Title

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Journal
American Journal of Public Health, 102(9)

ISSN
0090-0036

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Publication Date
2012-09-01

DOI
10.2105/ajph.2011.300497

Peer reviewed

Local Public Health Systems and the Incidence of Sexually Transmitted Diseases

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Objectives. We examined the associations of local public health system organization and local health department resources with county-level sexually transmitted disease (STD) incidence rates in large US health jurisdictions.

Methods. We linked annual county STD incidence data (2005–2008) to local health department director responses (n = 211) to the 2006 wave of the National Longitudinal Study of Local Public Health Systems, the 2005 national Local Health Department Profile Survey, and the Area Resource File. We used nested mixed effects regression models to assess the relative contribution of local public health system organization, local health department financial and resource factors, and sociodemographic factors known to be associated with STD incidence to county-level (n = 307) STD incidence.

Results. Jurisdictions with local governing boards had significantly lower county-level STD incidence. Local public health systems with comprehensive services where local health departments shoulder much of the effort had higher county-level STD rates than did conventional systems.

Conclusions. More integration of system partners in local public health system activities, through governance and interorganizational arrangements, may reduce the incidence and burden of STDs. (*Am J Public Health*. Published online ahead of print July 19, 2012: e1–e9. doi:10.2105/AJPH.2011.300497)

US annual sexually transmitted disease (STD) incidence rates have not declined despite the identification of effective surveillance and prevention methods.[1–5] For example, after decreasing annually since 1999, gonorrhea infection rates among adolescents increased 2% from 2004 to 2005, from 421.9 to 431.8 per 100 000, and then increased 6% again from 2005 to 2006, from 431.8 to 458.8 per 100 000.[6,7] Untreated STDs can have serious long-term health effects, such as cervical cancer, infertility, and pregnancy complications.[8] STDs are among the largest Black–White racial disparities in health,[9] which are heavily influenced by social determinants (i.e., area-level sociodemographic factors).[9–12]

It is a widely accepted view that local health departments and their system partners play a critical role in controlling the spread of STDs.[13–15] Local health departments differ dramatically in size, organizational structure, and available resources, and these factors can influence the reach and effectiveness of local STD prevention strategies. Previous studies indicate that larger local health departments, better resourced local health departments (as measured by expenditures per capita), and jurisdictions with local boards of health with policymaking authority more consistently provide a diverse set of essential public health functions,[16–19] including diagnosing and preventing health problems and informing and educating the public about health issues. Moreover, recent evidence indicates that increases in STD prevention funding are associated with reductions in gonorrhea[20] and syphilis[21] incidence rates. This suggests that resources available to local health departments and their system partners can affect the “reach” of STD prevention programs.

The contribution of community partner organizations to performing essential public health functions[18] may also influence the reach and effectiveness of STD prevention and treatment programs. For example, low integration of local health departments with their local system partners, including physician organizations, community health centers, and faith-based organizations, can impinge on the effectiveness of local STD prevention and treatment efforts.[15] Given that rescreening previously infected individuals is increasingly viewed as central to controlling the spread of STDs,[22] local health departments that have low integration with their health care delivery system partners might face more difficulties curtailing the spread of STDs. It may be difficult for local health departments that have limited integration with system partners to communicate surveillance data and to generate action to combat emerging health epidemics.

Little research, however, has assessed organizational and market determinants of local public health system effectiveness using population health indicators.[17–19] Although several studies have assessed the relationship of county-level sociodemographic factors and STD rates,[23,24] to our knowledge, no study has ever assessed the relationship of local public health system organization and STD incidence rates. Consequently, the extent to which the scope of local health department services and their integration with their local health system partners is associated with STD incidence rates remains unclear. Using responses to the National Association of County and City Health Officials (NACCHO) 2005 National Profile of Local Health Departments in the United States (NACCHO Profile) and county-level data from the Area Resource File, we examined the extent to which local health department financing per capita, the existence of a local governing board of health, and integration among key system partners are associated with county-level incidence rates of gonorrhea and chlamydia.

Consistent with previous research examining public health spending and medical care expenditures,[25] we hypothesized that local health departments with greater total expenditures per capita have lower STD incidence rates when controlling for county-level sociodemographic and other local health department characteristics. Local boards of health are increasingly considered central to improving community-based linkages and setting priorities for jurisdictions. Accordingly, we hypothesized that county-level STD rates would be lower in jurisdictions where local boards of health have governance responsibility than in those having no local board of health. The integration of local health departments with local public health system partners can influence the dissemination of preventive health care information and epidemiologic data to target interventions. We hypothesized that local health departments with a higher integration with system partners, as measured by the recent typology of local public health systems,[26,27] have lower STD incidence rates, controlling for other factors. Finally, we examined the role of social determinants of STD incidence relative to measurable local public health system factors.

METHODS

We obtained annual county STD incidence data (2005–2008) from the National Electronic Telecommunications Systems for Surveillance and linked the data to local health department director responses (n = 236) to the 2006 wave of the National Longitudinal Study of Local Public Health Systems (NLSLPHS),[27] the 2005 NACCHO Profile Survey,[28] and 2005 county-level sociodemographic and health professions data and county-level census data from the Area Resource File.[29] The analytic sample included 211 local health department jurisdictions fully covering 307 counties (or 307 local health department–county observations) that had information from the 2005 NACCHO Profile Survey and the 2006 wave of the NLSLPHS.

The study population covers local public health delivery systems serving a population of at least 100 000 residents with responses to the 2006 survey. Mays et al. provided detailed information about the local health departments included in the study sample and their representativeness of local health departments nationally.[27]

Measures

County-level STD incidence data have skewed distributions, and relatively smaller jurisdictions often do not have sufficient events per year to conduct reliable longitudinal analyses (i.e., assessing change over time in STD incidence). To reduce variance instability,[30] our main study outcome measure was constructed as the 4-year (2005, 2006, 2007, and 2008) temporally smoothed log-transformed combined gonorrhea and chlamydia incidence rate per population for each county–local health department unit.[24]

We examined the local health department organizational and financial factors associated with STD incidence. NACCHO Profile Survey data include information about local health department jurisdiction size (population served), jurisdiction type (city and town, county, city and county, or multicounty), the existence and governance role of local boards of health, local health department expenditures per capita, proportion of local health department revenue from local (city and county) sources of funding, and full-time equivalents per capita of various local health department personnel (nurses, epidemiologists, and health educators). These local health department factors have previously been considered to have important influences on public health system effectiveness.[17,18] County Federal Information Processing Standard codes were used to link the datasets. Some local health department jurisdictions (n = 37) covered more than 1 county Federal Information Processing Standard. In these cases, the local health department had multiple county STD rate observations.

We used responses to the 2006 NLSLPHS survey to construct a local public health system typology. The survey included questions covering a set of 20 public health activities, each of which is derived from 1 of 3 core public health assessment functions (policy, development, and assurance) identified by the Institute of Medicine.[31]

The main factors involved in construction of local health system typology include (1) differentiation (the proportion of the 20 public health activities performed within the system), (2) integration (the proportion of public health activities contributed by each type of organization in the system and averaging the proportion across all organizations represented in the system), and (3) concentration (the level of effort contributed by the local health department across all activities performed in the jurisdiction). Because of small cell sizes among some of the local public health system typologies in the 2006 wave of the survey, we categorized typology types that represented less than 5% of the total local health departments as "other."

We drew the 6 system typologies that we examined from a previously published study[27] that included the following:

1. concentrated comprehensive (n = 50; 21.5%),
2. independent comprehensive (n = 27; 11.6%),
3. distributed conventional (n = 72; 30.9%),
4. concentrated limited (n = 42; 18.0%),
5. distributed limited (n = 26; 11.2%), and
6. other (n = 16; 6.9%) types (Table 1).

Based on findings from previous research examining sociodemographic predictors of STD incidence,[23,24] we considered the following county-level variables from the Area Resource File and census data covariates for the study analyses: percentage Black race, percentage married, percentage aged 18 to 24 years, male–female ratio, proportion urban population, percentage living in poverty, deaths per 100 000 population, percentage owner-occupied housing, and a suburban commute index.

Analysis

Before merging local health department and county information with the STD incidence data, we examined the unadjusted relation of local health department organization and financing and local public health system typology (using the integrated 2005 and 2006 local health department surveys). To examine the extent to which specific local health department local health system partnerships and other local health department organizational factors differed by local health system typology, we made comparisons using analysis of variance for continuous variables and the χ^2 test for dichotomous and categorical variables. Next, we examined the extent to which STD rates differed by local public health system type. To do this, we compared the mean annual STD rate per 100 000 population by local public health system type and examined whether STD rates differed by type using analysis of variance.

In a sequential fashion, we specified nested multilevel regression models—using local health department random effects to predict STD incidence (using the "distributed

TABLE 1—Local Public Health System Typology Used in Categorizing Local Health Departments: US Longitudinal Study of Local Public Health Systems, 2006

Type	No. (%)	Differentiation	Integration	Concentration
Concentrated comprehensive	50 (21.5)	Broad scope	Wide range of organizations contributes	Local health department shoulders much of the effort
Independent comprehensive	27 (11.6)	Broad scope	Narrow range of organizations contributes	Local health department shoulders much of the effort
Distributed conventional (most common)	72 (30.9)	Moderate scope	Moderate range of organizations contributes	Effort is distributed across participating organizations
Concentrated limited	42 (18.0)	Narrow scope	Narrow range of organizations contributes	Local health department shoulders much of the effort
Distributed limited	26 (11.2)	Narrow scope	Moderate range of organizations contributes	Effort is distributed across participating organizations

Note. We categorized the remaining 6.9% (n = 16) as "other."
Source. Mays et al.[27]

conventional" system type as the reference group)—in the integrated dataset to examine the relative contribution of factors explaining county differences in STD incidence: (1) local health department organizational structure and local public health system typology, (2) local health department financial and resource factors, and (3) sociodemographic factors known to be associated with county-level incidence. We calculated collinearity diagnostics. Because of the modest local health department sample size, we estimated parsimonious models to prevent model convergence problems. For example, if local health department and local health system factors were highly correlated (<0.65)[32] with the main local health department independent variables (total expenditures per capita, board of health, and local public health system typology variables), we did not enter the variable into nested regression models. We compared soundness of model fit for ordinary least squares and multilevel models using the Akaike information criterion.[33]

Finally, using the Blinder-Oaxaca decomposition method,[34–36] we examined factors that accounted for differences in STD incidence rates between (1) jurisdictions with a governing local board of health versus no board of health, and (2) distributed limited systems and comprehensive independent local health systems. The decomposition method has been used extensively to assess mean outcome differences in labor economics literature.[36,37] In health services research, this method has been employed to study racial and ethnic disparities in different measures of health care access as well as utilization and health insurance coverage.[38–45] For our study, differences in STD rates between jurisdictions (using the 2 local public health system factors) may come from 2 broad sources: (1) differences that stem from observed factors (e.g., local public health system and area-level factors), and (2) differences that stem from unobserved heterogeneity (e.g., unmeasured population risk factors). We used the decomposition method to estimate the final ordinary least squares regression models for the 2 local public health system factors (governing local boards of health and typology). We then used the resulting coefficients and the mean values of all independent variables to decompose the observed variation into explained and unexplained components.

Sensitivity Analyses

We were also interested in clarifying the extent to which more extensive involvement of organizations considered central to community STD prevention activities had a different association with STD incidence compared with the typology of the local public health system. For example, local health department integration with health care delivery system partners might be more strongly associated with STD incidence compared with the overall level of integration in the local public health system.

Accordingly, as a sensitivity analysis, we examined the extent to which local health departments with more partnerships with health care delivery organizations (community health centers, physician organizations, and hospitals)[22] and faith-based organizations (partners known to mobilize communities to address risk behaviors)[46,47] had similar associations with STD incidence compared with the local public health system typology.

We used Stata 10.1 (StataCorp LP, College Station, TX) to conduct all statistical analyses.

RESULTS

The average county-level incidence of chlamydia increased by 28.8% (288 cases per 100 000 population in 2005 vs 371 cases per 100 000 population in 2008) among the 307 counties fully covered by the study's local health department jurisdictions during the study period (data not shown). By contrast, average county-level incidence gonorrhea rates were fairly consistent between 2005 and 2008 (106 vs 111 cases per 100 000). The average annual combined county-level chlamydia and gonorrhea incidence rate was 480.7 cases per 100 000 population (SD = 366.2; minimum = 28.3; maximum = 1379.5; Table 2).

Few local health department structural and financial characteristics differed across local public health system typology categories. One important local health department financial factor that did differ by typology was the proportion of local health department revenue from local funding sources (Table 2). For this factor, more comprehensive local health systems (concentrated comprehensive and independent comprehensive types) had higher proportions of their revenue coming from local sources of support than did conventional systems (distributed conventional). Not surprisingly, we used local health department factors that differed most across local public health system types in the classification of local public health systems, including the proportion of core public health activities that physician organizations, community health centers, and

TABLE 2—Local Health Department Characteristics by Local Public Health System Type: US Longitudinal Study of Local Public Health Systems, 2006

		Local Public Health System Type						
Characteristics	Overall	Concentrated Comprehensive	Independent Comprehensive	Distributed Conventional	Concentrated Limited	Distributed Limited	Other Types	P
Local health department, No. (%)	211 (100.0)	47 (22.3)	23 (10.9)	66 (31.8)	36 (17.1)	25 (11.9)	13 (6.2)	
Average county annual STD incidence rate per 100 000 population, mean (SD)	480.7 (366.2)	463.5 (283.9)	540.6 (327.8)	463.7 (442.4)	475.2 (311.5)	472.7 (288.3)	534.3 (354.3)	.236[a]
Local health department population, mean (SD)	496 375.5 (967630.7)	761 209.9 (1 808 374.0)	653 891.4 (778 095.6)	346 442.4 (299 210.9)	393 930.7 (500 754.4)	412 753.2 (561 123.6)	477 453.2 (626 031.2)	.276
Jurisdiction type, %								
County	59.2	61.7	52.2	58.2	61.1	64.0	35.9	.659
City and county	16.1	21.3	17.4	11.9	13.9	16.0	23.1	
City or town	7.1	6.4	4.4	6.0	5.6	16.0	7.7	
Multicounty	17.5	10.6	26.1	23.9	19.4	4.0	15.4	
Governance, %								
No local board of health (Ref)	28.0	19.2	30.4	35.8	30.6	24.0	15.4	.404
Board of health, no governing role	24.2	30.0	17.4	16.4	22.2	40.0	30.8	
Board of health, governing role	47.9	51.1	52.2	47.8	47.2	36.0	53.9	
Local health department resources, mean (SD)								
Local health department expenditures per capita	40.9 (29.5)	48.9 (40.8)	47.0 (31.8)	38.3 (25.1)	36.2 (24.4)	39.1 (23.5)	31.2 (11.6)	.196
Local (city and county) sources of funding	28.5 (20.6)	32.5 (20.5)	36.6 (25.85)	22.2 (19.24)	32.3 (16.86)	26.8 (21.08)	24.5 (18.73)	.017
Local health department employees per 100 000 population	54.2 (35.1)	53.6 (30.7)	76.9 (50.1)	50.1 (31.2)	54.1 (37.7)	52.5 (37.4)	44.3 (16.5)	.065
Local health department health educators per 100 000 population	1.6 (2.2)	1.6 (1.9)	2.1 (2.2)	1.5 (1.9)	1.1 (1.7)	2.4 (3.8)	1.1 (1.0)	.211
Local health department nurses per 100 000 population	12.6 (14.9)	11.6 (10.6)	15.4 (12.7)	11.4 (8.4)	12.6 (14.1)	17.6 (32.0)	7.9 (5.3)	.346
Local health department epidemiologists per 100 000 population	0.4 (0.6)	0.5 (0.6)	0.7 (0.9)	0.3 (0.4)	0.3 (0.4)	0.6 (1.1)	0.3 (0.4)	.199
Proportion of essential public health services available, mean (SD)	70.2 (17.7)	89.3 (8.5)	81.7 (6.3)	54.4 (12.0)	66.1 (7.4)	69.6 (9.2)	87.4 (9.0)	< .001

Continued

TABLE 2—Continued

Proportion of all essential public health services contributed by system partners, mean (SD)								
Across all partners[b]	27.8	41.0 (10.8)	36.6 (8.3)	15.4 (5.5)	30.1 (8.1)	25.7 (9.6)	25.0 (8.7)	< .001
Community health centers	28.6 (21.8)	43.8 (21.5)	42.9 (22.6)	12.5 (11.8)	31.6 (19.1)	29.8 (16.4)	18.6 (18.1)	< .001
Physician organizations	26.8 (23.2)	40.7 (28.0)	29.6 (22.8)	14.1 (12.7)	32.5 (19.8)	26.9 (20.6)	20.8 (27.6)	< .001
Hospitals	40.9 (19.2)	56.9 (18.0)	53.4 (14.4)	23.8 (11.0)	44.6 (15.1)	37.1 (12.8)	45.0 (12.6)	< .001
Faith-based organizations	19.2 (17.2)	32.8 (18.8)	29.4 (19.2)	9.5 (9.0)	17.5 (14.0)	13.4 (10.8)	17.4 (18.7)	< .001

Note. STD = sexually transmitted diseases (includes gonorrhea and chlamydia).
[a]We tested differences in log-transformed STD incidence rates.
[b]Across "all partners" includes local health departments, state health agencies, other state agencies, local agencies, federal agencies, physician organizations, hospitals, community health centers, faith-based organizations, other nonprofit organizations, health insurers, employers, schools, universities, and other organizations.

faith-based organizations contribute. Levels of contribution differed substantially across local public health system types ($P<.001$ for overall comparison across types).

In unadjusted analyses (Table 2), annual STD incidence rates were highest for counties operating in "comprehensive independent" systems (540.6 annual cases per 100 000 population; SD = 327.8) and "other" types of local public health systems (534.3 annual cases per 100 000 population; SD = 354.3). The higher STD rate for "comprehensive independent systems" compared with "distributed conventional" systems was stable in multivariate analysis (Table 3). Compared with "distributed conventional" systems, "independent comprehensive" systems had significantly higher STD incidence rates (b = 0.23; $P=.05$), controlling for other local health department and socioeconomic factors. Counties served by local health departments with local boards of health that had governance responsibilities had significantly lower STD incidence rates (b=–0.29; $P=.003$) than did counties served by local health departments that did not have a local board of health. This was true across various nested models. Local health department expenditures per capita and other resource factors were unrelated to STD incidence.

Results from multivariate analyses also indicate that the proportion of Black population in the county is the strongest predictor of higher STD rates (b = 0.37; $P<.001$). Many demographic and social factors were related to STD incidence in the full multilevel model (Table 3), including county male–female ratio (b = –0.10; $P<.001$), median household income (b = –0.41; $P<.001$), percentage urban population (b = 0.25; $P<.001$), and the death rate per 100 000 population (b = –0.20; $P<.001$).

The results from our sensitivity analysis (Table 3) indicate that integration of health care delivery system partners and faith-based organizations is not as strongly associated with STD incidence as the local public health system typologies, which consider 3 criteria: system differentiation, integration, and concentration.

Decomposition results indicate that a large proportion of differences in STD incidence rates between conventional distributed and comprehensive independent local public health systems (65.0%) and jurisdictions with a governing board of health and those without a board of health (61.9%) are explained by observed factors. The proportion of the Black population in the jurisdiction accounted for 72.7% of the explained differences in STD rates between distributed conventional local public health systems and comprehensive independent local public health systems (Table 4). The proportion of the Black population accounted for 54.1% and the male–female ratio accounted for 11.6% of explained differences in STD incidence rates between jurisdictions with a governing board and jurisdictions without a board, respectively (Table 4). If the 2 types of local public health systems had comparable proportions of the Black population and male–female ratios, the differences in STD incidence rates would diminish substantially.

DISCUSSION

Local public health systems differ markedly across the United States. Differences in organization, financing, and partnerships can influence the integration of evidence-based STD surveillance, prevention, and treatment strategies.[1–5] We found that county-level STD rates were lowest in local health jurisdictions supported by boards of health with governance responsibilities. Local boards of health with governance roles may more effectively facilitate the connection of local health departments with nontraditional system partners and may be able to more thoroughly scan the external environment to integrate evidence-based public health strategies, including STD prevention innovations, into practice.[17,26] More research is warranted to understand if and how local boards of health facilitate the integration of system partners to address local public health priorities.

Interestingly, "independent comprehensive" local public health systems—in which a broad set of services are offered, a narrow range of organizations contribute, and the local health department shoulders much of the effort—have higher STD rates than do "distributed conventional" systems, when the comparison accounts for other factors. This result may, in part, be because of local public health systems becoming generally more "comprehensive" and more "independent," because public health epidemics

TABLE 3—Local Public Health System and Sociodemographic Characteristics Associated With County-Level STD Incidence: US Longitudinal Study of Local Public Health Systems, 2006

	Model 1		Model 2		Model 3		Model 4[a]	
Characteristics	b	P	b	P	b	P	b	P
Local health department jurisdiction population, log	0.10	.007	0.12	.005	0.02	.559	0.02	.603
Local public health system type								
Distributed conventional (Ref)	1.00	...	1.00	...	1.00	...	1.00	...
Concentrated comprehensive	0.14	.26	0.30	.059	0.20	.056	...	...
Independent comprehensive	0.30	.055	0.43	.016	0.23	.046	...	...
Concentrated limited	0.07	.597	0.25	.169	0.12	.287	...	...
Distributed limited	−0.12	.457	−0.19	.403	0.03	.832	...	...
Other	−0.09	.637	−0.01	.976	0.06	.642	...	...
Proportion of all essential services contributed by select system partners[b]	...	...	...	...	...	...	0.09	.011
Jurisdiction type								
County (Ref)	1.00	...	1.00	...	1.00	...	1.00	...
City and county	0.37	.004	0.25	.105	0.15	.184	0.14	.197
City or town	0.37	.061	0.12	.647	−0.04	.819	−0.13	.501
Multicounty	−0.17	.142	−0.27	.074	−0.11	.324	−0.12	.272
Governance								
No local board of health (Ref)	1.00	...	1.00	...	1.00	...	1.00	...
Board of health, no governing role	−0.03	.81	−0.32	.062	−0.11	.345	−0.12	.291
Board of health, governing role	−0.23	.036	−0.50	< .001	−0.29	.003	−0.29	.002
Local health department resources								
Expenditures per capita, log			0.11	.133	0.05	.318	0.05	.284
Local (city and county) revenue, %			−0.07	.333	0.01	.763	0.03	.429
Health educators per 100 000 population			−0.01	.85	−0.04	.3	−0.05	.278
Epidemiologists per 100 000 population			0.00	.954	−0.03	.417	−0.02	.48
Sociodemographic variables,%								
Black					0.37	< .001	0.38	< .001
Population aged 18–24 y					−0.07	.152	−0.06	.209
Male–female ratio					−0.10	< .001	−0.10	< .001
Median household income					−0.41	< .001	−0.42	< .001
Suburban commute index					0.07	.146	0.06	.18
Owner-occupied housing					−0.09	.081	−0.10	.047
Urban population					0.25	< .001	0.23	< .001
Persons in poverty					−0.15	.095	−0.16	.075
Death rate per 100 000 population					−0.20	< .001	−0.20	< .001
Model statistics								
Constant	5.92	< .001	6.05	< .001	5.92	< .001	6.02	< .001
Model fit (AIC) statistic	563.60		330.50		233.30		224.65	

Note. AIC = Akaike information criterion; STD = sexually transmitted disease.
[a]Model 4 is a sensitivity analysis. The model replaces the local public health system type variables with a variable measuring the proportion of all essential services contributed by select system partners[b] and includes physician organizations, hospitals, community health centers, and faith-based organizations—organizations considered critical to STD prevention and control activities.

such as STD outbreaks are difficult to address without a comprehensive set of services.

Centralized control of prevention activities and the involvement of a limited number of partners (compared with the concentrated comprehensive system type; Table 2) may be a reaction to high incidence rates. More comprehensive systems have better surveillance processes, and surveillance bias may account for the higher STD incidence rates in these systems. Less integrated local public health systems may face challenges combating the spread of STDs, however, because important interactions are predominantly concentrated in a few organizations. For example, recent

TABLE 4—Blinder-Oaxaca Decomposition Method: Observed Versus Unobserved Factors Accounting for STD Incidence Rate Differences: US Longitudinal Study of Local Public Health Systems, 2006

Decomposition of STD Incidence Rate Differences by Local Board of Health Role	Mean STD Incidence Rate per 100 000	Decomposition of STD Incidence Rate Differences by Local Public Health System Type	Mean STD Incidence Rate per 100 000
No board of health (Ref): predicted ln(STD)	6.29	Independent comprehensive (Ref): predicted ln(STD)	6.24
Board of health with governance role: predicted ln(STD)	5.50	Distributed limited: predicted ln(STD)	5.51
Total difference	–0.79		–0.73
Total explained	–0.49 (61.9%)		–0.47 (65.0%)
Individual significant factors of total explained differences, %			
Black	54.12		72.67
Male–female ratio	11.60		

Note. ln(STD) = log-transformed STD incidence rates; STD = sexually transmitted disease.

research employing organizational network analyses underscores that STD prevention is more effective when all agencies interact with each other and less effective when interactions are concentrated predominantly among a few central agencies (degree of centralization).[48]

This finding is consistent with higher STD incidence rates observed for independent comprehensive systems. Clarifying partnership influences on the reach of public health activities can inform the development of effective organizational arrangements for STD prevention and control.[26,49–56]

The county concentration of Blacks was the strongest predictor of county-level STD incidence rates, and this finding is consistent with other studies.[11,24] Our decomposition results indicate that the proportion of Blacks in a jurisdiction accounts for most of the explainable differences in STD incidence rates across jurisdictions with differing board of health governance roles and local public health system organizations (typologies). Previous research has underscored that sexual sorting practices account for higher risk of STD and HIV transmission for Blacks, even when sexual behaviors are not higher risk compared with non-Black groups.[57–60]

Untreated STDs can have serious long-term health effects,[8] and reducing health disparities related to STD incidence will require a focus on minority health.[9,61] Our results underscore that reducing racial disparities in STD incidence may require targeted interventions implemented by a wide range of local public health system partners.

Limitations

Our results should be considered in light of important limitations. First, STD incidence data are always subject to surveillance bias; that is, counties with local health systems that have strong reporting systems may detect, report, and treat STDs more consistently than do less comprehensive or less integrated public health systems. Nevertheless, we considered a large number of statistical controls in multivariate regression analyses, and the results were fairly consistent when we considered sociodemographic factors. Next, we examined a cross-sectional relationship and did not examine changes in local health department factors or STD rates. Moreover, our analyses did not account for spatial dependence.

Given the spatial gaps between geographic units of our analysis, accounting for spatial dependence (i.e., spatial autocorrelation) was not feasible. When more complete local health department data become available, spatial dependence and change in STD incidence over time should be examined.

We were also unable to examine the representativeness of local health department respondents because county Federal Information Processing Standard codes for nonrespondent local health departments were not available in the dataset. Nevertheless, the respondent local health departments are large jurisdictions with substantial coverage of the US population. Finally, different STD reporting practices by state might result in the misclassification of incidence rates. For example, a recent study found that states that suppressed STD data to preserve confidentiality had lower gonorrhea, syphilis, and chlamydia rates.[62] This suggests that cross-state analyses might be biased. Because of our modest sample size ($n = 307$ counties fully covered by 211 local health departments), we could not account for state-fixed effects in our analyses.

Conclusions

The organization of local public health systems, including the extent to which core public health activities are shared among many partners and the existence of local boards of health with governance responsibility, may have an important influence on combating the spread of STDs. Importantly, our decomposition results indicate that jurisdictions with higher county concentrations of Blacks were less likely to have local governing boards of health and were more likely to have independent comprehensive local public health systems in which a broad set of services are offered, a narrow range of organizations contribute, and the local health department shoulders much of the effort.

It remains unclear what gives rise to differences in local public health system organization based on county-level Black concentration. Interventions for the modifiable local public health system correlates of STD incidence, including the involvement of public health system partners in core activities, might improve the reach and effectiveness of surveillance and control activities and reduce racial disparities in the burden of STDs. To improve public health system effectiveness, clarifying how to build and maintain effective community health partnerships[26,50,52–54,56,62] should be a high priority for researchers and public health practitioners. ■

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This article was accepted October 3, 2011.

Contributors

H. P. Rodriguez developed the study concept and design, drafted the article, obtained funding, and supervised the study. H. P. Rodriguez and J. Chen performed the statistical analysis. H. P. Rodriguez, J. Chen, K. Owusu-Edusei, A. Suh, and B. Bekemeier revised the article. H. P. Rodriguez, J. Chen, and A. Suh analyzed and interpreted the data. H. P. Rodriguez, K. Owusu-Edusei, and B. Bekemeier secured the secondary data used in the analyses.

Acknowledgments

The Center for Public Health Systems and Services Research at the University of Kentucky and the Robert Wood Johnson Foundation funded this research project.

Human Participant Protection

The University of California, Los Angeles South General institutional review board certified this research exempt (No. 10-000284) because all data were obtained from secondary sources without patient-level information.

References

1. Buckelew SM, Adams SH, Irwin CE Jr, Gee S, Ozer EM. Increasing clinician self-efficacy for screening and counseling adolescents for risky health behaviors: results of an intervention. *J Adolesc Health.* 2008;43(2):198–200.

2. Centers for Disease Control and Prevention. Recommendations for partner services programs for HIV infection, syphilis, gonorrhea, and chlamydial infection. *MMWR Recomm Rep.* 2008;57(RR-9):1–83; quiz CE1–4.

3. Gallagher KM, Denning PD, Allen DR, Nakashima AK, Sullivan PS. Use of rapid behavioral assessments to determine the prevalence of HIV risk behaviors in high-risk populations. *Public Health Rep.* 2007;122(suppl 1):56–62.

4. Owusu-Edusei K, Bohm MK, Chesson HW, Kent CK. Chlamydia screening and pelvic inflammatory disease: insights from exploratory time-series analyses. *Am J Prev Med.* 2010;38(6):652–657.

5. Ozer EM, Adams SH, Lustig JL, et al. Increasing the screening and counseling of adolescents for risky health behaviors: a primary care intervention. *Pediatrics.* 2005;115(4):960–968.

6. Aral SO, Fenton KA, Holmes KK. Sexually transmitted diseases in the USA: temporal trends. *Sex Transm Infect.* 2007;83(4):257–266.

7. Centers for Disease Control and Prevention. *Sexually Transmitted Disease Surveillance, 2009.* Atlanta, GA: US Department of Health and Human Services; 2010.

8. Institute of Medicine. *The Hidden Epidemic: Confronting Sexually Transmitted Diseases.* Washington, DC: National Academies Press; 1997.

9. Keppel KG. Ten largest racial and ethnic health disparities in the United States based on Healthy People 2010 objectives. *Am J Epidemiol.* 2007;166(1):97–103.

10. Aral SO. Social and behavioral determinants of sexually transmitted disease: scientific and technologic advances, demography, and the global political economy. *Sex Transm Dis.* 2006;33(12):698–702.

11. Chesson HW, Sternberg M, Leichliter JS, Aral SO. The distribution of chlamydia, gonorrhoea and syphilis cases across states and counties in the USA, 2007. *Sex Transm Infect.* 2010;86(suppl 3):52–57.

12. Hoover K, Bohm M, Keppel K. Measuring disparities in the incidence of sexually transmitted diseases. *Sex Transm Dis.* 2008;35(12 suppl):S40–S44.

13. Chesson HW. Estimated effectiveness and cost-effectiveness of federally funded prevention efforts on gonorrhea rates in the United States, 1971–2003, under various assumptions about the impact of prevention funding. *Sex Transm Dis.* 2006;33(10):S140–S144.

14. Hogben M, Chesson H, Aral SO. Sexuality education policies and sexually transmitted disease rates in the United States of America. *Int J STD AIDS.* 2010;21(4):293–297.

15. Kimball AM, Lafferty WE, Kassler WJ, Hundt A, MacCornack R, Bolan G. The impact of health care market changes on local decision making and STD care: experience in three counties. *Am J Prev Med.* 1997;13(6):75–84.

16. Bhandari MW, Scutchfield FD, Charnigo R, Riddell MC, Mays GP. New data, same story? Revisiting studies on the relationship of local public health systems characteristics to public health performance. *J Public Health Manag Pract.* 2010;16(2):110–117.

17. Mays GP, Halverson PK, Baker EL, Stevens R, Vann JJ. Availability and perceived effectiveness of public health activities in the nation's most populous communities. *Am J Public Health.* 2004;94(6):1019–1026.

18. Mays GP, McHugh MC, Shim K, et al. Institutional and economic determinants of public health system performance. *Am J Public Health.* 2006;96(3):523–531.

19. Turnock BJ, Handler AS, Miller CA. Core function-related local public health practice effectiveness. *J Public Health Manag Pract.* 1998;4(5):26–32.

20. Chesson HW, Harrison P, Scotton CR, Varghese B. Does funding for HIV and sexually transmitted disease prevention matter? Evidence from panel data. *Eval Rev.* 2005;29(1):3–23.

21. Chesson H, Owusu-Edusei K. Examining the impact of federally-funded syphilis elimination activities in the USA. *Soc Sci Med.* 2008;67(12):2059–2062.

22. Peterman TA, Tian LH, Metcalf CA, et al. High incidence of new sexually transmitted infections in the year following a sexually transmitted infection: a case for rescreening. *Ann Intern Med.* 2006;145(8):564–572.

23. Kilmarx PH, Zaidi AA, Thomas JC, et al. Sociodemographic factors and the variation in syphilis rates among US counties, 1984 through 1993: an ecological analysis. *Am J Public Health.* 1997;87(12):1937–1943.

24. Owusu-Edusei K, Chesson HW. Using spatial regression methods to examine the association between county-level racial/ethnic composition and reported cases of chlamydia and gonorrhea: an illustration with data from the state of Texas. *Sex Transm Dis.* 2009;36(10):657–664.

25. Mays GP, Smith SA. Geographic variation in public health spending: correlates and consequences. *Health Serv Res.* 2009;44(5 pt 2):1796–1817.

26. Mays GP, Scutchfield FD. Improving public health system performance through multiorganizational partnerships. *Prev Chronic Dis.* 2010;7(6):A116.

27. Mays GP, Scutchfield FD, Bhandari MW, Smith SA. Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q.* 2010;88(1):81–111.

28. Leep CJ. 2005 National profile of local health departments. *J Public Health Manag Pract*. 2006;12(5):496–498.

29. US Department of Health and Human Services; Health Resources and Services Administration; Bureau of Health Professions. Area Resource File. Rockville, MD; 2006–2008

30. Owusu-Edusei K, Owens CJ. Monitoring county-level chlamydia incidence in Texas, 2004– 2005: application of empirical Bayesian smoothing and exploratory spatial data analysis (ESDA) methods. *Int J Health Geogr.* 2009;8(1):12.

31. Institute of Medicine. *The Future of the Public's Health in the 21st Century.* Washington, DC: National Academies Press; 2002.

32. Shadish W, Cook T, Campbell D. *Experimental and Quasi-experimental Designs for Generalized Causal Inference.* Boston: Houghton Mifflin; 2002.

33. Akaike H. Likelihood of a model and information criteria. *J Econom.* 1981;16(1):3–14.

34. Blinder AS. Wage discrimination: reduced from and structural estimates. *J Hum Resour.* 1973;8(4):436–455.

35. Jann B. The Blinder-Oaxaca decomposition for linear regression models. *Stata Journal.* 2008;8(4):453–479.

36. Oaxaca R. Male–female differentials in urban labor markets. *Int Econ Rev.* 1973;14(3):693–709.

37. Oaxaca RL, Ransom MR. On discrimination and the decomposition of wage differentials. *J Econom.* 1994;61(1):5–21.

38. Freiman MP, Cunningham PJ. Use of health care for the treatment of mental problems among racial/ethnic subpopulations. *Med Care Res Rev.* 1997;54(1):80–100.

39. Gaskin DJ, Briesacher BA, Limcangco R, Brigantti BL. Exploring racial and ethnic disparities in prescription drug spending and use among Medicare beneficiaries. *Am J Geriatr Pharmacother.* 2006;4(2):96–111.

40. Hargraves JL, Hadley J. The contribution of insurance coverage and community resources to reducing racial/ethnic disparities in access to care. *Health Serv Res.* 2003;38(3):809–829.

41. Monheit AC, Vistnes JP. Race/ethnicity and health insurance status: 1987 and 1996. *Med Care Res Rev.* 2000;57(suppl 1):11–35.

42. Vargas Bustamante A, Fang H, Rizzo JA, Ortega AN. Understanding observed and unobserved health care access and utilization disparities among US Latino adults. *Med Care Res Rev.* 2009;66(5):561–577.

43. Waidmann TA, Rajan S. Race and ethnic disparities in health care access and utilization: an examination of state variation. *Med Care Res Rev.* 2000;57(suppl 1):55–84.

44. Weinick RM, Zuvekas SH, Cohen JW. Racial and ethnic differences in access to and use of health care services, 1977 to 1996. *Med Care Res Rev.* 2000;57 (suppl 1):36–54.

45. Zuvekas SH, Taliaferro GS. Pathways to access: health insurance, the health care delivery system, and racial/ethnic disparities, 1996–1999. *Health Aff (Millwood).* 2003;22(2):139–153.

46. Bustamante AV, Fang H, Rizzo JA, Ortega AN. Heterogeneity in health insurance coverage among US Latino adults. *J Gen Intern Med.* 2009;(24 suppl3):561–566.

47. Gee L, Smucker DR, Chin MH, Curlin FA. Partnering together? Relationships between faith-based community health centers and neighborhood congregations. *South Med J.* 2005;98(12):1245–1250.

48. Moss NJ, Gallaread A, Siller J, Klausner JD. "Street medicine": collaborating with a faith-based organization to screen at-risk youths for sexually transmitted diseases. *Am J Public Health.* 2004;94(7):1081–1084.

49. Thomas JC, Carter C, Torrone E, Levandowski BA. Pulling together: interagency coordination and HIV/STD prevention. *J Public Health Manag Pract.* 2008;14(1):E1–E6.

50. Shortell SM. Challenges and opportunities for population health partnerships. *Prev Chronic Dis.* 2010;7 (6):A114.

51. Mitchell SM, Shortell SM. The governance and management of effective community health partnerships: a typology for research, policy, and practice. *Milbank Q.* 2000;78(2):151, 241–289.

52. Zahner SJ. Local public health system partnerships. *Public Health Rep.* 2005;120(1):76–83.

53. Roan C, Clark CW. The Pfizer Foundation's Community Health Ventures program: providing models for community health partnerships. *Health Aff (Millwood).* 2002;21(6):250–254.

54. Shortell SM, Zukoski AP, Alexander JA, et al. Evaluating partnerships for community health improvement: tracking the footprints. *J Health Polit Policy Law.* 2002;27(1):49–91.

55. Alexander JA, Weiner BJ, Metzger ME, et al. Sustainability of collaborative capacity in community health partnerships. *Med Care Res Rev.* 2003;60(4 suppl):130S–160S.

56. Ellen JM, Gaydos C, Chung SE, Willard N, Lloyd LV, Rietmeijer CA. Sex partner selection, social networks, and repeat sexually transmitted infections in young men: a preliminary report. *Sex Transm Dis.* 2006;33(1):18–21.

57. Adimora AA, Schoenbach VJ. Social context, sexual networks, and racial disparities in rates of sexually transmitted infections. *J Infect Dis.* 2005;191(suppl 1): S115–S122.

58. Thomas JC, Sampson LA. High rates of incarceration as a social force associated with community rates of sexually transmitted infection. *J Infect Dis.* 2005;191 (suppl 1):S55–S60.

59. Jolly AM, Muth SQ, Wylie JL, Potterat JJ. Sexual networks and sexually transmitted infections: a tale of two cities. *J Urban Health.* 2001;78(3):433–445.

60. Leichliter JS, Chesson HW, Sternberg M, Aral SO. The concentration of sexual behaviours in the USA: a closer examination of subpopulations. *Sex Transm Infect.* 2010;86(suppl 3):iii45–iii51.

61. Delcher PC, Edwards KT, Stover JA, Newman LM, Groseclose SL, Rajnik DM. Data suppression strategies used during surveillance data release by sexually transmitted disease prevention programs. *J Public Health Manag Pract.* 2008;14(2):E1–E8.

62. Shortell SM, Zukoski AP, Alexander JA, et al. Evaluating community partnerships: a reply to Spitz and Ritter. *J Health Polit Policy Law.* 2002;27(6):1023–1028.