

The Importance of Health and Social Services Spending to Health Outcomes in Texas, 2010–2016

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Objectives: Public health and social services spending have been shown to improve health outcomes at the county level, although there are significant state and regional variations in such spending. Texas offers an important opportunity for examining nuances in the patterns of association between local government health and social services spending and population health outcomes. The primary objectives of this study were to describe local investments in education, health, and social services at the county-area level for all of Texas from 2002 through 2012 and to examine how changes in local investment over time were associated with changes in health outcomes.

Methods: We used two large secondary data sources for this study. First, US Census Bureau data were used to measure annual spending by all local governments on public hospitals, community health care and public health, and >1 dozen social services. Second, County Health Rankings & Roadmaps data measured county health outcomes. We performed regression models to examine the association between increases in local government spending and a county's health outcomes ranking 4 years later. Multilevel mixed-effects linear regression models accounted for mean spending in each category, county health factors ranking, and county and state random effects.

Results: Local governments in Texas spent an average of \$4717 per capita across all health and social services. Although spending was relatively consistent across 2002–2012, there was notable variation in spending across counties and services. Regression models found that changes in four spending categories were associated with significant improvements in health outcomes: fire and ambulance, community health care and public health, housing and community development, and libraries. For each, an additional one-time investment of \$15 per

capita was associated with a 1-spot improvement in statewide county health rankings within 4 years.

Conclusions: Existing evidence regarding the association between social services spending and health outcomes may not yield sufficiently granular data for policy makers within a single state. Investments in certain social services in Texas were associated with improvements in health outcomes, as measured by improvements in the County Health Rankings, in the years subsequent to spending increases. Similar analyses in other states and regions may yield actionable avenues for policy makers to improve population health.

Key Words: county health rankings, local government, population health, public health, social services

The United States spends >\$3 trillion per year on health, mainly in health care.^{1,2} Despite advanced medical technologies and large numbers of well-trained specialists, Americans have worse health outcomes than citizens in other developed nations.^{3,4} The United States spends more of its gross domestic product on health care (17.8%) than its peers. Switzerland and Sweden, the next highest spenders, expend approximately 12% of their gross domestic product on health care.⁴ Our increased spending, because of labor, pharmaceuticals, and administrative costs, does not yield better outcomes, however.⁵ Life expectancy, maternal outcomes, and perinatal outcomes lag behind

Key Points

- Evidence suggests that public health and social services spending may improve population health outcomes, but no state- or region-specific analyses exist.
- Local governments in Texas spend >\$4700 per person per year on public health and social services, although spending varies substantially across counties and across services.
- Increasing spending for four specific services was associated with improvements in a county's health outcome ranking: community health care and public health, fire and ambulance, housing and community development, and libraries.
- Existing evidence regarding the effects of health and social services spending on population health outcomes may yield actionable avenues for policy makers to improve population health in their communities.

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other developed nations and disparities in outcomes by race and class are profound.^{4,6,7}

Although access to high-quality, affordable care is an important determinant of health, there are numerous others.^{8–11} Individual health behaviors, social and economic factors, and the physical environment are important determinants of health, alongside clinical care.¹² Moreover, in the past several years, there has been recognition of and interest in characterizing the impact of nonhealth spending (eg, transportation, housing) on health outcomes. Bradley and others have shown that that increased spending on social services is associated with improved health outcomes at the state level.¹³ Brown, Mays, and others have shown particular kinds of spending, such as public health, to be particularly efficient at the local level.^{14–19} Across the United States, increases in social services spending have been shown to improve health outcomes at the county level.^{20–22}

Research has shown significant state and regional variation in public spending—both health and nonhealth—as they affect health outcomes.^{21,23} One such case example is Texas. Texas is among the largest states in the United States. It is increasingly diverse and has a unique way of delivering services in its local jurisdictions. Although municipalities, townships, and county governments are primarily responsible at the local level for the delivery of most services, state agencies, such as the Department of State Health Services, deliver programs and services when there are no applicable local agencies in the region. Texas historically rates in the middle of the United States in terms of health outcomes (34/50 overall as of 2017).²⁴ Although Texas ranks in the top 20 for health behaviors, it ranks in the bottom 20 for community and environment, the bottom 10 for policy environment, and the bottom 20 states for clinical care.²⁴ Given its size, state–local relation, and health outcomes broadly, Texas is primed for an investigation into the importance of local spending on health outcomes. The primary objectives of this study were to describe local investments in education, health, and social services at the county-area level for all of Texas from 2002 to 2012 and examine how changes in local investment over time were associated with changes in health outcomes.

Methods

For this study, we relied on two large secondary data sources. First, we brought a novel data source containing annualized estimates of local public spending for health and social services for all US counties, including those in Texas. These data are produced by the US Census Bureau's State and Local Finance Division, an underused source of financial data for state and local governments. The Census collects information on expenditures, revenues, and debts for all of the jurisdictions in the United States. For several decades, data have been collected from all of the >87,000 local governments every 5 years and from a stratified sample of local governments in the intervening years. Our team developed a methodology to obtain annualized estimates of expenditures, revenues, and debts for all counties.²¹

All of the governments within a county area are included in the figures reported in this analysis, meaning that all of the tables and figures represent the spending aggregation of all of the governments within a given county and their spending on each category in a given year—these include county governments, city/municipal/township governments, and special districts. The US Census Bureau reports data across every governmental service category.²⁵

This article focuses on a group of 15 key categories. We examine two health-related categories: public hospital sending and community health care and public health spending. We also examine 13 social services categories: Corrections, Fire and Ambulance, Higher Education, Housing and Community Development, K–12 Education, Libraries, Natural Resources, Parks and Recreation, Protective Inspections, Public Welfare, Sewerage, Solid Waste Management, and Transportation. Please see the Supplemental Digital Content, Table A1, for the definitions used by the US Census Bureau for each category (<http://links.lww.com/SMJ/A133>).

Second, we measure county-level health outcomes and health factors by leveraging The Robert Wood Johnson Foundation–funded County Health Rankings & Roadmaps (CHR) data available through the www.countyhealthrankings.org Web site.²⁶ This county-level data source covers the years 2010 through 2016 and ranks counties annually based on health outcomes such as premature mortality, physical and behavioral health status, and low birth weight incidence. These data are the study's health outcomes of interest. The CHR also rank counties based on health factors such as obesity rate, smoking rate, environmental quality, and socioeconomic factors. These data were used as a control variable in the project's regression models.

From a group of relevant public health and social services, the spending totals from all governments within a county area were aggregated and analyzed using the following three approaches:

- Spending per capita: dollars spent for a given category per person living within a county (used in descriptive statistics and bivariate tables and figures)
- Percentage of total expenditures: total expenditures for a given category divided by the total local governmental expenditures in the county (used in descriptive statistics and bivariate tables and figures)
- Yearly deviation from county mean: difference (in US dollars) between spending for a given category in a given county in a given year and the mean spending for that category for that county across all years in the sample (used in regression models)

These spending data are the study's main predictors of interest. After obtaining, cleaning, and coding all of the relevant data, we merged the two data sources to create our analytic dataset. This analytic sample consisted of all 254 counties in Texas. We calculate descriptive statistics regarding county-level public expenditures in relation to county-level health outcomes. Analyses include basic descriptive and bivariate statistics. We used the Bureau of Economic Analysis State & Local Government deflator to account for inflation²⁷; all spending amounts are shown in constant 2012 US dollars.

We used regression models to examine the association between local government expenditures and population health outcomes in Texas. The outcome of interest in the regression model was a county’s health outcomes ranking. The predictors of interest were yearly deviation from county mean for each of the 15 county health and social services spending categories. Multilevel mixed-effects linear regression models were used to predict a change in county health outcomes ranking based on changes from 4 years prior in each spending category (using the “yearly deviation from county mean” spending variables defined above) after accounting for mean spending in each category, county health factors ranking, and county and state random effects. Rankings data (and changes projected by our model) are standardized within the state of Texas. All of the data were managed and analyzed in STATA version 15.1 (StataCorp, College Station, TX).

Results

Trends in Local Health, Education, and Social Services Spending in Texas Compared with the Rest of the United States

Local governments in Texas generally rate in the middle of health and social services spending in the United States. On average in 2012, governments within Texas county areas (ie, all of the governments within a physical county jurisdiction) spent

approximately \$4717 per capita across all health and social services categories. Of the 10 specific social services highlighted in Figure 1, Texas rates in the quartile of least spending for two categories—fire protection and libraries—and in the highest spending in one—public hospitals. The remaining categories fall within the two middle quartiles.

As with local governments in almost every state, the plurality of local spending in Texas went toward K–12 education (mean \$1968 per capita, 2002–2012), followed by “all other” (\$1905 per capita), public hospitals (\$306 per capita), and police protection (\$225 per capita). The remaining categories, with the exception of libraries (approximately \$20 per capita throughout 2002–2012) averaged between \$75 and \$150 per capita in the intervening years, after adjusting for inflation.

Public spending at the local level has been relatively consistent in the most recent full decade for which spending was available (2002–2012). After adjusting for inflation, spending has decreased by 40% from 2002 to 2012 for parks and recreation and for K–12 education by 22%. Public hospital spending increased by 19% during the same period. The remaining categories, including “all other” and total expenditures returned to pre-Great Recession levels by 2012.

There is significant intercounty variation in expenditures. Figure 2 shows that expenditures for housing, community health care and public health, fire protection and emergency medical services, and parks and recreation vary across Texas counties from >\$100 per person per year to close to \$0 per person per

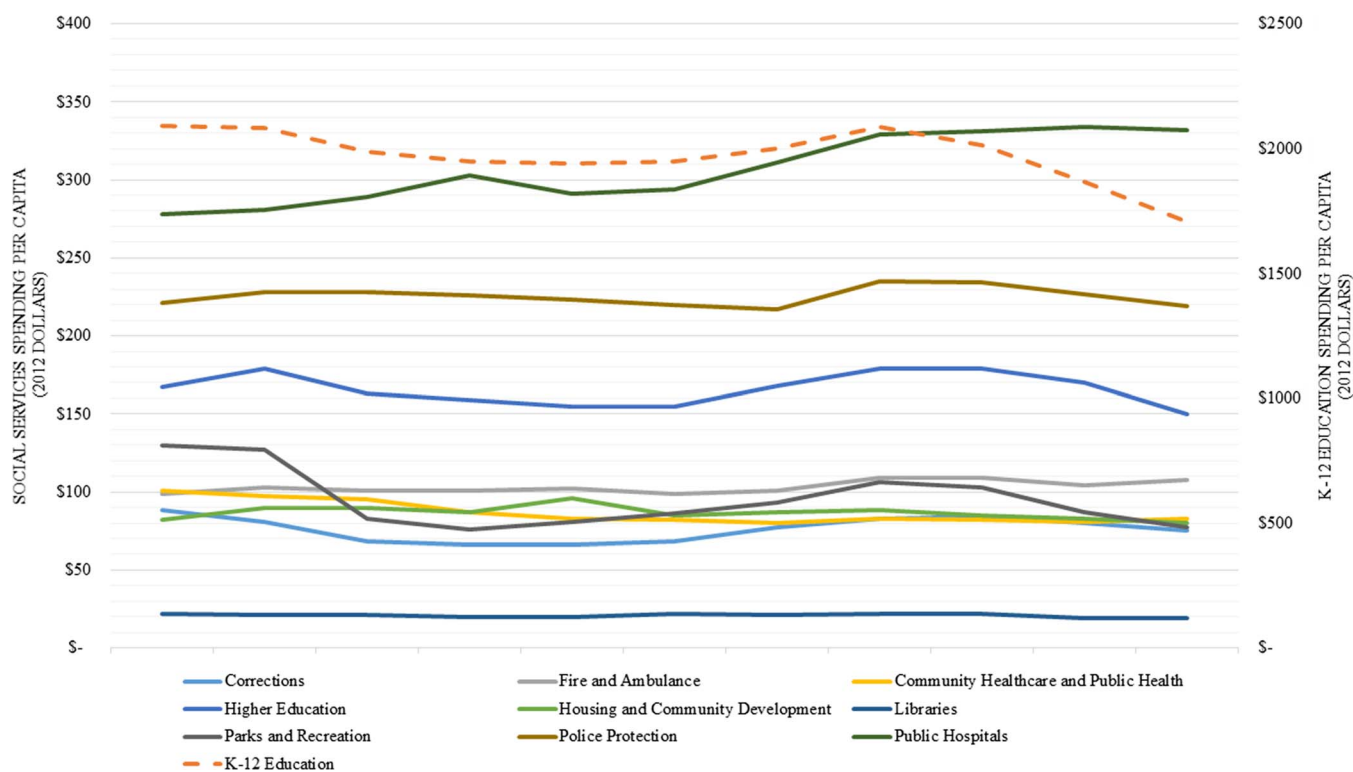
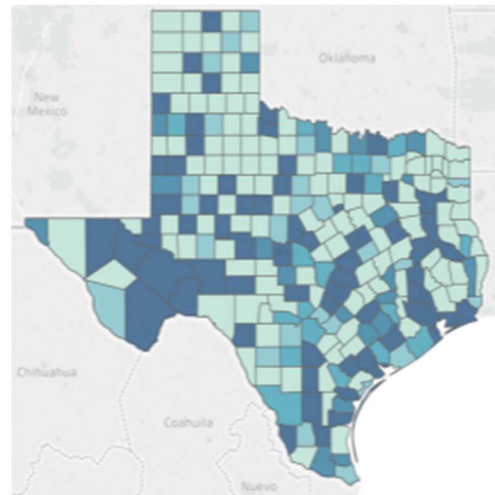
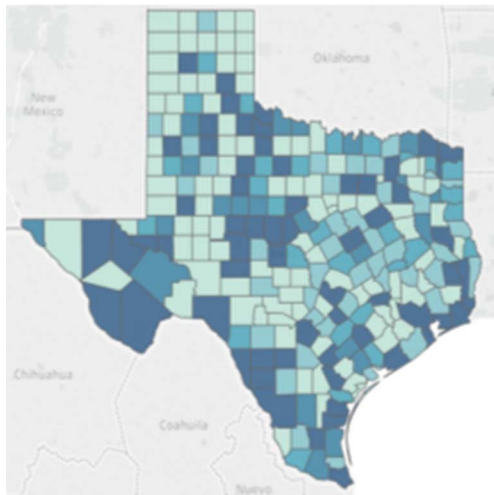


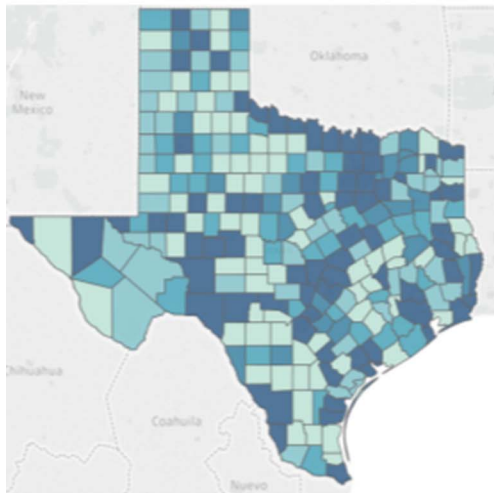
Fig. 1. Mean county-area spending on social services in Texas, 2002–2012 (adjusted for inflation). Average per capita county-area spending in the state of Texas, 2002–2012, across a number of health and social services.

Housing & Community Development

Community Health Care & Public Health



Fire & Ambulance



Parks & Recreation

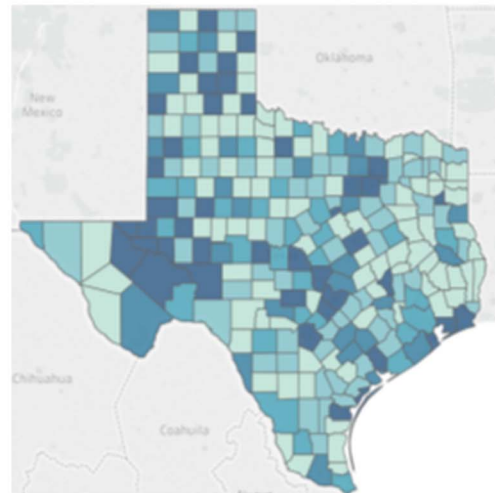


Fig. 2. Per capita social services spending in Texas county areas in 2012. Maps show local per capita spending on four key service areas in 2012.

year. Many counties also had no expenditures for some categories. Notably, only 144 of the 254 Texas counties reported having any public hospital spending at any point from 2002 to 2012 (it can be inferred that the remaining counties did not operate a public hospital nor have any expenditures for hospital operations). By comparison, only 24 county areas reported no community healthcare and public health spending in 2012. As shown in the Supplemental Digital Content, Figures 1 and 2 (<http://links.lww.com/SMJ/A133>), spending also varies substantially regionally.

A final area for descriptive expenditure analysis is related to county size. Table 1 shows per capita expenditures after weighting by population size, whereas Supplemental Digital Content, Table 1 (<http://links.lww.com/SMJ/A133>) shows unweighted estimates. Even with population-weighted estimates, significant differences are observable by population size and over time. Per capita spending was highest for the jurisdictions with

the largest populations (>150,000 population, n = 23–26) at \$4912 in total on average in 2012, followed by the smallest populations (<25,000 population, n = 152–157) at \$4883 in total on average, followed by the middle two population size categories (\$3970 and \$3836, respectively).

Public Spending and Its Impact on Health Over Time

The 2016 CHR, published by the University of Wisconsin’s Population Health Institute in concert with The Robert Wood Johnson Foundation, offer two sets of rankings for each state: “health outcomes” and “health factors” (Supplemental Digital Content, Figure 3, <http://links.lww.com/SMJ/A133>).²⁶ Commonly viewed as quartiles, these two ranking sets show strong regional and relational variation.

Table 1. Mean county-area spending on social services by county population size in Texas, 2002–2012 (adjusted for inflation and population weighted)

	Population											
	<25,000			25,001–50,000			50,001–150,000			>150,000		
	2002	2007	2012	2002	2007	2012	2002	2007	2012	2002	2007	2012
Corrections	\$64	\$72	\$90	\$86	\$88	\$74	\$68	\$71	\$84	\$95	\$66	\$72
K–12 education	\$2219	\$2097	\$1990	\$2039	\$1844	\$1674	\$1973	\$1888	\$1572	\$2107	\$1954	\$1711
Fire and ambulance	\$35	\$33	\$49	\$48	\$43	\$48	\$77	\$80	\$91	\$115	\$114	\$120
Community health care and public health	\$37	\$30	\$43	\$69	\$79	\$84	\$107	\$81	\$79	\$109	\$88	\$87
Higher education	\$101	\$96	\$91	\$221	\$219	\$219	\$130	\$116	\$133	\$175	\$163	\$152
Housing and community development	\$50	\$52	\$51	\$40	\$42	\$52	\$66	\$55	\$49	\$93	\$98	\$89
Library	\$14	\$12	\$13	\$14	\$12	\$12	\$15	\$14	\$14	\$25	\$26	\$21
Other	\$1240	\$1521	\$1590	\$1044	\$1032	\$1252	\$1158	\$1182	\$1268	\$2103	\$2120	\$2025
Parks and recreation	\$39	\$40	\$49	\$39	\$40	\$40	\$51	\$50	\$46	\$163	\$101	\$87
Police protection	\$161	\$155	\$186	\$155	\$158	\$170	\$189	\$172	\$176	\$239	\$240	\$232
Public hospitals	\$527	\$546	\$599	\$239	\$293	\$301	\$317	\$254	\$321	\$249	\$279	\$316
Mean total expenditures	\$4505	\$4718	\$4883	\$4021	\$3878	\$3970	\$4151	\$3962	\$3836	\$5472	\$5248	\$4912

All estimates represented as constant 2012 US dollars.

Regression models tested associations between county health outcome rankings and changes in health and social services spending categories. Models showed that not all spending categories were associated with significant changes in health outcomes, but four were associated: fire and ambulance, housing and community development, libraries, and community health care and public health. Spending more on health (relative to what had been spent by that county in previous years) was associated with a modest improvement in that county's health outcomes. Complete regression results are shown in the Supplemental Digital Content (<http://links.lww.com/SMJ/A133>). An additional, one-time investment of \$15 per capita is predicted to lead to a 1-spot gain in statewide county health rankings within 4 years. Similarly, 1-spot gains in statewide county health rankings were shown to be associated with one-time investments of \$15 on fire and ambulance or \$10 on housing and community development or \$5 on libraries. These associations account for spending for all other categories, baseline levels of spending for these and all other categories, for county-level demographics and health factors, and for county- and state-level random effects.

In addition to a traditional regression, we estimated marginal changes to rank based on increases in per capita spending at \$10 per capita increases and selected the items showing the greatest median rank change for each price point in which community health care and public health increases (Table 2). For instance, were a county area to increase its total per capita spending by \$30, distributing approximately one-third of that funding to community health care and public health and two-thirds to libraries, models would predict that the county would see a 4-spot improvement in its county health ranking within 4 years. Increases in spending for housing and community development or fire and ambulance also were shown to correlate

with changes in a county's health outcomes rank in our prediction models.

Discussion

There is an increasing recognition of the importance of government spending on health and social services as it relates to population health outcomes, and yet there are meaningful differences in populations, health needs, and specific health and social services programs across states. The literature analyzes data from all 50 states and may not yield sufficiently granular data for policy makers within a single state. Even descriptive statistics for spending patterns and trends can be challenging to obtain from the existing research. Texas offers an important opportunity for examining nuances in the patterns of association between local government health and social services spending and population health outcomes.

Examination of local public spending in Texas shows relatively stagnant or declining spending totals for many health and social services, with the exception of public hospitals. Declines were observed overall in K–12 education, the largest single area of spending and local government in Texas. Significant intercounty variation was observed across almost every category of governmental spending, even after adjusting for population size. Population-adjusted averages show that per capita spending is relatively higher in large jurisdictions compared with smaller jurisdictions across most categories of spending, with the exception of public hospitals. Community health care and public health spending is relatively modest and relatively slow growing compared with other health expenditure areas. This may be the result in part of the state health department's relationship to local jurisdictions in Texas. The Texas Department of State Health Services directly provides services in jurisdictions

Table 2. Median projected County Health Rankings change based on increases in per capita spending

One-time additional per capita spending					Regression model predicted change in county's health outcome ranking
Housing and community development	Community health care and public health	Fire and ambulance	Libraries	Total extra per capita spending	
\$0	\$10	\$0	\$10	\$20	2
\$0	\$10	\$0	\$20	\$30	4
\$0	\$10	\$0	\$30	\$40	5
\$0	\$10	\$0	\$40	\$50	7
\$0	\$10	\$0	\$50	\$60	8
\$0	\$20	\$0	\$50	\$70	10
\$0	\$10	\$50	\$10	\$70	5
\$0	\$20	\$10	\$50	\$80	11
\$30	\$10	\$0	\$50	\$90	13
\$0	\$20	\$50	\$20	\$90	8
\$20	\$10	\$20	\$50	\$100	14
\$40	\$10	\$10	\$50	\$110	15
\$50	\$10	\$10	\$50	\$120	16
\$30	\$30	\$30	\$30	\$120	13
\$50	\$10	\$20	\$50	\$130	17
\$40	\$20	\$30	\$50	\$140	17
\$50	\$30	\$20	\$40	\$140	16
\$50	\$10	\$40	\$50	\$150	19
\$50	\$10	\$50	\$50	\$160	20
\$40	\$30	\$50	\$50	\$170	20
\$50	\$30	\$50	\$50	\$180	21
\$40	\$50	\$50	\$50	\$190	21
\$50	\$50	\$50	\$50	\$200	21

that have no local health department. Only a few states have this arrangement, which may complicate local spending estimates.

Our regression models show that increases in spending for certain categories are associated with improvements in health outcomes for counties in Texas. Specifically, spending increases for fire and ambulance, community health care and public health, housing and community development, and libraries were positively associated with health gains. Moreover, there are multiple ways in which a county may choose to allocate additional investments in public health and social services to achieve improvements in health in their communities.

It was outside of the scope of this study to determine the specific causal mechanisms that led to the associations that spending for these specific categories had; however, it is instructive to consider other studies that have explored the nuanced relations between certain social services and health outcomes. For example, a relatively rich literature exists that links specific housing interventions to improvements in specific health measures.²⁸ Gains may be made through improvements in housing stability, quality and safety, affordability, or neighborhoods.²⁹ Often, however, evidence is presented on an intervention-by-intervention level, limiting generalizability and applicability to other settings.³⁰ Our evidence takes a broader, system-level view

of whether government spending, broadly defined, can be linked back to the overall health of the community. Extending this approach to fire and ambulance, existing intervention-specific findings suggest new innovative strategies to staff ambulances with physician extenders as a part of comprehensive delivery systems.³¹ Although the body of evidence is growing, the literature strongly suggests positive associations between social services and some health outcomes.^{13,16,19,21} This study extends that through its system-level analysis (as opposed to program- or policy-specific analysis) and its specific focus on Texas' experiences.

Another application of our modeling relates to the investment of public dollars in nonhealth areas to achieve health benefit. Although long-term debt and austerity are likely to remain in Texas, especially in smaller rural jurisdictions, it is reasonable to ask where new dollars ought to be incrementally allocated. System stakeholders and state and local policy makers may benefit from using an evidence-informed approach to allocating spending to yield maximum anticipated health benefits to a community. The corollary to this would be that if and when policy makers seek to reduce spending in certain health and social services areas, the evidence would suggest that it is reasonable to anticipate commensurate declines in health outcomes at the community level.

Our findings should be viewed in the light of several important limitations. First, spending data are self-reported by governments. Although US Census–defined categories remained consistent during the study period, there may be variation in how expenditures are classified by different counties or as personnel change within a county; however, it is not hypothesized that this measurement error would necessarily be correlated with health outcomes and thus is not anticipated to result in differential bias. Second, our models cannot fully account for the potential for reverse causality between spending and health outcomes. We have accounted for observable and unobservable county-level characteristics and for baseline spending for all of the categories. Third, our analyses focus only on spending by local governments. No data were available for spending by nongovernment or nonprofit entities, nor for direct state expenditures in a given area. Likewise, spending by state or federal governments that flows directly to individuals (and not to or through local governments) would not be reflected in these spending estimates. Nevertheless, our data are an important improvement compared with the existing evidence and represent an important source of publicly funded resources (>\$4700 per person per year). It is important to understand and track the effects of this public investment on the health of our communities.

Conclusions

Analysis of several years of public spending on health, education, and other social services has shown that public investments have a statistically significant impact on the health outcomes and health factors of communities in relatively short time frames. Investments especially in community health care and public health, fire and ambulance, housing and community development, and libraries in Texas were associated with improvements in health outcomes, as measured by improvements in the CHR, in the years subsequent to spending increases. An open question remains as to the appropriate portfolio of social services spending to have an optimal impact on population health at the local level. Our analysis suggests that nonhealth spending, especially on fire and ambulance or housing and community development or libraries may have health effects in the short term alongside any nonhealth benefit the service is intended to provide.

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