

Appendix

Technical Information Regarding Intercensal Estimates

Every five years (in years ending in 2 and 7), the Census conducts a Census of Governments to catalogue all of the local governments in the U.S. and gathers expenditure information from each of the approximately 87,000 governmental entities. In the intervening years (i.e., years ending in 0, 1, 3, and 4), the Census samples a portion of these local governments to create state-based spending estimates. Larger entities (e.g., large county and city governments) are oversampled while smaller entities are undersampled. Functionally, this means that the Census regularly samples large governments (county and city) to get reliable estimates for their state, and that smaller governments (townships and special districts) are less-frequently sampled in between quinquennial Census of Governments. We leverage these intercensal-year estimates to estimate spending by each government entity between quinquennial Census of Governments.

To obtain these annual estimates, we conducted linear nearest-neighbor interpolation by year for each expenditure category for each individual governmental entity. For governments for which interpolation was necessary, this meant taking interpolating spending for, say, parks and recreation in 2010 by taking spending reported the most recent year prior to 2010 and the most recent year after 2010. Theoretically the longest time period for which interpolation would be necessary is 4 years (3, 4, 5, and 6) but in practice many governments are sampled more frequently than this. In total, only a relatively small proportion of governmental spending across a county area was interpolated, generally ranging from approximately 5-15%. We then aggregated all direct expenditures within a county area by spending category, which controls for double counting expenditures resulting from governmental transfers (e.g., payments from state to county or county to city). These interpolated estimates were validated against official county-area estimates constructed by the Census for the Census of Governments.

Technical Information Regarding Variable Lag & Model Specification

We selected a four-year lag period for spending to account for the fact that the hypothesized impact of expenditures on health outcomes is likely to accrue over several years but the bulk of the impact occurs within four years.⁽¹⁾ A two-year lag was selected for the health factors variable because the underlying data used by the County Health Rankings to create that measure, with a few minor exceptions, precede the release year by at least two years. Thus, a two-year health factors lag is actually roughly equivalent to a four-year expenditure lag (see limitations).

Tests revealed that health outcomes and expenditures were correlated within counties over time (see limitations) and potentially endogenous with the outcomes of interest, so lagged random-intercept models were used (“xtmixed” in Stata). Models included state-level random effects to account for state-level clustering. As potentially-endogenous time-varying covariates, the

county's health factors ranking and all spending variables were centered (i.e., de-meanned) and the both the mean and the year-specific deviation from the mean were included in the model. Please see the appendix for full specification of the models.

Table A1: Complete listing and overview of U.S. Census Bureau-defined expenditure categories used in all analyses

Sector Name Used in this Manuscript	Expenditure Category	Census Bureau Definition
Hospital	Public Hospitals	Expenditures related to a government's own hospitals as well as expenditures for the provision of care in other public hospitals. Own hospitals are facilities directly administered by the government, including those operated by public universities. Other expenditures cover the provision of care in other hospitals and support of other public hospitals. This function also covers direct payments for acquisition or construction of hospitals (whether or not the government will operate the completed facility) and payments to private corporations that lease and operate government-owned hospitals.
Public Health	Non-Hospital Health Care	Provision of services for the conservation and improvement of public health, other than hospital care, and financial support of other governments' health programs. (Referred to by Census Bureau as "Health – Other")
Social Services	Fire & Ambulance	Prevention, avoidance, and suppression of fires and provision of ambulance, medical, rescue, or auxiliary services provided by fire protection agencies.
	Housing & Community Development	Construction, operation, and support of housing and redevelopment projects and other activities to promote or aid public and private housing and community development.
	Libraries	Establishment and provision of libraries for use by the general public and the technical and financial support of privately-operated libraries.
	Natural Resources	Expenditures related to water resources, mineral resources, agriculture, and the regulation of industries which develop, utilize, or affect natural resources, as well as the regulation of agricultural products and establishments. Includes conservation, promotion, and development activities related to agriculture and natural resources (soil, water, energy, minerals, etc.).
	Parks and Recreation	Provision and support of recreational and cultural-scientific facilities maintained for the benefit of residents and visitors.
	Protective Inspections	Regulation and inspection of private establishments for the protection of the public or to prevent hazardous conditions NOT classified under another Census Bureau function, and the regulation of professional occupational licensing.
	Public Welfare	All classes of welfare programs, including direct benefit transfers and administrative programs.
	Sewerage	Provision, maintenance, and operation of sanitary and storm sewer systems and sewage disposal and treatment facilities, as well as all intergovernmental payments for such activities.

	Waste Management	Collection, removal, and disposal of garbage, refuse, hazardous, and other solid wastes and the cleaning of streets, alleys, and sidewalks.
	Transportation	Maintenance, operation, repair, and construction of highways, streets, roads, alleys, sidewalks, bridges, tunnels, ferry boats, viaducts, and related non-toll structures.
Education	K-12 Education	The operation, maintenance, and construction of public schools and facilities for elementary and secondary education (kindergarten through high school), vocational-technical education, and other educational institutions except those for higher education. Covers operations by independent governments (school districts) as well as those operated as integral agencies of state, county, municipal, or township governments. Also covers financial support of public elementary and secondary schools.
	Higher Education	Degree-granting institutions (associate, bachelor, master, or doctorate) operated by state or local governments that provide academic training beyond the high school (grade 12) level, other than for auxiliary enterprises of the state or local institution.

Source: U. S. Bureau of the Census. Government Finance and Employment Classification Manual. 2006

Table A2: Comparison of County-Level Population, Health, and Health Care Characteristics for Counties included in sample versus those not included in sample

County Characteristic (as of 2012)	Overall (N=3,130)	Mean/Proportion for Counties Included in Study's Sample (n=1,877)	Mean/Proportion for Counties Not Included in Study's Sample (n=1,311)
Total Population	99,327	150,866	27,816
Percent of Population Living in Urban Areas	41%	53%	25%
Percent of Population that is White Non- Hispanic	63%	62%	69%
Median Household Income	\$46,004	\$47,158	\$44,403
Unemployment Rate	7.7%	7.7%	7.7%
Number of Hospitals in County	2.3	2.8	1.2
Primary Care Providers per 10,000 Population	5.3	4.2	13.9
Per Capita Medicare Costs	\$9,428	\$9,430	\$9,426
Life Expectancy (years)	82.9	82.9	82.8

Table A3: State-by-State Breakdown of Counties included in study sample versus those not included

State	Total Counties in State	Counties Included in Study Sample	Percent of Counties Included in Sample
Alabama	67	45	67%
Alaska	23	8	35%
Arizona	15	14	93%
Arkansas	75	40	53%
California	58	49	84%
Colorado	63	34	54%
Connecticut	8	8	100%
Delaware	3	3	100%
Florida	66	45	68%
Georgia	159	67	42%
Hawaii	5	4	80%
Idaho	44	15	34%
Illinois	102	67	66%
Indiana	92	47	51%
Iowa	99	51	52%
Kansas	105	56	53%
Kentucky	120	80	67%
Louisiana	64	33	52%
Maine	16	15	94%
Maryland	24	19	79%
Massachusetts	14	14	100%
Michigan	83	56	67%
Minnesota	87	53	61%
Mississippi	82	44	54%
Missouri	115	53	46%
Montana	56	35	63%
Nebraska	93	22	24%
Nevada	17	7	41%
New Hampshire	10	10	100%
New Jersey	21	20	95%
New Mexico	33	18	55%
New York	62	46	74%
North Carolina	100	69	69%
North Dakota	53	16	30%
Ohio	88	58	66%
Oklahoma	77	56	73%
Oregon	36	32	89%

Pennsylvania	67	53	79%
Rhode Island	5	4	80%
South Carolina	46	31	67%
South Dakota	66	35	53%
Tennessee	95	39	41%
Texas	254	199	78%
Utah	29	14	48%
Vermont	14	10	71%
Virginia	133	49	37%
Washington	39	27	69%
West Virginia	52	34	65%
Wisconsin	72	58	81%
Wyoming	23	15	65%
Total	3,130	1,877	60%

Table A4: Comparing regression results for models including hospital community service provision variables (Model Set A; n=1877) versus models without hospital community service provision variables (Model Set B; n=3002)

		Model Set A (n=1,877 counties)				Model Set B (n=3,002 counties)			
		Model A1: Public Hospital Spending	Model A2: Public Health Spending	Model A3: Social Services Spending	Model A4: Education Spending	Model B1: Public Hospital Spending	Model B2: Public Health Spending	Model B3: Social Services Spending	Model B4: Education Spending
Government Spending Variables	Additional Public Hospital Spending (\$ per capita)								
	Current Year	--	0.01	0.01	-0.02	--	0.01*	0.02*	-0.01
	1 Year Prior	0.50***	0.00	0.00	0.05	0.68***	0.00	0.00	0.03
	Additional Public Health Spending (\$ per capita)								
	Current Year	0.13	--	0.22	0.03	0.17	--	0.27*	0.03
	1 Year Prior	-0.07	0.81***	-0.13	0.16	-0.19	0.83***	-0.14	0.10
	Additional Social Services Spending (\$ per capita)								
	Current Year	0.02	0.03	--	0.12***	0.05*	0.03*	--	0.14***
	1 Year Prior	0.02	0.00	0.47***	0.04	0.03	-0.01	0.43***	0.07
	Additional Education Spending (\$)								
	Current Year	-0.02	0.00	0.03**	--	0.00	0.00	0.03**	--
	1 Year Prior	0.00	0.00	0.03**	0.18***	0.02*	0.00	0.02**	0.26***
Community Health Variables	Additional Hospital Services (#)								
	Current Year	1.59	0.21	-2.52	1.54	--	--	--	--
	1 Year Prior	3.32	0.23	-2.72	4.54	--	--	--	--
	Improvement in County Health Outcomes Ranking (# spots within state)								
	1 Year Prior	-0.37	0.02	-0.18	0.29	-0.23	0.04	-0.16	0.06
	Improvement in County Health Factors Ranking (# spots within state)								
	1 Year Prior	-0.55	0.05	-0.09	0.05	-0.21	0.00	-0.04	0.17
Control Variables	Population (thousands)								
	Current Year	-0.10	0.02	-2.80***	-5.41***	-0.14	0.01	-3.28***	-5.93***
	1 Year Prior	0.11	-0.02	2.80***	5.43***	0.14	-0.01	3.28***	5.95***
	Baseline Public Hospital Spending (\$ per capita)	0.00	0.00	0.00	-0.02***	0.01	0.00	0.00	0.00
	Baseline Public Health Spending (\$ per capita)	0.01	-0.05**	0.00	-0.04	-0.01	-0.04***	-0.02	-0.07
	Baseline Social Services Spending (\$ per capita)	0.00	0.00	-0.02	0.03	0.01	0.00	0.00	0.04
	Baseline Education Spending (\$ per capita)	0.01	0.00	0.01	-0.03*	0.01	0.00	0.00	-0.03
	Presence of for-profit hospital in county	-10.65	-1.68	-0.97	-21.06*	--	--	--	--

Notes: Models also controlled for state random effects and year fixed effects

* p < .05 ** p < .01 *** p < .001

Table A5: Comparing regression results for all counties (Model Set A; n=1877) versus large counties only (population > 100,000; Model Set C; n=545)

		Model Set A (n=1,877 counties)				Model Set C (n=545 counties)			
		Model A1: Public Hospital Spending	Model A2: Public Health Spending	Model A3: Social Services Spending	Model A4: Education Spending	Model C1: Public Hospital Spending	Model C2: Public Health Spending	Model C3: Social Services Spending	Model C4: Education Spending
Government Spending Variables	Additional Public Hospital Spending (\$ per capita)								
	Current Year	--	0.01	0.01	-0.02	--	0.03	0.02	-0.04
	1 Year Prior	0.50***	0.00	0.00	0.05	0.84***	-0.04*	0.01	-0.02
	Additional Public Health Spending (\$ per capita)								
	Current Year	0.13	--	0.22	0.03	0.31	--	0.00	-0.14
	1 Year Prior	-0.07	0.81***	-0.13	0.16	-0.13	0.66***	-0.19	0.31
	Additional Social Services Spending (\$ per capita)								
	Current Year	0.02	0.03	--	0.12***	0.03	0.00	--	0.14*
	1 Year Prior	0.02	0.00	0.47***	0.04	-0.02	0.02*	0.39***	0.09
	Additional Education Spending (\$)								
	Current Year	-0.02	0.00	0.03**	--	-0.03	-0.01	0.07*	--
	1 Year Prior	0.00	0.00	0.03**	0.18***	0.02	0.00	0.09*	0.41***
Community Health	Additional Hospital Services (#)								
	Current Year	1.59	0.21	-2.52	1.54	3.03**	-0.74	-0.45	2.04
	1 Year Prior	3.32	0.23	-2.72	4.54	-1.00	0.65	-1.52	9.72**
	Improvement in County Health Outcomes Ranking (# spots within state)								
	1 Year Prior	-0.37	0.02	-0.18	0.29	0.03	0.04	0.52	0.59
	Improvement in County Health Factors Ranking (# spots within state)								
	1 Year Prior	-0.55	0.05	-0.09	0.05	-0.21	-0.05	0.10	-1.04**
Control Variables	Population (thousands)								
	Current Year	-0.10	0.02	-2.80***	-5.41***	-0.36*	0.02	-2.16***	-3.78***
	1 Year Prior	0.11	-0.02	2.80***	5.43***	0.36*	-0.02	2.17***	3.80***
	Baseline Public Hospital Spending (\$ per capita)	0.00	0.00	0.00	-0.02***	-0.02	0.00	0.00	-0.01
	Baseline Public Health Spending (\$ per capita)	0.01	-0.05**	0.00	-0.04	-0.02	-0.02	0.04	-0.07
	Baseline Social Services Spending (\$ per capita)	0.00	0.00	-0.02	0.03	0.01	0.00	-0.06**	0.05*
	Baseline Education Spending (\$ per capita)	0.01	0.00	0.01	-0.03*	0.00	0.00	0.02	-0.03**
	Presence of for-profit hospital in county	-10.65	-1.68	-0.97	-21.06*	7.35*	2.02	4.38	-11.29

Notes: Models also controlled for state random effects and year fixed effects

* p < .05 ** p < .01 *** p < .001