Local Health Department Food Safety and Sanitation Expenditures and Reductions in Enteric Disease, 2000–2010

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Objectives. In collaboration with Public Health Practice–Based Research Networks, we investigated relationships between local health department (LHD) food safety and sanitation expenditures and reported enteric disease rates.

Methods. We combined annual infection rates for the common notifiable enteric diseases with uniquely detailed, LHD-level food safety and sanitation annual expenditure data obtained from Washington and New York state health departments. We used a multivariate panel time-series design to examine ecologic relationships between 2000–2010 local food safety and sanitation expenditures and enteric diseases. Our study population consisted of 72 LHDs (mostly serving county-level jurisdictions) in Washington and New York.

Results. While controlling for other factors, we found significant associations between higher LHD food and sanitation spending and a lower incidence of salmonellosis in Washington and a lower incidence of cryptosporidiosis in New York.

Conclusions. Local public health expenditures on food and sanitation services are important because of their association with certain health indicators. Our study supports the need for program-specific LHD service-related data to measure the cost, performance, and outcomes of prevention efforts to inform practice and policymaking. (*Am J Public Health*. Published online ahead of print ■■■: e1–e8. doi:10.2105/AJPH.2015.302555)

Local health department (LHD) resources are intended to be spent on improving health, protecting the public from disease and disability, and reducing disparities.[1] Although LHDs differ across states and communities in services provided and approaches to health improvement, one of the most common LHD activities is the performance of food safety and sanitation education and inspection.[2,3] Yet, as in other areas of LHD service,[4] local public health leaders lack the data and evidence needed to direct decision making and advocacy regarding the value of these food safety and sanitation efforts and expenditures. In the face of major US budget cuts and job losses in LHDs in recent years,[5] the need for evidence to direct resources effectively has become urgent.

Food safety and sanitation activities are regulated by federal, state, and local governments, with many state and local health departments adopting the Food and Drug Administration's food code model to ensure food safety.[6] At the state level, state health departments enact legislation and regulation and execute "police powers" in food safety. State and local health department responsibilities include licensing food establishments, inspecting food storage warehouses to ensure required food storage compliance, and authorizing temporarily restricted employment of food service workers with certain contagious diseases. The extent and independence of LHD activities regarding food safety and sanitation vary widely across states, with the authority for an LHD's independence generally delegated by the state. State or local staff from agencies other than health departments, for example, are sometimes responsible for local food safety inspections and enforcement. In many states, including Washington and New York, LHD officials often have authority to perform food establishment licensing, food inspections, restriction of ill food workers, and other areas of inspection and licensing that are carried out to protect the public from foodborne illness. Related LHD food safety budgets are often influenced by number of restaurants, inspections, training, and technology.[7–11]

LHD responsibilities extend to facility sanitation services, with health departments often charged with testing and regulation of public and recreational areas and water sources. Additional LHD functions may include providing laboratory services and partnering with other agencies (such as the US Department of Agriculture, Centers for Disease Control and Prevention, and food service industries) in public education, disease surveillance, and response to outbreaks of food and waterborne disease. A limited number of published studies have identified relationships between sanitation measures and health, with research complicated by the fact that no simple water quality indicator accurately predicts illness across diverse water source environments.[12,13]

Local efforts supporting inspection, education, and food code enforcement related to food and water are intended to reduce the incidence of enteric diseases such as norovirus, *Salmonella,* and *Clostridium perfringens*.[11,14,15] Supporting research, however, has been inconclusive. Evidence from a study of 1 county, for example, indicated that routine restaurant inspection could predict the likelihood of an enteric disease outbreak,[16] but other studies have found that restaurant inspection scores are not associated with foodborne outbreaks.[14,17–19] Few published studies have actually examined the performance of LHD disease prevention efforts in relation to food safety (e.g., restaurant inspection, water quality testing) to see whether those efforts reduce rates of the enteric diseases they try to prevent.[19] Inconsistent and inadequate amounts of research regarding food safety and sanitation practices leave public health leaders with little evidence on which to establish their approach to these activities.[14] This lack of research may have contributed to environmental health programs the programs that oversee food safety and sanitation activities being among those most affected by recent LHD budget cuts.[5] Better evidence would support advocacy for the staff, programs, and funding that have long been thought to be reasonably expected to protect the public's health.

LHD service specific expenditures do not always align with related local need.[20] This is also true of public health system expenditures for food safety, sanitation, and other environ mental health related services.[21] Studies have indicated, for example, that activities such as restaurant inspections are not always carried out at a frequency and depth that is responsive to recent rates of enteric disease.[22,23] A lack of detailed data interferes greatly with pro ducing the evidence public health leaders require for policymaking regarding the contri bution and distribution of these services rela tive to need.[24] The same lack of data has hampered the development of evidence and direction for decision making in terms of other LHD services.[4,25]

In collaboration with statewide Public Health Practice Based Research Networks (PBRNs) in Washington and New York, the University of Washington's Public Health Activities and Services Tracking research team compiled uniquely detailed annual LHD expenditure data specific to food safety and sanitation. We used these expenditure data as a proxy for public health food safety and sanitation services and linked them to notifi able enteric disease data in those states. Previous studies have shown that LHD ex penditure data can be used to demonstrate critical relationships between LHD output and community health.[4,26,27] The purpose of our study was to determine whether higher LHD food safety and facility sanitation expendi tures were associated with fewer enteric in fections. The results provide evidence regarding the value of these LHD service investments and help address questions re garding the impact of LHD food safety or facility sanitation services on the public's health.

METHODS

We used a panel study design to estimate relationships between LHD food safety and sanitation specific LHD per capita expenditures on enteric disease rates with LHDs as the unit of analysis. Our study population consisted of LHDs in New York and Washington State. New York had 58 LHDs throughout the study period, but we included only 36. The 22 New York LHDs omitted from our sample did not directly provide food safety and facility sanita tion services and, therefore, had no expenses in the services under investigation. Washington had 34 LHDs during 2000 2002 and 35 during 2003 2010, and all were included. Most (94.44%; n = 68) of the LHDs in our study served a single county, and the remain der (5.6%; n = 4) served multicounty jurisdic tions. Our final sample (New York, n = 36; Washington, n = 34 through 2002, and n = 36 units after 2002) totaled 778 LHD observa tions over 11 years (2000 2010).

Measures

Outcome measures examined were the reported incidence rates (number of cases per 10 000 people) of the 7 most common notifi able enteric diseases in New York and Wash ington during the study years (Figure 1).[28,29] We extracted the number of reported cases of these diseases from each state's Communicable Disease Annual Reports. For each, we calcu lated disease rate as the sum of the number of cases in each jurisdiction per year divided by annual population estimates from the US Cen sus Bureau's County Intercensal Estimates.[30,31]

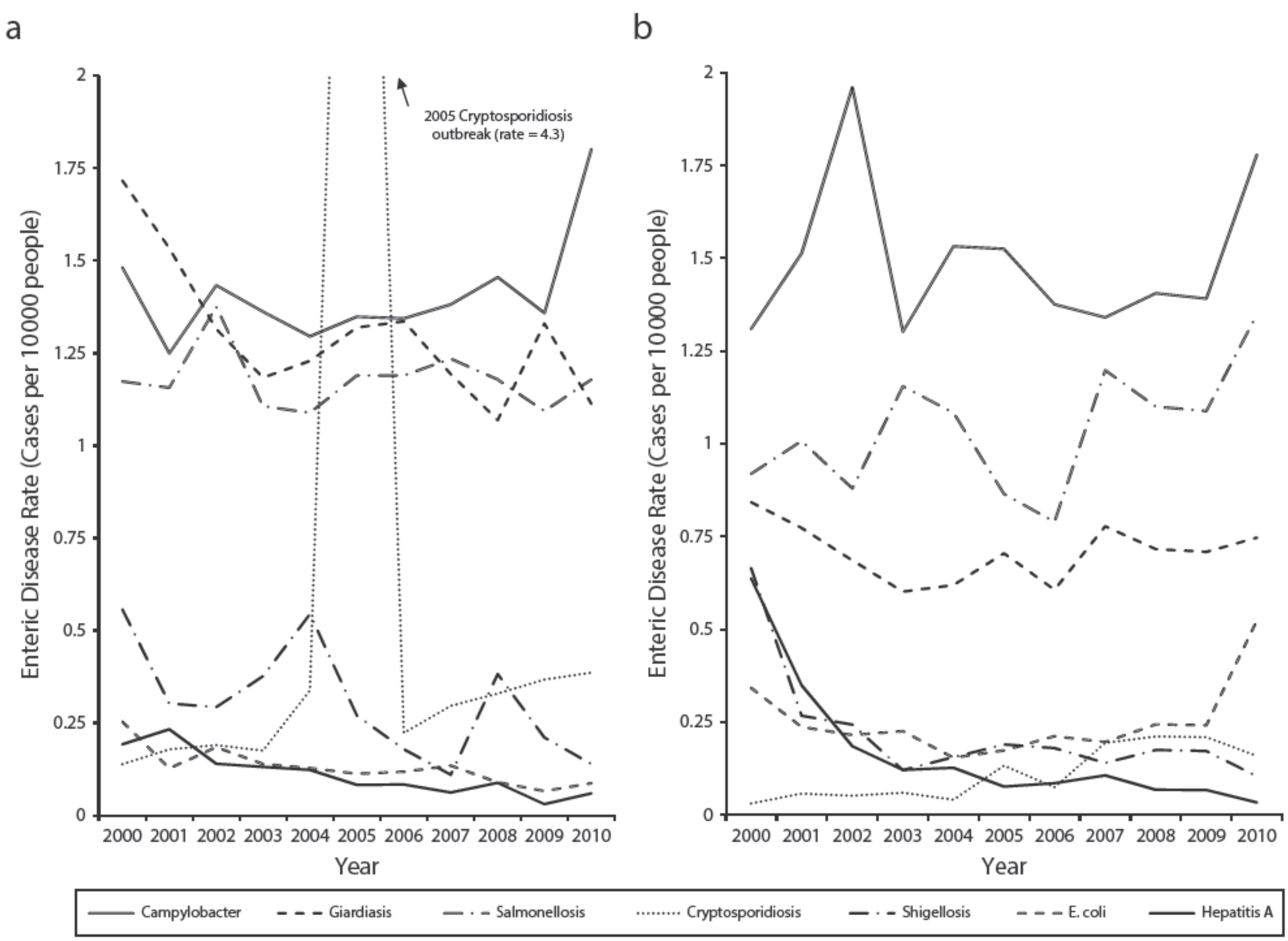
We obtained detailed annual food and sanitation related LHD service expenditure data from New York and Washington public health PBRN partners. Categories represented expenditures that we could harmonize across state and local public health systems, given the known variations in service, which were sepa rable from other annual LHD expenditure data. We used data dictionaries, regular queries of practice partners, sensitivity tests, and data validation across data sources to ensure data quality, rigor, and comparability. We created harmonized New York and Washington service specific expenditure data using a com posite of 2 rather different pairs of expenditure categories in New York and Washington that together depicted local spending related to food safety and sanitation in both states.[32]

Food safety activities for New York and Washington expenditure categories were de fined as including food safety education, implementation of state and local regulations governing retail food establishments, issuance of food handler permits, inspection of food establishments, and investigation of complaints of unsafe food handling. We defined facility sanitation activities related to community and living environments as including reviewing plans for and inspections of schools, camps, shelters, temporary worker housing, parks, other public buildings, swimming pools, spas, water parks, and natural bathing areas. New York and Washington PBRN partners helped confirm our interpretation of these measures and expenditure distributions to ensure com parability of these budget categories across states.

We controlled for population and commu nity characteristics known to be associated with higher rates of enteric disease. Population characteristics included high social disadvan tage, measured using a social disadvantage index,[33–35] which we constructed using a sum of Z scores representing median household income, proportion of households receiving public assistance, and unemployment rate. These sociodemographic data were obtained from the 2000 Decennial Census and from the 2010 American Community Survey (5 year estimates for 2006 2010).[36,37] We also accounted for counties' proportion of foreign born residents[38,39] and of children aged 0 4 years.[40–42] The community factors accounted for in a jurisdiction included number of per capita food and drink establishments, which we obtained from the 2007 Economic Cen sus[43,44]; classification as metropolitan, micro politan, or rural by the federal core based statistical areas dataset[45,46]; state (New York or Washington); and year.

Analysis

We conducted our 2013 analysis using Stata version 12 (StataCorp LP, College Station, TX) and generalized estimating equations to exam ine longitudinal and clustered or correlated data.[47,48] Descriptive analyses compared mean differences between LHDs and within LHDs



Source. New York State Department of Health Communicable Disease Annual Reports and Washington State Department of Health Communicable Disease Annual Reports. [Q2]

FIGURE 1—Notifiable enteric disease rates by year from (a) New York local health departments (LHDs; n = 36) and (b) Washington State LHDs: 2000–2010. [Q3]

across years. Our primary predictor variable was the combined per capita food safety and sanitation expenditures among New York and Washington LHDs during 2000 2010, adjusted for inflation to 2010 dollars using the consumer price index. We modeled each of the 7 enteric diseases separately. We also examined the combined food safety and sanitation expenditures for New York City's LHD separately because of the city's unique funding sources, structure, and size. Unobserved time effects were controlled for using study year as a categorical variable. We did not include time lags in our analytic models because common wisdom among our public health PBRN partners suggested that food safety and sanitation budgets are not typically developed on the basis of specific disease rates in a previous year.

Preliminary analysis led to removing 1 year of data (2005) from the cryptosporidiosis model because of a large multicounty 2005 outbreak in New York resulting from a state park fountain feature that distorted model results (Figure 1).[49]

RESULTS

The demographics of our jurisdiction sample were relatively similar to those of counties across the United States with the exception that jurisdictions in New York had, on average, a much higher percentage of foreign born residents (Table 1). Jurisdictions in both states also had a higher average median household income than did average US counties.

Over the 11 year study period, the average inflation adjusted, per capita food and sanitation expenditures among the 36 New York LHDs (range = $2.32 $2.84; mean = $2.61; SD = 1.01) and the Washington LHDs (range = $3.01 $3.58; mean = $3.19; SD = 2.05) demonstrated some variation in spending across time. On average, Washington LHDs significantly outspent New York LHDs, (t_{549} = 4.97; P < .001). Both states demonstrated relatively similar and nonsignificant increases in expenditures over time, with the exception of a decrease in New York expenditures in 2001 and 2002 (Figure 2). These expenditures were also significantly correlated (positively and negatively) with the demographic characteristics of LHD jurisdictions and

TABLE 1—Characteristics of Washington and New York State LHDs Relative to All US Counties and LHDs: 2000–2010

Covariate	Averages Based on All US Counties		Average of NY LHD Jurisdictions (n 36)		Average of WA LHD Jurisdictions		[Q4]
	2000 2005	2006 2010	2000 2005	2006 2010	2000 2005	2006 2010	
Total population	233 489 414	303 965 272	17 485 877	17 703 252	5 894 121	6 561 297	
Total population (< 5 y)	19 175 798	20 426 118	1 151 082	1 072 646	394 315	426 450	
Median household income, $	38 891	44 270	43 393	51 384	45 776	52 583	
Households with public assistance, %	3.6	2.5	5.1	3.2	3.8	3.7	
Unemployed, %	5.9	8.6	7.1	8.2	6.3	8.2	
Foreign born residents, %	13.4	12.8	21.9	23.3	10.4	12.7	
2007 food and drinking place establishments, no.	571 621		37 723		14 226		
2005 CBSA counties, %, metro/micro/rural	49.4/19.1/31.5		72.2/19.4/8.3		42.9/25.7/31.4		

Note. CBSA core based statistical area; LHD local health department.

local enteric disease rates (see Table A, avail able as a supplement to the online version of this article at http://www.ajph.org).

The set of enteric infections with the 3 highest incidence rates were the same in both states (Figure 1). The average annual incidence rate of campylobacteriosis was 1.24 to 1.80 cases per 10 000 people in the sampled New York LHD jurisdictions (mean = 1.41; SD = 0.74) and 1.30 to 1.96 cases in the Washington jurisdictions (mean = 1.49; SD = 1.67). For salmonellosis, the average annual incidence rate of salmonellosis was 1.08 to 1.37 cases per 10 000 people in the sampled New York LHDs (mean = 1.18; SD = 0.50) and 0.78 to 1.34 in the Washington LHDs (mean = 1.04; SD = 0.87). The average annual incidence rate of giardiasis was 1.07 to 1.71 cases per 10 000 people in New York (mean = 1.30; SD = 0.71) and 0.60 to 0.84 in Washington (mean = 0.71; SD = 0.69). Exclud ing the 2005 cryptosporidiosis outbreak in New York, the New York jurisdictions in our sample had 0.13 to 0.38 cases of cryptospor idiosis per 10 000 people (mean = 0.26; SD = 0.46) and there were 0.00 to 0.21 cases per 10 000 people in WA (mean = 0.11; SD = 0.33).

Our analyses identified a significant associ ation between food safety and sanitation ex penditures and decreased enteric illness rates. Table 2 shows the significant inverse relation ships demonstrated between LHD food safety and sanitation expenditures and salmonellosis and cryptosporidiosis. Model results did not change with data for New York City removed, so we kept New York City in the model.

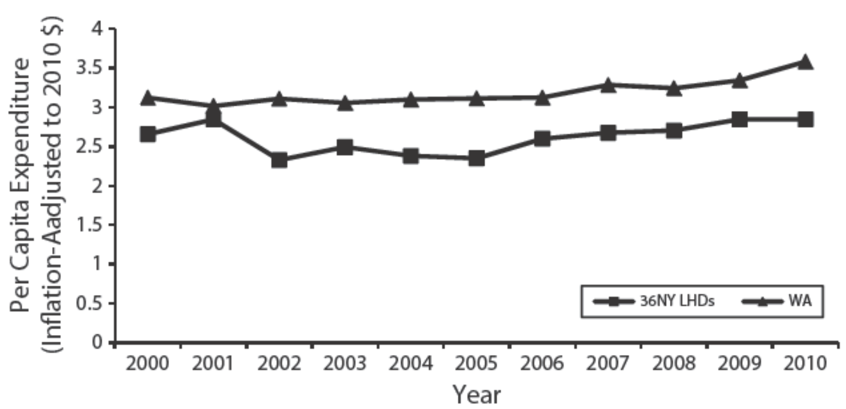


FIGURE 2—Mean per capita food safety and sanitation expenditure: Washington and New York States, 2000–2010.

For every additional dollar per person spent on food safety and sanitation services, inci dence rates of cryptosporidiosis decreased significantly by 0.091 cases per 10 000 person years among the 36 New York LHDs with control for New York City or 0.083 cases per 10 000 person years when New York City was excluded from the model. In Wash ington, for every additional dollar per person spent on food safety and sanitation expendi tures, the incidence rate of salmonellosis sig nificantly decreased by 0.053 cases per 10 000 person years. This inverse relationship between food and sanitation expenditures and salmonellosis also took place in the full sample of Washington and New York LHDs combined but was not apparent in the 36 New York LHDs alone. Also of note was the signif icant positive relationship between a higher proportion of foreign born residents in a juris diction and a higher rate of salmonellosis (b = 0.05; *P* = .002), which indicated that for every 1% increase in a county's foreign born population, the incidence rate of salmonellosis increased by 0.05 cases per 10 000 person years in Washington.

DISCUSSION

Our model results suggest that LHD expen ditures on food safety and sanitation were associated with a significant reduction in the rate of salmonellosis in Washington, while control ling for other factors. Similar LHD expenditures were also associated with a significant reduction in the rate of cryptosporidiosis in New York.

TABLE 2—Relationship Between per Capita Local Health Department Expenditures and Enteric Disease Outcomes: Washington and New York States, 2000–2010

LHD	No. of observations	Camplylobacteriosis		Cryptosporidiosis		Giardiasis		Hepatitis A		Shigellosis		*E. coli*		Salmonellosis	
		Coefficient (95% CI)	P	Coefficient (95% CI)	P	Coefficient (95% CI)	P	Coefficient (95% CI)	P	Coefficient (95% CI)	P	Coefficient (95% CI)	P	Coefficient (95% CI)	P
NY and WA combined[a]	72 778	-0.040 (-0.127, 0.047)	.372	-0.011 (-0.039, 0.016)	.408	0.002 (-0.046, 0.050)	.938	-0.011 (-0.025, 0.003)	.119	-0.003 (-0.044, 0.038)	.896	-0.017 (-0.037, 0.003)	.093	-0.041 (-0.079, -0.002)	.038*
Combined without NYC	71 767	-0.040 (-0.128, 0.047)	.369	-0.011 (-0.038, 0.016)	.431	0.003 (-0.045, 0.052)	.895	-0.011 (-0.025, 0.003)	.119	-0.003 (-0.044, 0.038)	.892	-0.017 (-0.037, 0.003)	.096	-0.041 (-0.0[illegible]9, -0.00[illegible])	.04*
NY[b]	36 396	-0.050 (-0.146, 0.046)	.306	-0.091 (-0.058, -0.024)	.007**	0.048 (-0.052, 0.148)	.346	-0.010 (-0.028, 0.008)	.279	0.051 (-0.058, 0.161)	.359	0.002 (-0.019, 0.023)	.859	0.011 (-0.058, 0.081)	.753
NY without NYC	35 385	-0.038 (-0.138, 0.061)	.448	-0.083 (-0.152, -0.015)	.018*	0.059 (-0.045, 0.162)	.265	-0.008 (-0.026, 0.010)	.390	0.053 (-0.059, 0.166)	.351	0.001 (-0.021, 0.023)	.911	0.017 (-0.054, 0.088)	.635
WA	36 382	-0.032 (-0.149, 0.086)	.597	0.005 (-0.018, 0.029)	.671	-0.013 (-0.068, 0.042)	.646	-0.011 (-0.031, 0.010)	.309	-0.013 (-0.040, 0.015)	.365	-0.018 (-0.047, 0.010)	.205	-0.053 ([illegible], [illegible])	.029*

Note. CBSA = core-based statistical area; CI = confidence interval; *E. coli* = *Escherichia coli*; NYC = New York City; SDI = Social Disadvantage Index. Variables included in all models: year, state, CBSA, percentage of population age < 5 y, percentage foreign-born population, percentage of food or drinking place establishment, SDI (median household income + percentage of households receiving public assistance + percentage of unemployment), and total population. Food safety and sanitation expenditure is a composite of local health department expenditures related to food safety expenditure and sanitation.

[a]Controlling for New York.

[b]Controlling for New York.

*$P < .05$. **$P < .01$.

These findings conform to current practice and research. Both *Salmonella* and *Cryptosporidium* are common causes of notifiable foodborne and waterborne enteric diseases, respectively, for which many LHDs execute jurisdiction wide specific control measures.

Enteric disease is contracted through ingestion of contaminated food or water and spread through unsafe food handling and water quality practices. Although most common enteric diseases differ by region and year, the leading reportable food related enteric diseases in the United States are *Campylobacter, Listeria, Salmonella,* Shiga toxin producing *Escherichia coli*, *Yersinia,* and *Vibrio.* Among these 6 foodborne pathogens, *Salmonella* is the most common and was found, in a 2010 study, to be the most likely of these pathogens to result in hospitalization and death.[50] Waterborne pathogens contributing to outbreaks vary depending on the type of water venue, with *Cryptosporidium* accounting for the most water source related diarrheal illness.[51–55]

Of the diseases we examined, salmonellosis was consistently among the most commonly reported enteric diseases (along with *Campylobacter* and *E. coli*) and of these diseases is the condition most often associated with restaurant related infections.[56] A study of restaurant violations in Minnesota has supported this connection; researchers found a significantly higher number of restaurant inspection violations at locations that had outbreaks of salmonellosis infection.[57] Similarly, the Centers for Disease Control and Prevention has reported that among outbreaks investigated during 2009 to 2010, salmonellosis was the 2nd most common and accounted for 30% of 790 outbreaks.[56]

Although norovirus is the most commonly reported etiologic agent in foodborne illness outbreaks in the United States, accounting for 42% of outbreaks in 1 study,[7,56] we were unable to include norovirus rates as an outcome. Individual cases of norovirus are not notifiable, and LHDs rarely perform laboratory testing for suspected norovirus outbreaks. County level data regarding norovirus outbreaks, therefore, were not available from our state health department partners or from the Centers for Disease Control and Prevention's National Outbreak Reporting System for this time period.[58]

Despite federal guidance for enhanced surface water treatment,[59] cryptosporidiosis remains a relatively common waterborne disease and is often associated with contaminated drinking water or recreational water sources such as fountains and swimming pools.[55,60,61] Facility sanitation activities carried out by an LHD's environmental health staff include efforts and expenditures related to monitoring, inspection, and public education regarding such public water sources.

Several factors may explain the differences we observed between New York and Washington. New York jurisdictions had high concentrations of foreign born residents. Given the strong relationship between international travel and salmonellosis,[62] a higher proportion of foreign born residents could have increased the proportion of travel associated cases and decreased the proportion of restaurant associated cases, thereby dampening detection of the effects of New York LHDs' food safety and sanitation expenditures and related activity on salmonellosis. Conversely, Washington LHD jurisdictions had a lower proportion of foreign born residents and had a much stronger relationship between spending and salmonellosis. The particularly strong relationship observed in the Washington data likely drove the significant effect on salmonellosis found in the 2 state sample. Likewise, significant relationships with cryptosporidiosis found in New York and not in Washington may have been the result of differences in the prevalence of risk factors for which we did not have data, such as levels of recreational water exposure, individual immune deficiencies, and animal exposures.

There are several possible explanations for why we did not detect significant associations between food safety and sanitation expenditures and the other common enteric infections examined. One is that food contamination can occur in the production chain before distribution to restaurants, resulting in a higher proportion of cases among individuals who consume contaminated food at home, which would not be affected by practices examined here. Enteric infections also have other risk factors such as international travel that would not be modified by food and sanitation interventions except in cases occurring among food workers. Our sample of LHDs might have had insufficient power to detect associations with conditions with lower incidence rates or substantial underreporting. Finally, differences in pathogen specific investigation protocols could have played a role. In Washington, for example, state guidelines called for LHD investigation of all reported cases of *Salmonella,* whereas investigation of *Campylobacter* reports were optional because of resource constraints and the high volume of cases.[63] This could have led to increased case finding for salmonellosis compared with campylobacteriosis.

Implications

No known published studies have had the detailed data, sample size, and time series data to rigorously provide inferential evidence that links LHD expenditures in food and water protection to better jurisdiction or county level health outcomes. Data limitations have greatly undermined production of rigorous public health systems and services research that can direct practice and policymaking with regard to the impact of specific local public health activities on the public's health.[24,25] The formation of the nation's first public health PBRNs in 2008[64] and related Public Health Activities and Services Tracking study efforts to identify, compile, harmonize, and utilize LHD administrative data to answer research questions of interest to practice and policymaking are helping to advance this research.[65] With the support of PBRN partners, Public Health Activities and Services Tracking study researchers have been able to produce these findings, as well as a similar recent study linking maternal and child health service expenditures by LHDs with healthy birth outcomes.[4] These findings demonstrate the potential for strong empirical research that can provide valuable evidence supporting population level prevention activities such as these that can prevent hospitalizations and save lives.

The difficulties entailed in compiling and harmonizing existing administrative data, however, limit the number of multistate studies of LHD activities that can be effectively pursued. The need for standardized measures of LHD services, costs, performance, and outcomes is critical for these poorly understood activities to be clearly linked to the outcomes we expect. This evidence is necessary for our underfunded yet vital prevention systems to be accountable to their communities, to attain and maintain public support, and to direct performance and program improvements.

Limitations

Using LHD food and sanitation expenditures as a proxy for service level has limitations because states use different accounting methods. As a result, for example, we could isolate food safety specific expenditures for LHDs in Washington, but not for those in New York. For this reason, we combined food safety with sanitation spending and conducted careful examinations of what each state included in these definitions. Despite use of these secondary administrative data as a proxy for service volume and type and being limited to data from 2 states, the strong findings detected here conform to the experiences of practitioners and to the research literature. Public health regulations and food safety and facility sanitation practices also vary across states and LHDs. We did not examine differences in the nature of specific services provided.

Food safety and sanitation expenditures do not reflect LHD spending on services related to enteric disease detection and investigation such as surveillance, laboratory tests, and medical services. Nor did we examine the impact of these LHD services on norovirus because of a lack of county level data. Finally, case finding resources also vary from LHD to LHD, with potential underreporting as a result of budget constraints, lack of staff, and LHDs' competing priorities. These factors complicated our model and interpretation and potentially diminished the strength of detectable associations.

Conclusion

Beneficial relationships appear to exist between LHDs' specific food and sanitation expenditures and certain related enteric disease outcomes. These relationships between expenditures and outcomes have important public health safety and policy implications. Detailed administrative data that represent changes and variation in service delivery can be used to examine important research questions for public health practice when reviewed and examined in collaboration with practice partners. Our study also supports the need for detailed, standardized, program specific public health service related data to measure the cost, performance, and outcomes of public health prevention efforts to inform practice and policymaking. ■

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Contributors

B. Bekemeier provided the primary conceptualization and design of the study, obtained funding, provided oversight of the analytics, and took the lead in writing the initial and subsequent article drafts. M. P. Y. Yip carried out the article's review and synthesis of the literature, statistical analysis, and writing of significant sections. M. D. Dunbar assisted with the analysis and interpretation of data, critically reviewed the manuscript and revisions, and provided technical support. G. Whitman carried out the acquisition of data, cleaned and prepared data sets, assisted with interpretation of data, critically reviewed the manuscript and revisions, and provided technical support. T. Kwan Gett assisted with the interpretation of analyses, critically reviewed the manuscript and revisions, and provided technical support and subject matter expertise.

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Human Participant Protection

Institutional review board exemption was obtained through the University of Washington.

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