52]	-0.0108 [0.49]	-0.0009 [0.04]
Percentage of population receiving Medicaid X Black	0.0116 [1.17]				-0.0181 [1.68]*
Vaccination coverage	0.0089 [0.98]		0.0030 [0.22]	0.0042 [0.32]	0.0022 [0.17]
Vaccination coverage X Black	0.0016 [0.23]				
Indicator =1 if Black Mortality is Being Estimated	-5.433 [1.81]*	0.723 [17.19]***	0.754 [14.26]***	-6.701 [3.03]***	1.068 [6.44]***
Constant	24.763 [2.06]**	48.045 [3.88]***	12.141 [0.65]	18.161 [1.00]	7.136 [0.38]
Observations	164.000	164.000	161.000	161.000	161.000
Number of States with Sufficient Black Births	42.000	42.000	42.000	42.000	42.000
R-squared	0.880	0.790	0.750	0.760	0.750
Absolute value of t statistics in brackets					
* significant at 10%; ** significant at 5%; *** significant at 1%					

[1]Model shown included all interactions simultaneously. One at a time interactions showed the same patter

[2] One at a time interactions between black and every other variable were not significant, the only significar occurred for federal research and development spending in the state

Reference List

Aber, J. L. & Bennett, N. G. (1997). The Effects of Poverty on Child Health and Development. *Annual Review of Public Health, 18,* 463-483.

Alexander, G. R., Tompkins, M. E., Allen, M. C., & Hulsey, T. C. (1999). Trends and racial differences in birth weight and related survival. *Matern.Child Health J., 3,* 71-79.

Centers for Disease Control and Prevention (2002). Infant mortality and low birth weight among black and white infants--United States 1980-2000. *MMWR Morb Mortal Weekly Report, 51,* 589-592.

Conley, D. & Bennett, N. G. (2000). Is biology destiny? Birth weight and life chances. *American Sociological Review, 65,* 458-467.

Hoyert, D. L., Freedman, M. A., Strobino, D. M., & Guyer, B. (2001). Annual summary of vital statistics: 2000. *Pediatrics, 108,* 241-255.

Keppel, K. G.; Pearcy, J. N. and Wagener, D. K. "Trends in Racial and Ethnic-Specific Rates for the Health Status Indicators: United States, 1990-98." *Healthy People 2000 Stat Notes*, 2002, (23), pp. 1-16.

McLeod, J. D., Nonnemaker, J. M., & Call, K. T. (4 A.D.). Income Inequality, Race, and Child Well-being: An Aggregate Analysis in the 50 United States. *The Journal of Health and Social Behavior, 45,* 249-264.

Polednak, A. P. "Black-White Differences in Infant Mortality in 38 Standard Metropolitan Statistical Areas." *Am J Public Health*, 1991, *81*(11), pp. 1480-2.

Scott, C. L., Iyasu, S., Rowley, D., & Atrash, H. K. (1998). *Postneonatal Mortality Surveillance -- United States, 1980-1994* (Rep. No. 47 (SS-2)). Center for Disease Control.

Sen, Amartya. "Capability and Well-Being," M. Nussbaum and A. Sen, The Quality of Life. New York: Oxford Clarendon Press, 1993,

Stockwell, E. G. and Goza, F. W. "Racial Differences in the Relationship between Infant Mortality and Socioeconomic Status." *J Biosoc Sci*, 1996, *28*(1), pp. 73-84.

Weinick, R. M., Zuvekas, S. H., & Cohen, J. W. (2000). Racial and Ethnic Differences in Access to and Use of Health Care Services, 1977 to 1996. *Medical Care Research and Review, 57*, 36-54.