Can County Public Health Spending Lower Mortality?

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ABSTRACT

We examine county health spending effects on mortality in the US from 1972-2007 by the racial makeup and socioeconomic status composition of counties. Innovations include collective county public health spending data from the US Census of Governments (USCoG). Panel data include 22,558 observations from a universe of 3,071 US counties every five years from 1972 to 2007. Being unable to control for counties spending more to respond to epidemics means we will underestimate the benefits of health spending. Our multivariate FE model shows that a 10% increase in county-level spending (non-hospital) on health is associated with a decrease in mortality of 0.013% ($p<0.05$). This effect is larger in the 1069 counties with the highest proportion of African American people in their population in which a 10% spending increase would lower mortality by 0.0304% ($p<0.05$). Local health department spending at the county level can narrow health gradients. This analysis can inform decision-makers and public health practitioners on the value of public health spending not just on overall mortality, but on narrowing gradients in health.

BACKGROUND

- This paper contributes evidence about the impact of public health spending on all-cause mortality using a longer untapped longitudinal dataset, with eight quinquennial obs. from 1972-2007 and 3,071 counties nationwide
- This analysis can inform decision-makers who need to know the value of public health spending for population health improvements. This information can help direct more funding to what works best and less to ineffective programs.

METHODS

DATA

- 8 waves every 5 years from 1972-2007
- 22,558 county-obs. on 3,071 unique counties from all 50 states and DC
- Dependent variable: all-cause mortality (count of total deaths in a county or county equivalent)
- Independent variable: county spending on health (the census of governments Local Finance division record on public spending on health exclusive of hospitals, Code 32)
- Control variables**:** local spending on hospitals (Code 36), sewerage (Code80*81), welfare (Code 79), total revenue, socio-demographic variables

ECONOMETRIC METHODS

- Estimated Ordinary Least Squares (OLS) & fixed effects (FE) to control for unobserved heterogeneity. Regression Equation:

$$logDeaths_{Ti} = \beta_0 + \beta_1 logLHE_{T-1i} + \beta_2 Pop_{\cdot Ti} + \beta_3 logLOE_{Ti} + \beta_4 X_{Ti} + \beta_5 A_{Ti} + \beta_6 T_i + \alpha_i + \varepsilon_{Ti}$$

- Where $logDeaths_{Ti}$ is the dependent. var. at time T for the i-th county, β_0 is the constant term, LHE is local county health expenditure, β_1 is main parameter of interest, β_2 estimates population size effects, LOE is a vector of other local expenditure indicators, X is a vector of controls, A is vector of 10 age-group dummies, T is a dummy for year, α_i is the county specific error term and ε_{Ti} is the time and place related error term. Models are weighted using average county population size from 1972-2007.
- We using Huber/White standard errors clustered at the state level.
- All monetary expenditures were inflation adjusted to 2013 dollars

STRATIFIED MODELS

- Our theory predicts the possibility that different settings offer different benefits from publicly funded health capital investments
- We tests whether health spending effectiveness differentiates by counties' level of: racial make-up, wealth, and health

ENDOGENEITY

- FE cannot control for dynamic endogeneity bias ("Nickell bias") which would occur if counties endowed with healthy populations react by reducing PH spending and counties with sick populations increase it, the latter being the most plausible response.
- Such a dynamic endogeneity bias should attenuate effects of health spending and make it more difficult to find beneficial effects.
- To address this bias, we tested the "difference" and "system" generalized method of moments (GMM) estimators, but these models failed the Sargan test of exogeneity and were abandoned.

RESULTS

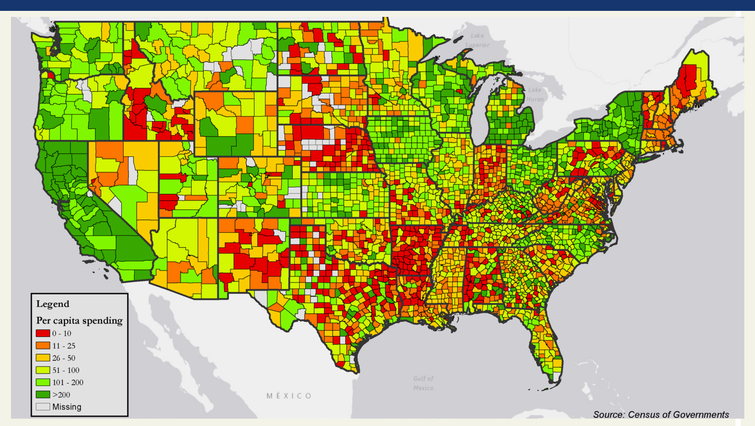

Figure: Local government per capita community health care and public health spending (excluding hospital and welfare) and 2012 (Note: Expenditures have been adjusted to 2013 dollars. This map includes all records reported to the Census)

- The national non-hospital local public health expenditure (LHE) 1972-2007 avg. is $5.9 M (2013US Dollars)
- The national non-hospital LHE per capita is $51 ($0-$380)
- The national local expenditure on hospitals per capita is $193
- FE models showed a **10% increase in LHE** is associated with a **0.013%** ($p<0.05$) **decrease in mortality**.
- Arellano-Bond GMM instruments were not statistically significant.
- We conservatively estimate that LHE costs **$10.38 M per death averted**.
  - In the 1,091 counties with the highest proportion of African American people in their population the comparable elasticity is nearly double at 0.0228% ($p<0.05$)
  - In the 1,208 counties with highest proportion mortality, a 10% increase in LHE is associated with a 0.018% ($p<0.1$) decrease in mortality †

Table1 - Variable Description (Census codes in parentheses)	Mean (22,558 obs.)	Std. Dev.
Total deaths	650.98	1496.78
Local health expenditure (Code 32)	5.88E+06	2.51E+07
Local hospital expenditure (Code 36)	1.23E+07	5.60E+07
Local sewerage plus solid waste management expenditure (Code 80+81)	9.17E+06	3.20E+07
Local public welfare expenditure (Code79)	5.36E+06	2.40E+07
Local general revenue own sources** (Code 2GenRevOS)	1.69E+08	5.57E+08
Total population in county	7.51E+04	1.86E+05
Resident population under 18 years, percent	0.27	0.04
Resident population 65+, Percent	0.14	0.04
Education attainment, Bachelor's degree+, persons 25years+, percent	0.13	0.07
Owner-occupied housing units-of total occupied housing units, percent	0.73	0.07
Median family income, Dollars	5.45E+04	1.29E+04
Civilian labor force unemployed, 1-employed, percent	0.07	0.03
Population of Hispanic origin (of any race), percent	0.05	0.11
Population Black, one-race, percent	0.09	0.15
Population American Indian, Eskimo, or Aleut , one-race, percent	0.01	0.06
Population Asian, Pacific Islander, Native Hawaiian, one-race, percent	0.01	0.02
Population in urban areas, percent	0.38	0.30
Code 32 per capita	50.65	64.09
Code 36 per capita	193.62	340.29
Code 79 per capita	49.97	81.04
Code E80+E81 per capita	79.87	60.40
Local general revenue per capita	1784.53	899.91

Table II - Main Model Results (Coefficients)

VARIABLE	OLS	Fixed Effects (FE)	AB - GMM †
	Log Total deaths	Log Total deaths	Log Total deaths
Log Local health expenditure (Code 32)	-0.000157	-0.00131**	-0.00219**
	[0.00174]	[0.000626]	[-2.456]

† Model failed the Sargan test of exogeneity

Table III - Stratified Results (Fixed Effects - FE) by County Tertile Groups

VARIABLES	Lowest proportion of African Americans	Highest proportion of African Americans	Lowest proportion of Hispanics	Highest proportion of Hispanics	Lowest proportion in poverty	Highest proportion in poverty	Lowest proportion of mortality	Highest Proportion of mortality
	Log Total deaths	Log Total deaths	Log Total deaths	Log Total deaths	Log Total deaths	Log Total deaths	Log Total deaths	Log Total deaths
Log Local health expenditure (Code 32)	0.000212	-0.00228**	0.000242	-0.00113	-0.000714	-0.000771	-0.000223	-0.00182*
	[0.000872]	[0.00111]	[0.00107]	[0.00104]	[0.00113]	[0.000749]	[0.000557]	[0.001000]

CONCLUSION

- More public health spending led to significant reductions in mortality
- Our results show smaller effects than those found by other studies because our model only capture benefits in one year and the spending aggregates both public health and non-hospital outpatient services by counties including mental health and emergency medical services
- Local health department spending at the county level can narrow health gradients because effects on health appear larger in counties with populations that have a higher proportion of African American people or of mortalities.

Acknowledgements: This work was generously supported by a grant from the de Beaumont Foundation