

## EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

# The politics of preventable deaths: local spending, income inequality, and premature mortality in US cities

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**Objective:** To examine the association between (1) local political party, (2) urban policies, measured by spending on local programmes, and (3) income inequality with premature mortality in large US cities.

**Design:** Cross sectional ecological study.

**Outcome measures:** All cause death rates and death rates attributable to preventable or immediate causes for people under age 75.

**Predictor measures:** Income inequality, city spending, and social factors.

**Setting:** All central cities in the US with population equal to or greater than 100 000.

**Results:** Income inequality is the most significant social variable associated with preventable or immediate death rates, and the relation is very strong: a unit increase in the Gini coefficient is associated with 37% higher death rates. Spending on police is associated with 23% higher preventable death rates compared with 14% lower death rates in cities with high spending on roads.

**Conclusions:** Cities with high income inequality and poverty are so far unable to reduce their mortality through local expenditures on public goods, regardless of the mayoral party. Longitudinal data are necessary to determine if city spending on social programmes reduces mortality over time.

Recent research focusing on income inequality, the measure of the distribution of income in a geographical area, has brought new insight into geopolitical disparities in health. The theory behind studies on health and income inequality is that health is not only an outcome of individual choices and cultural characteristics but ultimately of socio-political phenomena.

Income inequality has been shown to be an important risk factor for adverse health outcomes, even after adjusting for median levels of poverty for various jurisdictions within countries,<sup>1,2</sup> although recent research is less consistent regarding these effects.<sup>3–8</sup> The positive relation between income inequality and age adjusted all cause mortality has been found in US metropolitan areas.<sup>9</sup> Some studies have attributed this relation to psychosocial qualities of community members in areas of high inequality.<sup>10,11</sup> There are inherent limitations to this approach, however. Reducing a social political construct to the behaviour of community members limits, according to Muntaner and Lynch, the “explanatory power” of income inequality and limits our ability to develop policy responses to social inequalities.<sup>12</sup> Furthermore, a focus on behaviour obscures the importance of policies and programmes despite the fact that there is growing evidence that local social policies affect the distribution of health and risks to health.<sup>13,14</sup> With several important exceptions, there are few studies that have examined policies in relation to income inequality.

Geopolitical variation in mortality and income inequality may be attributable to differences in governmental policies. A comparison of US and Canadian metropolitan areas showed no effect of income inequality on mortality for the Canadian metro areas whereas the relation was robust and positive for US metro areas.<sup>15</sup> The authors note differences in the social welfare net, as well as absolute differences in the levels of income inequality between countries may explain the disparate results. Kaplan and colleagues undertook a study of state policies and other factors to determine causal pathways between income inequality and premature mortality.<sup>1</sup> The authors demonstrated that states with highest levels

of income inequality had significantly higher rates of homicide and a higher percentage of low birthweight infants. States with high income inequality also had greater per capita expenditures on medical care and police protection.<sup>1</sup> As local expenditures on public goods and services respond to local conditions and pressures<sup>16</sup> and are markers of the influence of both public interest groups and type of local governance,<sup>17</sup> the role of local politics and local expenditures merits further investigation.

The purpose of this study is to examine the association between (1) spending on local programmes, and (2) income inequality with premature mortality. In theory, cities that spend relatively more on public goods would have lower income inequality and poverty because high civic investment attracts and maintains a middle and upper class population.

## METHODS

### Unit of analysis

All cities in the US defined by the Census Bureau to be a central city and with a population of at least 100 000 in 1980 and 1990 are included. In 1990, 75% of the US population lived in urbanised areas and almost a quarter of the entire population resided in central cities of 100 000 people or more.<sup>18</sup>

### Outcome variables

Premature death rates attributable to all causes were constructed using census age distributions for the entire population under age 75 for each city merged with mortality data from the National Center for Health Statistics Mortality Detail tapes for 1989, 1990, and 1991.<sup>19–21</sup> These age specific death rates were averaged and age adjusted by the direct method using the age distribution of the entire US population for 1990 as the standard.

Premature death rates attributable to preventable or immediate causes were also analysed to focus on conditions linked with poverty. These include (1) motor vehicle accidents, (2) all other accidents, (3) asthma, (4) pneumonia and influenza, (5) suicide, (6) homicide and legal intervention,

(7) complications of pregnancy, (8) diabetes, (9) tuberculosis (all forms), and (10) HIV. These causes are related to poverty and social disorganisation either in their incidence (asthma, tuberculosis, HIV, motor vehicle accident, homicide, complications of pregnancy) or in their progression to premature mortality (asthma, diabetes, pneumonia). Premature mortality attributable to tuberculosis, influenza, pneumonia, asthma, complications of pregnancy, and diabetes is avoidable if the conditions are diagnosed early and appropriate treatment is received. These 10 conditions and events were analysed together as one rate for increased statistical significance and power. These rates were calculated for all persons under age 75 and the same merging and weighting techniques described above were used.

### Independent variables

City sociodemographic variables of interest include percentage in poverty, defined by federal poverty thresholds (\$12 674 for a family of four in 1990) and percentage non-Hispanic black. There is overwhelming evidence that African-Americans suffer from higher death rates than their white counterparts (for example, see Health, United States, 2001).<sup>22</sup>

Income inequality, measured by the Gini coefficient, measures how much a population must exchange of household income to others within the population to achieve an equal distribution of income. A complete description of the calculation of the Gini coefficient is published elsewhere.<sup>1</sup> The theoretical range of the Gini coefficient is 0.0 (perfect equality) to 1.0 (perfect inequality). Therefore, in regression models the unit change against which mortality rates are measured is the entire theoretical range of the Gini coefficient; this has no “real world” significance. To make the interpretation of this variable meaningful, we performed a transformation by multiplying the coefficient by 10. In the regression models, a unit change in the coefficient is a change by one tenth.

The city financial expenditure variables were derived from a public electronic database maintained by The Office of Social and Economic Data Analysis and the Missouri State Census Data Center. Per capita expenditures on hospitals and health include city supported public health, outpatient clinics, and city hospitals. Per capita expenditure on roads, their upkeep and new construction, is a proxy for the city's investment in local infrastructure. Welfare is a catchall measure of city spending on indigent populations; education expenditures refer to the city's own contribution to local public schools. Police protection spending includes “preservation of law and order” as well as traffic safety.<sup>23</sup> In the regression models, spending variables were categorised into “high expenditures” (top quartile of expenditures) and “all others” because of non-parametric distributions and significant variation in range between programmes.

Data on mayoral type (either city manager or mayor) and party were collected from years 1985–1990 (assuring data from at least two elections) to investigate whether the spending factors were associated with political party. We summarised the mayoral data as follows: Democratic mayor only; Republican mayor only; non-partisan mayor only; city manager only; or change in mayor party or type (that is, from mayor to manager or Democrat to Republican).

### Analytical methods

Bivariable analyses were first performed for descriptive purposes. Spearman rank correlation coefficients were calculated to assess the relations between city spending, income inequality, poverty, and mortality rates as these variables had non-parametric distributions.<sup>24</sup>

We used ordinary least squares regression models to analyse the relation between premature mortality and

socio-political variables; a log link function and a normal distribution were specified. The interpretation of each regression coefficient is the estimated percentage change in the death rate for every unit change of the independent variable—that is,  $100(e^{\beta}-1)$ .

The models were built in a three step fashion. Firstly, income inequality was regressed on premature mortality rates (model 1). Secondly, all social variables (income inequality, percentage in poverty, and percentage non-Hispanic black) were regressed on the mortality rates (model 2). Finally, spending variables were added to the model (model 3). We constructed a pseudo  $r^2$  to assess goodness of fit (Kleinbaum *et al*, page 509)<sup>25</sup> based on the following equation:

$$\frac{\text{deviance of null model} - \text{deviance of additive model}}{\text{deviance of null model}}$$

### RESULTS

There were 141 cities in our sample. Because of missing data, the final models had 138 observations. Table 1 shows the distribution of all variables. Cities have a wide range of premature death rates (311/100 000 to 945/100 000) and premature death rates attributable to preventable and immediate causes (44/100 000 to 236/100 000). City expenditures also vary substantially; 24 cities spent zero of their own funds on health programmes and another 33 spent under \$10 per capita per year on health.

Table 2 shows correlation statistics between the independent variables. Income inequality and the percentage of population in poverty are strongly correlated ( $r=0.62$ ,  $p=0.0001$ ), as are income inequality and the percentage of population that is non-Hispanic black ( $r=0.47$ ,  $p=0.0001$ ). Percentage non-Hispanic black and percentage in poverty are also highly correlated ( $r=0.56$ ,  $p=0.0001$ ). Theoretically, city spending could be associated with reductions in income inequality and poverty: high civic investment anchors a stable middle and upper class. Yet, only spending on roads had a negative correlation with urban poverty. Health spending was positively correlated with the population percentage non-Hispanic black only ( $r=0.19$ ,  $p<0.05$ ).

Income inequality, poverty, and the proportion non-Hispanic black are all positively correlated with premature mortality. Income inequality has a stronger correlation with mortality attributable to preventable or immediate causes (0.54) compared with all cause mortality (0.44).

Spending on health, waste, and education show no relation with premature mortality while spending on police, fire, and welfare are strongly and positively correlated with both death rates. Road spending is the only category that is negatively correlated with both death rates.

Bivariate analyses were also performed on mayoral data, comparing one political party or mayor type to all others (results not shown). Cities with a Democratic mayor showed a positive association with per capita spending on the following public goods: education (mean expenditure: \$306.73 v \$120.14,  $p=0.002$ ); on fire services (\$99.78 v \$85.12,  $p=0.02$ ); on health (\$102.75 v \$43.45,  $p=0.01$ ); on welfare (\$110.19 v \$12.84,  $p=0.002$ ); on waste disposal (\$153.92 v \$128.01,  $p=0.02$ ); and police (\$160.13 v \$136.77,  $p=0.04$ ), compared with all others. Democratic cities were also associated with higher income inequality and mortality. Cities with a manager instead of mayor spent less per capita on fire services and health programmes compared with all others. These cities also had lower income inequality. There were no differences between mayor party or type in mortality and other spending categories.

**Table 1** Descriptive summary measures of city level outcome and predictor variables

	Mean (SD)	Range	Median
<b>Mortality:</b>			
Death rates, all cause per 100000	539.50 (112.67)	311.11–946.73	529.96
Death rates attributable to preventable or immediate causes, per 100000	98.20 (31.97)	44.00–236.41	90.0
<b>Poverty measures:</b>			
Gini coefficient	0.33 (0.03)	0.26–0.42	0.33
% Of families in poverty	13.83 (5.43)	3.3–29	13.1
<b>Population measures:</b>			
Total city population	400946 (723111)	101082–7322564	221275
Density of population	4204 (3340)	133–23705	3050
% Of families who are non-Hispanic black	23.89 (18.55)	0.56–84.11	19.45
<b>Per capita city spending*:</b>			
Health	\$58.06 (50.44)	0–\$1234.56	\$16.86
Police	\$142.10 (54.42)	\$55.08–\$443.54	\$131.98
Roads	\$87.35 (44.27)	\$4.02–\$236.08	\$77.30
Waste	\$136.03 (82.48)	\$14.37–\$503.43	\$117.11
Fire	\$89.39 (27.98)	\$42.44–\$174.52	\$84.05
Welfare	\$37.77 (132.59)	0–\$1137.48	0
Education	\$167.32 (371.80)	0–\$1661.54	0

\*US dollars.

Table 3 shows the results for the final regression models. Differences in population distributions—population size and density—were not significant in any of the models. Adjusting for average income also did not significantly change the models; these three variables were omitted from the final analyses. The first model shows that income inequality is a highly significant explanatory variable for all cause mortality and mortality attributable to preventable or immediate causes, which is similar to studies of US metropolitan areas.<sup>9</sup> In model 2, the percentage in poverty and non-Hispanic black are both significantly associated with premature mortality, although the effect size for the non-Hispanic black population is small. Each percentage increase in poverty is associated with 2% higher premature death rates attributable to all causes. Income inequality is only associated with death rates attributable to preventable and immediate causes, but the magnitude of this relation is strong. To interpret the results in the table, it is useful to remember that the Gini coefficient was transformed by multiplying the coefficient by 10. A unit change in the transformed Gini coefficient is associated with 46% higher death rates attributable to preventable or immediate causes.

Model 3 includes spending variables as well as social factors. Poverty and the non-Hispanic black population remain significant for the all cause model, however poverty

is no longer associated with premature mortality attributable to preventable causes. The relation between income inequality to preventable or immediate death rates modestly attenuates with the addition of spending variables. Spending on police and roads is a significant explanatory variable for both all cause and preventable premature mortality: high spending cities (those that spent over \$155 per capita) experience an average 7% and 14% lower mortality rates respectively, compared with low spending cities. Police spending, however, is positively associated with an 8% higher all cause premature mortality and a 23% higher preventable or immediate premature mortality. Spending on health, waste, and education were not significant as separate factors. We then combined them in a single measure of “social support”, which was negatively associated with death rates attributable to preventable or immediate causes.

**DISCUSSION**

This study was conducted to examine the associations between local spending, income inequality, and premature mortality in US cities. The bivariable relation between spending on police and social variables consistently shows positive associations. With cross sectional data, we cannot determine causality. This relation may mark the regressive nature of cities that invest highly in their police forces at the

**Table 2** Bivariable relations between dependent and independent variables. (Spearman correlation coefficients)

	Death rates attributable to all causes	Death rates attributable to preventable and immediate causes	% In poverty	Income inequality	% Non-Hispanic black
<b>Social variables:</b>					
Income inequality	0.44*	0.54*	0.62*	–	0.47*
% In poverty	0.72*	0.62*	–	0.62*	0.56
% Non-Hispanic black	0.66*	0.56*	0.56*	0.47*	–
<b>Per capita city spending:</b>					
Health	0.01	0.00	0.02	0.11	0.19*
Police	0.39*	0.48*	0.25*	0.33*	0.29*
Roads	–0.18*	–0.14	–0.25*	0.01	0.02
Waste	0.05	0.09	0.05	0.21*	0.14
Fire	0.30*	0.29*	0.25*	0.28*	0.25*
Welfare	0.18*	0.18*	0.14	0.07	0.27*
Education	0.16	0.06	0.16	0.10	0.31*

\*p<0.05.

### Key points

- There is substantial variation in mortality and income inequality in large US cities.
- The relation between income inequality and mortality due to immediate or preventable causes is strong: a unit increase in the Gini coefficient is associated with 37% higher death rates.
- Cities with high income inequality and poverty are so far unable to reduce their mortality through local expenditures on public goods.
- Cities are important units to analyse because they represent discrete political jurisdictions whose policies can affect a defined population.

expense of programmes that could alleviate income inequality. Alternatively, spending on police services over time may reduce violent crime and deaths attributable to violent crime. Police spending is also strongly associated with premature mortality. It would be interesting to investigate whether areas with high income inequality have higher crime rates or higher perceptions of crime compared with areas with the same levels of poverty but less income inequality. Such perceptions may encourage spending on police forces.

In the final models, income inequality is only significantly associated with deaths attributable to preventable causes. One criticism of cross sectional studies of social phenomena and all cause mortality or leading causes of mortality (that is, cardiovascular disease) is that certain causes of death reflect lifetime exposures. Preventable deaths were selected because they represent failures in healthcare delivery and/or are deaths for which low socioeconomic status is a significant risk factor. The strong effect of income inequality on death rates attributable to preventable causes suggests failures in the healthcare system in cities with high inequality but not necessarily in cities with high poverty. For example, cities with high income inequality may not have adequate safety nets for immigrant populations or treatment and needle exchanges for people using intravenous drugs leading to high death rates attributable to tuberculosis and HIV.

The effect of income inequality is moderated for preventable deaths with the inclusion of spending data. This

### Policy implications

- Increasing expenditures by local governments on social programmes is likely to reduce mortality rates attributable to preventable and immediate causes.
- Cities that reduce local income inequality are likely to reduce the number of deaths attributable to preventable or immediate causes.

suggests that urban policies can mediate the relation between income inequality and mortality, yet road spending is the only category that seems to provide a protective effect on mortality. One possible reason is that road spending indicates a political commitment to public goods. Another interpretation draws on the “spatial mismatch hypothesis”, which describes a mismatch between areas of new job growth and areas with low income housing and high unemployment.<sup>26</sup> Improvements in transportation systems that facilitate travel within the city and from the city to ring communities is likely to benefit low and middle income persons.

International comparisons such as Ross *et al* suggest that federal taxation and social policies play a part in reducing overall income inequality and buffering its effects,<sup>15</sup> yet the question remains whether or not local policies matter in reducing the level of local poverty and improving health outcomes. Public choice theorists contend that cities are in competition with each other to capture mobile capital. In a capitalistic economy, competition means basically providing the proverbial “good business climate” (for example, low taxes, minimal regulations) so that cities attract revenue generating rather than service consuming populations.<sup>27–29</sup> But in fact competing and often conflicting interests at the local level are as salient as the unitary interest in capturing mobile capital. Some localities are more progressive, consciously pursuing equity as well as growth objectives, including redistribution from more to less privileged communities.<sup>30–35</sup> The protective effect of spending on social programmes in this study’s final model does support the idea that local investment can dampen the effect of income inequality. Local policy action may also depend in part on the extent of local resources available for public goods, which is one explanation for the absence of significant findings by mayor party or type.

**Table 3** Exponentiated regression coefficients presented for additive models for age adjusted premature death rates (all cause) and premature death rates attributable to preventable or immediate causes. (Confidence intervals in parentheses)

Variables	Model 1		Model 2		Model 3	
	Income inequality		Social variables		Spending	
	Death rates, all cause	Death rates, preventable	Death rates, all cause	Death rates, preventable	Death rates, all cause	Death rates, preventable
Income inequality	1.41 (1.26 to 1.58)	1.98 (1.71 to 2.30)	1.01 (0.90 to 1.13)	1.46 (1.22 to 1.75)	1.0 (0.89 to 1.11)	1.37 (1.17 to 1.60)
Percentage in poverty			1.02 (1.01 to 1.02)	1.01 (1.00 to 1.02)	1.01 (1.01 to 1.02)	1.0 (.99 to 1.02)
Percentage non-Hispanic black			1.00 (1.00 to 1.01)	1.00 (1.00 to 1.01)	1.00 (1.00 to 1.00)	1.00 (1.00 to 1.01)
City spending:						
Police					1.08 (1.01 to 1.15)	1.23 (1.13 to 1.34)
Roads					0.93 (0.88 to 0.99)	0.86 (0.78 to 0.95)
Fire					1.01 (0.95 to 1.06)	1.0 (0.92 to 1.08)
Social support					0.97 (0.91 to 1.03)	0.90 (0.83 to 0.98)
Low spending			Ref	Ref	Ref	Ref
Goodness of fit (pseudo-r <sup>2</sup> )	0.21	0.34	0.52	0.47	0.55	0.57

### Limitations

As with all cross sectional studies, the problem of reverse causality cannot be ignored. For example, most spending categories show no effect on city mortality rates, but by looking at one point in time, it is impossible to know if cities are spending in response to local conditions or if spending has a delayed effect on mortality rates. Another reason for the absence of an association is the presence of a misspecification bias; cities differ in their use of local budgets for public goods and services because of variation in funding from other government sources, such as state or federal funds. None the less, spending on fire, police, and roads tends to draw from local budgets only (personal communication, T Luce, June 2002). Additionally, spending levels measured here may be insufficient to reduce entrenched inadequacies in social goods and services. Finally, it is important to consider that these ecological findings may in fact reflect the cumulative effects of individuals' socioeconomic status and health outcomes rather than, or in addition to, indicators of social or political constructs.<sup>36</sup> Important individual characteristics were not possible to measure at the city level and future urban studies on policies and inequalities would benefit from their inclusion.

Case studies of local spending and distribution of resources within the city, while accounting for underlying need, would be helpful in determining if policies, expenditures, and local political/governmental conditions can reduce local income inequality and improve overall health outcomes. Additionally, Muntaner and Lynch discuss policies that may directly affect the creation of inequitable income distributions, such as shifts towards a service sector economy, that merit closer investigation at local levels.<sup>37 38</sup>

Local politics do matter in urban health. After all, population health is not only an outcome of individual behaviours and risk factors, but ultimately of social and political phenomena. This calls for further research that studies health disparities from a geopolitical perspective.

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